E. T. GREENFIELD.
ART RELATING TO THE STAPLING OF SHEETS.
APPLICATION FILED OCT. 24, 1916.

Patented Dec. 10, 1918.

1,287,583.

Inventor

By his Attorneys

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To all whom it may concern:

Be it known that I, Edwin T. Greenfield, a citizen of the United States, and a resident of Yonkers, in the county of Westchester and State of New York, have invented and useful Improvements in the Art Relating to the Stapling of Sheets, of which the following is a specification.

The invention relates to the securing of several layers, preferably sheet paper, together by means of a staple.

My prior United States Patent No. 572,298, dated December 1, 1896, is shown and described a means for securing sheets or layers of paper together by staples. When several sheets of paper have been stapled together by means of the apparatus shown in said patent it is exceedingly difficult, if not practically impossible, to subsequently separate the papers without mutilating them, as the staples are in effect permanently secured in place due to the bending of the ends of the legs of the staple inwardly under the cross-bar of the staple; or in other words toward each other.

The object of the present invention is to secure several sheets of paper together by means of a staple in such a manner that the staple can be readily removed without mutilating or injuring the papers which are secured together by the staple. This is accomplished by constructing a machine so that when the staple is driven one leg will be bent inwardly under the cross-bar of the staple and the other leg will be bent outwardly away from its companion leg. This is accomplished by constructing the anvil of the stapling machine in such a manner as to deflect both points or ends of the staple in the same direction, for example, to the left, as the staple is being driven. The staple is also driven and bent in such a manner that the sheets are more or less loosely secured together by the staple. A staple thus driven can be subsequently removed, as by drawing the staple to the right.

As showing a specific manner in which the invention may be realized reference is made to the drawings forming a part of this specification, in which drawings:

Figure 1 is a side elevation of a staple driving machine showing a vertically movable plunger thereof in its upper or elevated position.

Fig. 2 is a view looking at the forward end of the machine. In this figure the lower front portion of the guide-way for the vertically movable plunger has been removed and there are shown in section an upper and a lower anvil, either one of which can be in operative position relative to the vertically movable plunger according to the desire of the operator.

Fig. 3 is a partial vertical-sectional view showing the vertically movable driving plunger in its lower position and showing the manner in which a staple is driven when the upper anvil is in operative position relative to the plunger.

Fig. 4 is a view similar to Fig. 3, but in Fig. 4 the upper anvil has been removed. In this figure the staple is shown in the manner in which it appears when the plunger and the lower anvil cooperate to bend the legs of the staple as the staple is driven by the plunger.

Fig. 5 is a perspective view of a strip of staples such as is used in the machine. Such a strip of staples is indicated as being in operative position in Figs. 1, 2, 7, 8, and 9.

In Figs. 3, 4 and 5 the parts are shown on a somewhat larger scale than in the rest of the figures.

Fig. 6 is a perspective view partially broken away of a side piece of the upper frame of the machine.

Fig. 7 is a vertical-sectional view taken on the planes indicated by the broken line 7-7 in Fig. 2 looking in the direction of the arrows.

Fig. 8 is a sectional view similar to Fig. 7 but in Fig. 8 the vertically movable plunger is shown in its lower position whereas in Fig. 7 the vertically movable plunger is shown in its raised or elevated position.

Fig. 9 is a horizontal-sectional view taken on the plane indicated by the line 9-9 in Fig. 7.

Fig. 10 is a plan view showing only the base and an attachment which includes as a part thereof the upper anvil. In Fig. 10 the upper anvil has been moved from operative position to permit the employment of the lower anvil.

In said drawings the reference character 1 designates the base of the machine upon which there is pivotally mounted at 1' an upper frame or movable member. This upper frame comprises two side pieces formed of pressed sheet metal and intermediate...
plates 4 and 4' (see Fig. 2). The side pieces and plates are connected together so as to form a unitary structure. The rear portion 5 of this frame, which portion is really a part of the plate 4', is the part which is preferably pivoted to the base. At the forward part of the frame there is provided a vertically-extending guide-way 6 in which there is slidably mounted the vertically-movable plunger, to wit, the plunger 7, which is normally held in its upper or elevated position by means of a spring 8. This frame is also constructed so as to provide a horizontally-extending guide-way 9 upon which a strip of staples 10 is supported and along which said strip of staples can slide whereby each successive staple can be brought below the plunger into position to be severed and driven by the plunger as the latter is forced downward. The strip of staples shown is the same as that illustrated and described in my prior U. S. Patent No. 1,106,983, granted Aug. 11, 1914. The lower portion of the intermediate plate 4 provides a rib or projection 4' which extends into a longitudinal groove 12 of the strip of staples 10. The intermediate plate 4', heretofore referred to, operates in effect the same as a lower shear blade because it cooperates with the plunger 7 to sever each successive staple from the rest of the staples in the strip. This intermediate plate or shear blade is preferably grooved at 40 so as to receive the under side of the grooved portion 12 of the staple strip. If, however, it is desired to employ a strip of staples which does not have this particular groove, then this can be done as by eliminating the lower projecting rib 4' of the intermediate plate 4 and by making the upper surface of the intermediate plate 4' flat so as to conform with the under side of the cross-bar of the staples.

I prefer, however, to employ the staples such as are shown in my before-mentioned Patent No. 1,106,983, and also shown in Fig. 5 herein, as the longitudinal grooved portion 12 in the staple can be relied upon to facilitate the removal of a driven staple, if desired, as will hereinafter appear, but it will be understood that the invention in its broad aspect is not limited to the employment of this particular form of staple. When in operative position the strip of staples is moved along the guide-way by means of a set of feeding pawls 15 which is pivotally connected at 14 to the forward portion of the frame 2. This set of feeding pawls 15 extends downward along the exterior of the frame and the lower ends can spring outwardly so as to pass over the outer sides of the legs, which legs it will be noted are of equal length of the staple as said ends are moved rearwardly to a position where they can engage the rear side of the legs of a staple next to be driven preparatory to moving said staple into position where it can be severed from the strip of staples and subsequently driven. There is also provided a set of spring members constituting holding or checking pawls 15, the forward ends of which engage the rear side of the cross-bar of the staple next to be driven so as to prevent any rearward movement of the strip of staples as the ends of the feeding pawls are being moved rearwardly, preparatory to engaging the rear sides of the staple next to be driven. The holding or checking pawls 15 permit a forward movement of the strip of staples as the latter is being fed forward by the feeding pawls 13. The set of checking pawls 15 has a cross member 15' which fits a slotted portion in the rear part of the upper frame 2.

From what has preceded, as also from an inspection of the drawings, it will be manifest that in order to accomplish this feeding the lower ends of the feeding pawls must be able to move laterally outwardly away from the vertically-extending guide-way past the sides of the legs of the staple to a position where they can move inwardly so as to engage the rear edges of the legs of the staple to be driven. Consequently, the material in this member which provides these feeding pawls is made with sufficient spring to permit this movement to take place. The feeding pawls are operated by the upward and downward movement of the plunger 7 through the medium of a lever 16 which is pivotally mounted on the frame at 17. The rear end of this lever 16 engages a rearward extension 18 of that on the feeding pawls and the forward end of the lever is engaged by the portion 19 of the plunger 7 striking the lever as the plunger moves downwardly and by the portion 20 of the plunger striking the lever as the plunger moves upwardly. If it is desired to drive a staple as heretofore done the attachment designated by A is swung out of place, to wit, to the position shown in Figs. 4 and 10, in which case the plunger cooperates with an anvil of the well-known type. This anvil is designated as 21 and it will be observed that the depressions or clinching grooves 22 and 23 therein are so shaped and positioned relatively to the legs of the staple being driven as to deflect the free ends of the legs toward each other, to wit, under the cross-bar of the staple, thus causing the staple to be bent and permanently secured in place, as shown in Fig. 4. When it is desired to drive a staple which can be readily removed, the attachment A is swung in place, or, in other words, is positioned under the plunger so that it will be placed as shown in Figs. 1, 2, 3, 7, 8 and 9, in which case when a staple is severed and driven both legs of the staple will be deflected toward the left, thus causing the staple to be bent as shown in Fig. 3.
In the construction shown in Fig. 4 it will be observed that the outer portion of the depressions or clenching grooves 22 and 23 are arranged under the free ends of the staple to be driven and thus deflect the staple ends inwardly, whereas in the construction shown in Fig. 3 the outer portion of the depression or clenching groove 24 is positioned under the free end of staple leg 25 and the inner portion of the companion depression or clenching groove 26 is positioned under the free end of staple leg 27; thus, as the staple is driven the free ends of the legs 25 and 27 will be forced to the left.

The attachment A comprises the anvil member 21 in which the depressions or clenching grooves 24 and 26 just referred to are located and a spring 28 which is pivotally connected to the base 1 as by means of a screw 29. It will here be noted that this attachment A could be applied to existing stapling machines whereby the existing stapling machines which are constructed to drive staples so that the staples are permanently secured in place can be employed by means of said attachment to drive staples in a manner to permit the subsequent removal of the staples, if desired.

In the construction shown, the movable anvil 21 is made hollow and fits upon the exterior of the fixed anvil 21 and thus the anvil of the attachment is properly positioned by means of the anvil 21 when the attachment is brought into operative position.

It will be manifest, however, that other means for causing this attachment to be properly positioned could be employed, if desired.

When it is desired to remove the staple shown in Fig. 3 this can be readily done by holding in the left hand the papers secured by the staple, by placing the nail of the thumb in the longitudinally-extending groove 12 of the staple and by seizing the right-hand end of the staple between the thumb and the first finger, the latter of which will engage the under side of the leg 25 at the right hand side of the staple. By movement to the right the staple will be readily removed from place and this will be accomplished without damaging or mutilating the papers. To accomplish this, however, it will be necessary to bend the papers at the right-hand side of the staple downwardly to permit the first finger to engage the under side of the leg 25, but this action will not injure the papers.

Reference has heretofore been made to the fact that the side pieces 3 are made of pressed sheet metal and in Fig. 6 there is shown in detail one of these side pieces. Furthermore, it will be observed that each side piece comprises the comparatively flat vertically and longitudinally-extending body portions 30 and 31 which are connected to their rear by means of a portion 32 that is bent outwardly but which is cut away at 32" to permit the passage of the staples in the strip. Each of these side pieces is bent laterally outwardly at 33, thence forwardly at 34, thence laterally inwardly at 35 so as to provide one of the side members of the vertically extending guide-way 6 in which the plunger 7 slides. The side members or guide-way portions just described serve to rigidly connect the body portions 30 and 31 at their front. The sides of the guide-way for the strip of staples is designated by 36. The portion which provides a side of this guide-way is clearly shown in Fig. 6.

In Figs. 3 and 4 it will be observed the cross-bar of each staple engages the top of the upper sheet of the several sheets which are secured together and that the legs, after passing through the several sheets of paper, are bent laterally below the under side of the under sheet of the papers secured together by the staple. In both Figs. 2 and 3 it will be observed that the depression or clenching groove 24 is deeper than the depression or clenching groove 26. It will also be observed that each said depression or clenching groove provides a curvilinear path along which the free end of the leg being bent travels and that in the bending operation each leg is caused to assume a curved form. As the legs are of equal length and as the depression or clenching grooves 24 and 26 are of different depths it will be noted that the free ends of one of the legs will have different positions relative to the horizontal cross bar due to the legs having different bends or curves. While the bent legs as a whole may be referred to in a broad sense as being parallel with the cross bar of the staple, still as will be manifested from an inspection of Fig. 3, a more accurate and a detailed description of the bent staple shown in said figure is as follows:

The staple has a horizontal cross bar, extending from the right to the left, with two depending legs, namely, 25 and 27, at the ends thereof and which legs are bent so as to extend, laterally so to speak, to the left, so that one leg, to wit, leg 25, extends inwardly under the cross bar and so that the other leg, to wit, leg 27, extends outwardly or away from the cross bar. The leg 25 has a bar portion 25a, so called since it is the portion of the leg that is nearest to the cross bar, and which portion 25a extends downwardly and to the left to a position below the cross bar, the bar portion 25a merges into the central portion, 25c, which may be described as a curved portion parallel to the cross bar and this central curved portion 25c merges into the end portion 25e, which extends to the left and upwardly toward the cross bar. The end portion 25e may be re
ferred to as the free end portion. The end 25 does not engage the underside of the lower sheet of paper which is temporarily clamped by the staple, in other words, a space is left between the free end 25 and the papers secured together by the staple when the staples are pressed together as they are at the end of the operation of inserting and bending the legs of the staple. The leg 27 has a bar portion 27 that extends downwardly and to the left—away from the cross bar. This portion 27 merges into the curved central portion 27, which is in effect parallel to the cross bar but not under the cross bar, and this curved central portion 27 merges into the end portion 27 that extends upwardly and to the left—away from the cross bar. The end 27 engages the underside of the lower sheet of the several sheets of paper which are being temporarily secured together.

The parts 27, 27 and 27 of the bent leg 25 form a smooth curve leaving a pocket between the lower sheet of paper being stapled together and the bent leg, and the sheets of paper are more or less loosely held by this particular leg 28, of which said portions together constitute an integral whole.

The parts 27, 27 and 27 of the bent leg 27 form a smooth curve that provides a pocket between the leg 27 and the sheets of paper thus stapled together. The end 27 which engages the underside of the lower sheet of paper being thus stapled together is higher or nearer the general level of the underside of the cross bar than is the end 25 of the leg 28 of the staple that is located below or under the cross bar. Due to the particular construction shown and above described one is enabled to remove the staple without mutilating the papers.

In Fig. 3 the legs have both been bent to the left so as to permit the ready removal of the staple from the papers, if desired, whereas in Fig. 4 each of the legs has been bent inwardly so as to assume a position underneath the cross-bar. The staple when driven as shown in Fig. 4 cannot be readily or easily removed from the set of papers which it secures, whereas a staple driven in the manner shown in Fig. 3 can be readily removed in the manner heretofore described and this can be done without further bending of the legs of the staple and without mutilating the paper. In both Figs. 3 and 4 that portion of each leg which is below the bottom sheet extends in effect substantially parallel with the cross-bar of its staple.

From what has preceded it will be clear that existing machines can be altered by merely changing the anvil so as to procure the bending of the staples in a manner to permit their ready removal after being driven, and it will be manifest that the invention can be realized in different ways and in different forms of machines without departing from the spirit and scope thereof.

A machine which is also particularly adapted for use in the performing of the invention herein described and claimed is the subject of a companion application bearing Serial No. 210,815, filed January 8th, 1918, entitled "Machine for stapling sheets."

What I claim and desire to secure by Letters Patent is:

1. In combination, a plurality of layers of sheets of paper or the like and a staple, the cross bars of which staple engages the upper surface of the top sheet and the legs of which staple extend downwardly through said sheets of paper, thence laterally in the same direction, one of said legs being so bent that it has a bar portion which extends downwardly and laterally to a position below the cross bar, a curved central portion that is substantially parallel with and located below the cross bar, and a free end portion that extends laterally and upwardly toward the cross bar; the construction at the end of the bending operation being such that there is a space between said free end portion and the papers secured together by the staple when the sheets of paper are pressed together, the other of said legs being bent so that it has a bar portion which extends downwardly and laterally away from the cross bar, a curved central portion that is parallel to the cross bar, and an end portion that extends laterally and upwardly.

2. In combination, a plurality of layers of sheets of paper or the like and a staple, the cross bar of which staple engages the upper surface of the top sheet and the legs of which staple extend downwardly through said sheets of paper and thence laterally, both in the same direction, one of said legs being bent so as to have a bar portion that extends downwardly and laterally to a position below the cross bar, a central portion that is located below and parallel with the cross bar and an end portion that extends laterally and upwardly toward the cross bar, the other of said legs being bent so that it has a bar portion that extends downwardly and laterally away from the cross bar, a curved central portion parallel with the cross bar and an end portion that extends laterally and upwardly, the free end of the last mentioned leg being higher than the end of the previously described leg when the cross bar of the bent staple is horizontal.

3. The securing together of several sheets of paper or the like by inserting in place a staple which at the end of the inserting operation has a cross bar extending horizontally from right to left, engaging the upper surface of the sheet, and engaging legs at each end of the cross bar which legs pass downwardly through said sheets of paper.
and extend laterally to the left, the right leg being shaped so that it has a bar portion that extends downwardly and to the left, a central curved portion and an end portion that extends to the left and upwardly, the left leg being shaped so as to have a bar portion that extends downwardly and to the left, a central curved portion and an end portion to a point higher than the end portion of the right leg.

4. The securing together of several sheets of paper or the like by means of a staple having a cross bar extending horizontally from the left to the right and engaging the upper surface of the top sheet, depending legs one at each end of the cross bar, which legs pass downwardly through said sheets of paper and are bent laterally to the left, one of said bent legs having a bar portion extending downwardly and to the left, a curved portion and an end portion extending upwardly and to the left, the other of said bent legs having a bar portion extending downwardly and to the left, a central curved portion and an end portion extending upwardly and to the left, the free end of the left leg being higher than is the free end of the right leg.

5. The securing together of sheets of paper by means of a staple the legs of which are driven downwardly so as to pass through the sheets and are thereafter bent in such a manner that they extend laterally in the same direction, one of said legs being bent so as to have a bar portion that extends downwardly and laterally, a central curved portion that is directly below and substantially parallel with the cross bar of the staple and an end portion that is directly below the cross bar and that extends laterally and upwardly toward the cross bar, the other of said legs being bent so as to have a bar portion that extends laterally and downwardly, a central curved portion and an end portion that extends laterally and upwardly, the staple being shaped at the end of the bending operation so that between the end portion of the leg which is directly below the cross bar and the lower of the sheets of paper secured together by the staples a space is left when the sheets of paper are pressed together.

6. In the securing together of several sheets of paper or the like the method which comprises driving a staple downwardly and simultaneously bending the ends of the legs laterally in the same direction so that when driven the legs are in effect substantially parallel with the cross bar of the staple, each of said legs being bent so as to have a bar portion that extends downwardly and laterally, a central curved portion that is parallel with the cross bar and an end portion that extends laterally and upwardly, the end of the leg which extends under the cross bar being lower than the end of the other leg when the cross bar is horizontal.

7. The temporarily securing together of several sheets of paper or the like by means of a staple having a cross bar extending horizontally from the right to the left and engaging the upper surface of the top sheet, which staple also has depending legs at the ends of the cross bar, which legs pass downwardly through said sheets of paper and are bent laterally to the left but in a manner to leave a vertical play or looseness of the sheets of paper between the cross bar and the bent ends of the legs whereby the staple can be readily removed from the temporary securing position without mutilating the sheets of paper.

8. In combination, sheets of paper and a staple temporarily securing the sheets together, which staple has a cross bar extending horizontally from right to left and engaging the upper surface of the top sheet, and depending legs at the end of the cross bar, which legs pass downwardly through said sheets of paper and are bent laterally to the left but in a manner to leave a vertical play or looseness of the sheets of paper between the cross bar and the bent ends of the legs whereby the staple can be readily removed from temporary securing position without mutilating the sheets of paper.

9. In combination, sheets of paper and a removable staple that secures said sheets together, said staple having a cross bar extending horizontally and engaging the upper surface of the top sheet and depending legs that pass downwardly through said sheets and both of which legs are bent in the same direction, one laterally and outwardly and the other laterally and inwardly to a position below the cross bar and in such a manner that there is left a pocket between it and the lower face of the lower sheet so that the staple can be readily removed from its securing position.

10. The securing together of sheets of paper by the method which comprises supporting a number of sheets of paper on an anvil having depressions or clenching grooves of different depths, pressing a staple having legs of equal length downwardly in a manner to cause the free ends of the legs to first pierce the sheets and thereafter engage the portions defining said depressions or clenching grooves which portions are arranged with respect to said legs so as to deflect the legs laterally and in the same direction and so that one of the legs is bent outwardly and the other is bent inwardly below the cross bar, the deeper clenching groove being the one into which the last-mentioned leg enters.

11. The securing together of sheets of paper by means of a staple having legs of
equal length by the method which comprises supporting the sheets of paper and forcing the lower free ends of the legs downwardly through the sheets against an anvil having 5 depressions or clenching grooves of unequal depths and which clenching grooved portions are arranged so that the deeper depression or clenching groove causes one of the legs to be deflected laterally and inwardly under the cross bar and so that the shallow depression or clenching groove causes the other leg to be deflected laterally and outwardly, the downward pressure being continued until the legs are thus bent.

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The securing together of several sheets of paper or the like by means of a staple having a cross bar extending horizontally from left to right and engaging the upper surface of the top sheet and having 2 depending legs one at each end of the cross bar, which legs pass downwardly through said sheets of paper and are bent laterally to the left, one of said bent legs having a bar portion extending downwardly and to the left, a curved portion and an end portion extending upwardly and to the left, the other of said legs having a bar portion extending downwardly and to the left, a central curved portion and an end portion extending to the left, the bent right leg being shaped so as to leave a pocket between it and the lower sheet and so that when said sheets of paper are pressed together the free end of said right leg does not engage the lower sheet.

This specification signed and witnessed this 23d day of October, A. D. 1916.

EDWIN T. GREENFIELD.

Signed in the presence of—

Edwin A. Packard,

G. McGrann.