

June 20, 1944.

T. T. GREENWOOD

2,351,608

STAPLE AND METHOD OF MAKING THE SAME

Filed Jan. 18, 1941

3 Sheets-Sheet 1

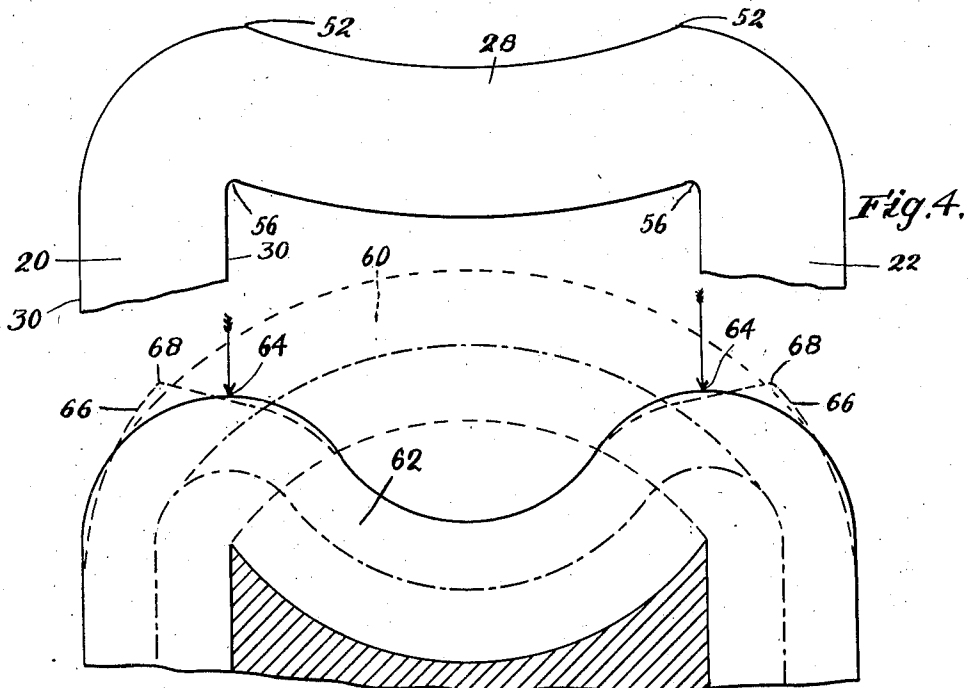


Fig. 4.

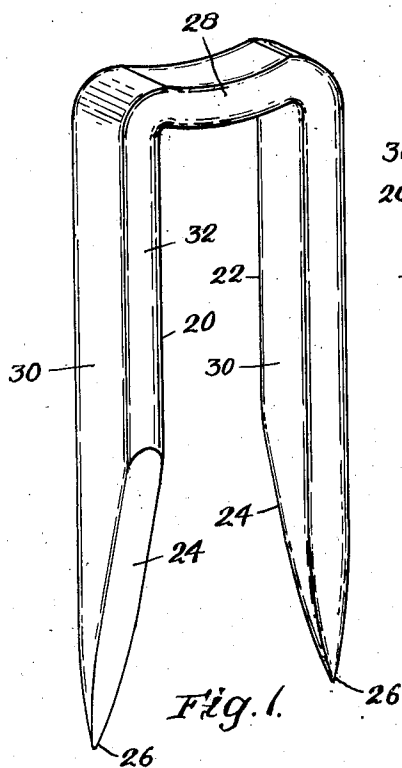


Fig. 1.

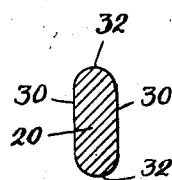


Fig. 3.

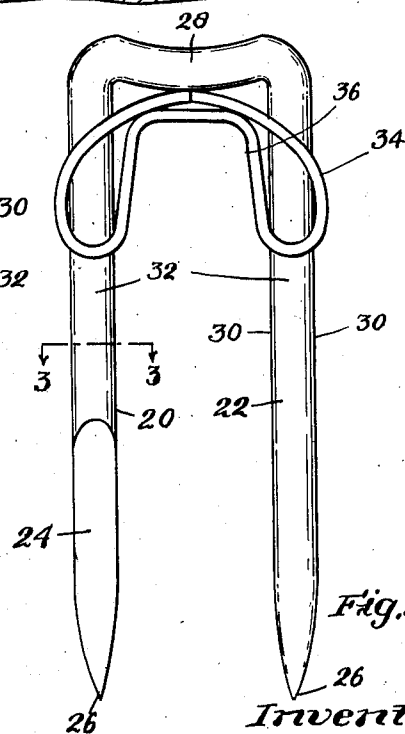


Fig. 2.

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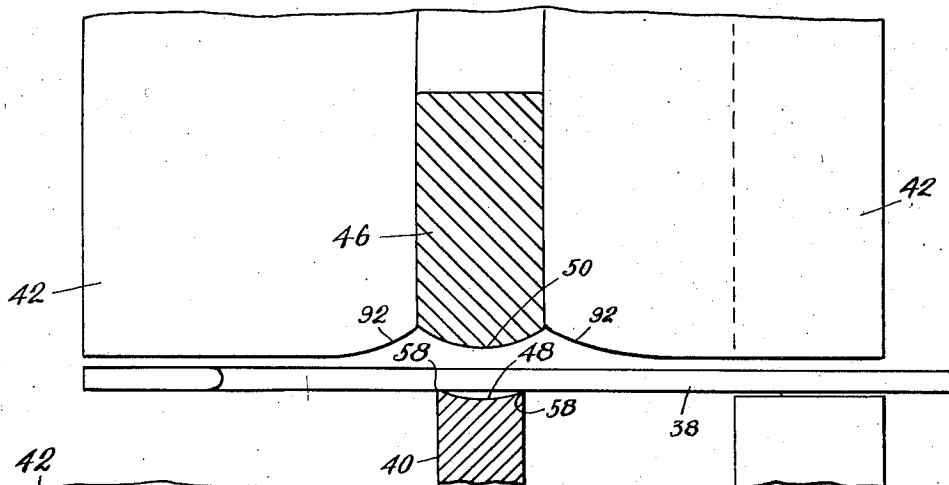


Fig. 5.

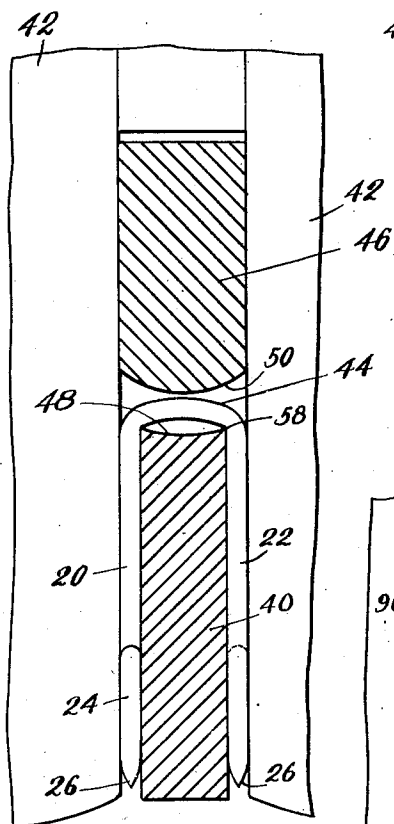


Fig. 6.

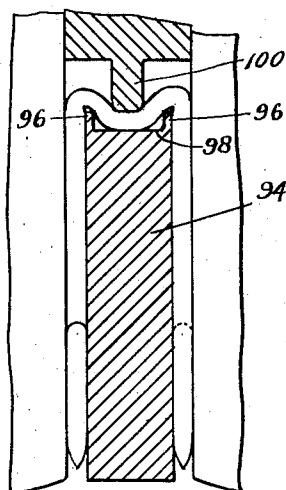


Fig. 12.

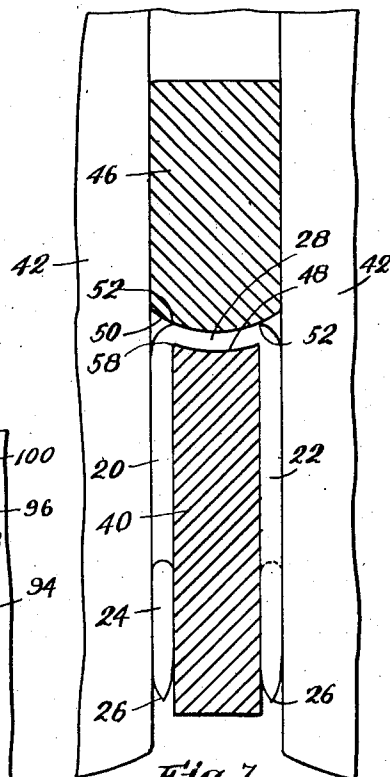


Fig. 7.

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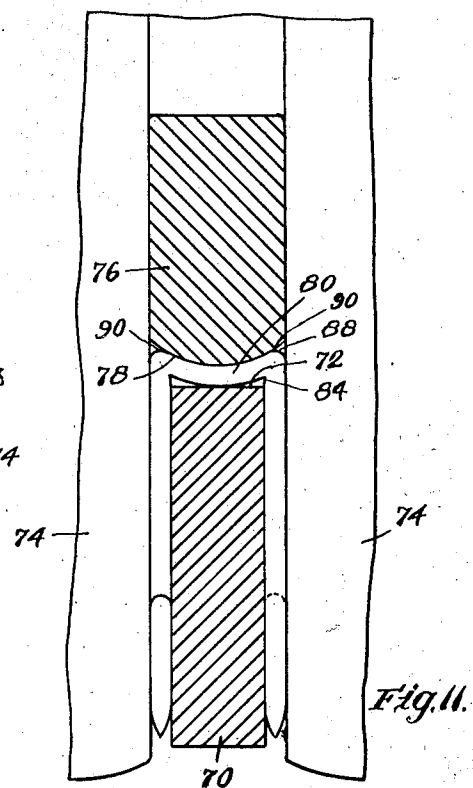
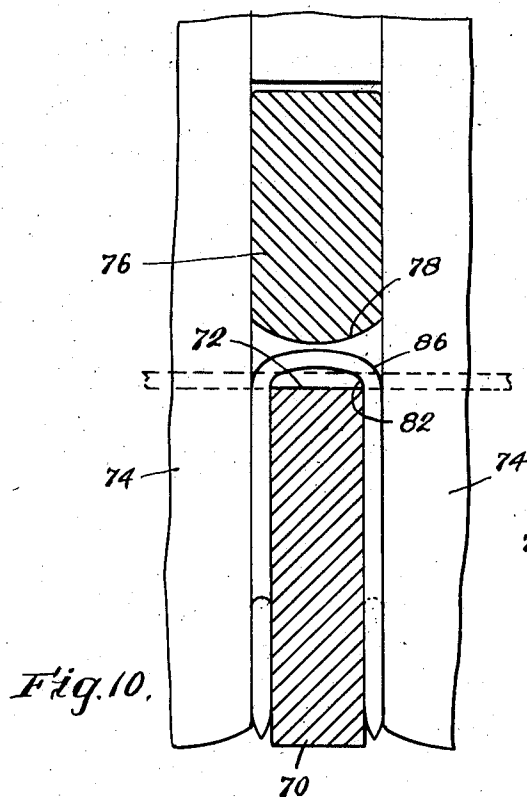
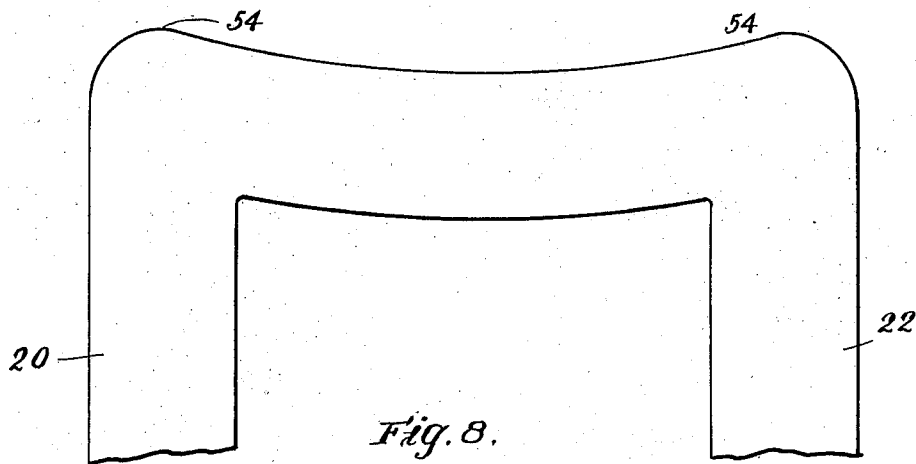
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Filed Jan. 18, 1941

3 Sheets-Sheet 3



Inventor,

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UNITED STATES PATENT OFFICE

2,351,608

STAPLE AND METHOD OF MAKING THE
SAME

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Application January 18, 1941, Serial No. 375,032

10 Claims. (Cl. 59—77)

This invention relates to staples and particularly to the type of staple employed for securing a wire, and particularly an electric conductor, to a support; and has to do with a construction of staple and a method of making the staple, so that the staple can be driven into hard materials without bending or spreading of the legs.

The staple with which the present invention is particularly concerned is made of wire, usually flattened so that the wire is wider than it is thick, and having two spaced parallel legs pointed at their similar ends and integrally connected at their other ends by a connecting member or so-called bridge. The bridge of the ordinary staple is arched so that the middle thereof upstands above the ends of the staple legs, although the height of the arch may be different for different staples.

Such a staple is insulated by an insulating strip or saddle which is located between the upper parts of the legs under the bridge and is formed to provide an insulating channel for an electric conductor.

In at least one make of staple, an attempt is made to bend the staple wire to have the bridge fiat or at right angles with the legs but the bridge, nevertheless, is slightly arched or is higher in the middle than at the ends.

It is quite difficult to drive this arched type of staple into a hard support, as into a hard board, especially by an inexperienced person, without bending the staple legs in the plane occupied by the legs. This bending action of the usual staple construction as above described when driven by the usual hammer into a sufficiently hard material is inevitable.

The hammer strikes the bridge of the staple. Since the bridge is arched the hammer head strikes the middle of the bridge. The blow of the hammer thus has a relatively large component acting at right angles to the legs and a relatively small component acting in the direction of the legs. When the wire of which the staple is made is sufficiently resistant and the resistance of the material to penetration by the legs is sufficiently small the staple can be driven home without bending. When, however, the resistance of the material to penetration is sufficiently high and the staple wire is of relatively small gauge, as is particularly the case with insulated or saddle staples, the bridge flattens and hence spreads apart the upper ends of the legs of the staple. On following blows the upper part of one leg of the staple is bent inwardly and the other leg of the staple is pushed outwardly by

the thrust of the bridge and also has its upper end part bent inwardly so that the staple is deformed and cannot be driven further, will not hold a wire securely and looks unsightly.

5 An attempt has been made to prevent such bending action of the staple and thus to improve its driving ability by lowering or indenting the middle part of the staple so that the bridge has a central indented or depressed part between two elevated bent parts located between the legs of the staple. Such a staple under some conditions has a somewhat better driving quality than the regular staple but is greatly inferior in its driving quality to the staple that is the subject of the present invention. It does not appear that
10 such a staple is on the market at the present time.

To produce a staple that will not bend when driven into a hard or resistant surface, I have discovered that it is not sufficient merely to depress the middle part of the bridge of the staple. I have discovered that the striking point or head of the staple, that is, the point hit by the hammer, must be so close to the line of the leg of the staple that the leg will not bend under the hammer blow. For best results, this striking point should be in the axial line of the leg. I have produced such staples which have excellent driving qualities. It is not essential, however that the striking point be precisely in the axial line of the leg, and, where the staple wire is sufficiently stiff, the striking point can be somewhat at one side of the axial line. The striking point, however, should be as close in line with the leg as it is practicable to make it. A staple so constructed constitutes an object of the present invention.

I have found further that the best results are obtained when the bridge is in the form of an inverted arch which extends between the legs in a continuous curve of one character and where the ends of the arch join the material of the legs abruptly. I have further found that the point of connection between the inverted arch and the leg of the staple on the under side of the arch, for best results, should be abrupt and should not be a curve of large radius as one approximating the thickness of the wire. Such a staple constitutes an object of the present invention.

I have also found that the driving quality of the staple is improved if instead of merely bending the staple wire to form the inverted bridge the material of the bridge at least in part is compacted by impact of the forming die, thereby

making the bridge more resistant to bending than it would otherwise be. This construction is also an object of the present invention.

A further object of the invention is an improved method of making the staple.

Another object is generally to improve the resistance of the staple to bending when subjected to driving impacts.

Fig. 1 is a perspective view of one form of staple embodying the present invention.

Fig. 2 is a front elevation of the staple of Fig. 1 having an insulating saddle thereon.

Fig. 3 is a sectional view taken along line 3—3 of Fig. 2, and illustrating the shape of the staple making wire.

Fig. 4 is an enlarged front view of the bridge end of the staple of Figs. 1 and 2.

Fig. 5 is an enlarged view of the staple forming dies in position to form a staple.

Fig. 6 is a view of the dies of Fig. 5 with the staple formed but prior to the bridge shaping process.

Fig. 7 is a view showing the completion of the bridge shaping process.

Fig. 8 is an enlarged detail of the upper end of a staple made in accordance with a somewhat different method.

Fig. 9 is an enlarged detail of the upper end of the staple showing upright and inverted bridges having the same length.

Figs. 10 and 11 are views similar to Figs. 6 and 7, showing the formation of the staple of Fig. 8.

Fig. 12 is a view of a modified form of dies for making a staple in accordance with the present invention.

The staple with which the present invention is particularly concerned, and one form of which is illustrated in Figs. 1 through 4, comprises the parallel legs 20 and 22, the lower ends of which are cut diagonally from a length of staple making wire to provide oppositely inclined faces 24 and pointed ends 26. The upper parts of the legs are integrally connected by a bridge 28. The staple is made from initially round wire which has been flattened to provide the opposite flat sides 30 and the rounded edges 32, as illustrated in Fig. 3. The staple is formed by bending the wire across the flat faces 30 so that the staple leg is wider transversely of the plane of the legs than the leg is thick.

When the staple is used for securing an electric conductor to a support, as to a wood board, the staple is provided with a saddle 34 comprised of a strip of insulating material, as fibre, through parts of which the legs of the staple pass, with the bridge overlying the saddle, the saddle having a channel 36 which receives the conductor, the walls of the channel providing insulation between the conductor and the legs of the staple and the bridge, a staple for use with such insulating saddle constituting an important feature of this invention.

The staple embodying the present invention can be made by the dies illustrated diagrammatically in Fig. 5. The initially straight staple making wire 38 rests upon the top face of a stationary anvil 40, which face for making the common staple is flat. Said anvil is located between a pair of side wipers or forming dies 42. These dies are moved downwardly and bend the wire about the anvil causing the bridge forming part of the wire overlying the top face of the anvil to arch upwardly, as indicated at 44, Fig. 6. A hammer or striking member 46 is located between the forming dies 42 and at the lower part of the

stroke of the forming dies the hammer is forced downwardly onto the bridge.

In the manufacture of my improved staple, in the form illustrated in Fig. 4, the anvil 40 is given a concave upper face 48 which preferably extends entirely to the side faces of the anvil. The lower face of the hammer 46 is made convex, as at 50. With this construction, the hammer 46 depresses the arched bridge 44 of the staple into the concave face 48 of the anvil and thus depresses the bridge or inverts the arch in the manner illustrated in Figs. 4 and 7, the length of the chord of the concave arch of the upper face of the bridge being approximately equal or not materially less than the distance between the confronting faces of the legs. This construction provides the staple with a pair of striking points or heads 52 located close to the line of the staple legs. All parts of the bridge between these striking points are below a plane perpendicular to the legs and passing through the points so that the head of the hammer can engage only the points and not the bridge. The points are so close to the line of the staple legs that the staple can be driven into hard wood or the equivalent without the bending of the legs. Each striking point may be struck independently of the other without bending either leg. The striking points 52 can be positioned immediately above the legs, as indicated by the striking points 54 of the staple of Fig. 8, by a proper selection of the radius of the curve 50 of the striking face of the hammer 46 and by the length of material in the bridge 44, Fig. 6, prior to the shaping of the bridge by the hammer. Ordinarily, however, it is not necessary to position the striking points entirely within the outlines of the legs.

In forming my improved staple, the curve of the striking face 50 of the hammer 46 is more important than the curve of the top face 48 of the anvil. The curve of the face 50 in large part determines the positions of the striking points 52 with respect to the legs of the staple, while the concave face 48 of the anvil mainly provides a space into which the material of the bridge can be depressed. The amount of depression of the middle part of the bridge below the plane including the striking points 52 is not particularly important, providing the staple is properly made in the first instance, so long as the body of the bridge remains below this plane during the driving of the staple and the consequent possible small deformation of the surfaces of the striking points under the hammer blows. It is important that the bend 56 between the staple leg and the bridge be as sharp as it is practicable to obtain as this permits the striking points to be set back within or close to the outline of the legs, in forming dies as illustrated in Figs. 5 and 6, by a simple bending of the material of the bridge without impacting the material, although I have found it frequently desirable to impact the bridge material to make the material denser and the bridge stiffer than in the ordinary staple as it is customarily made. The sharp bend 56 requires the anvil to have sharp edges 58, Fig. 5, which is desirable in the Fig. 5 dies in that the edges engage the initially upwardly arched bridge and hold the staple from moving downwardly with the side wipers during the time that the bridge is being inverted and shaped by the hammer 46.

The amount of arch in the bridge after the staple legs have been bent and before the bridge has been inverted by the hammer 46 control the

amount that the arch of the bridge can be inverted or depressed without stretching the bridge material. Fig. 9 illustrates this situation where the arch 60, illustrated in dotted lines, represents the bridge prior to its inversion into the form embodying the present invention and illustrated at 62. In both cases the medial length of the bridge is the same. The striking points of the staple are at 64 in line with the inner face of the leg and the staple can be driven into very hard materials without the bending of the legs. The inverted bridge 62 thus is formed without any stretching of the bridge material other than that which takes place at the outer face portions of the curves. It is understood that if the depression is too great the bridge material will stretch and the striking points will be pulled inwardly of the legs so that the resistance of the staple to bending is reduced.

By a proper shaping of the striking face of the anvil, the material can be swedged into the dotted positions indicated at 66 to set the striking points 68 back within the outline of the staple legs and into the axial line thereof.

The staple of the present invention also can be made between a hammer having a curved striking face and an anvil having a flat top face, in dies where the staple is held from moving longitudinally thereof during the bridge forming operation.

Figs. 10 and 11 illustrate the staple forming operation in such dies. In these dies, the anvil 70 is stationary as before and is provided with a flat top face 72. The leg forming dies or side wipers 74 move downwardly on opposite sides of the anvil to bend the legs and form the arched bridge as before. When, however, the staple legs have been completely formed and the dies 74 overlie approximately the entire length of the leg, the dies are then caused to be stationary and are moved inwardly and clamped against the staple, thereby holding the staple against movement longitudinally thereof during the bridge shaping operation. This can be done in a side action press or in any convenient manner not necessary to illustrate herein.

After the staple is clamped stationary the striker or hammer 76 with the curved striking face 78 is brought into engagement with the arched bridge of the staple and forces it downwardly towards the anvil until the inner face of the middle part of the bridge engages the top plate face of the anvil. This action causes the arch of the bridge to flatten and ultimately to assume the configuration of the striking face 78 of the hammer, as illustrated at 80, the under surface of the bridge also assuming a correspondingly curved shape. Since the staple is held from longitudinal movement during the bridge forming operation and since the length of the arch is greater than the direct distance between the confronting faces of the legs the endwise thrust of the bridge on the ends thereof as the bridge is being straightened causes the bend 82 between the bridge and the end of the arch first to straighten and then to bend at a sharp angle, as illustrated at 84, Fig. 11, the outer curve 86 being also made sharper as at 88. The excess length of the bridge causes the bridge to reshape itself endwise to provide a sharp radius of bend at 88 and striking points or heads 90 which are within or close to the outline of the leg. By varying the amount of material in the arch prior to the inversion of the arch, the position of the striking points 90 may be controlled and located

where desired. It is possible to fold the bridge flat against the inner face of the staple leg by having a sufficiently high arch prior to the bridge shaping action.

In forming the usual staple, there is a tendency sometimes for the pointed ends of the legs to diverge after the staple is removed from between the dies and to prevent this divergence and to insure parallel legs the staple wire is bent abruptly over the anvil by having but little relief at the confronting corners of the forming members 42. With the present construction of staple, due to the inversion of the bridge, the ends of the bridge tend to be forced apart or outwardly and hence tend to swing the pointed ends of the legs inwardly or toward each other and against the anvil. Thus, the legs are brought into parallelism without difficulty and without having to bend the wire sharply over the anvil. The confronting corners of the side wipers or forming members 42 can thus have great relief as indicated at 92, Fig. 5, so that the bottoms of the wipers first engage the simple wire remote from the anvil and thus cause the wire to bend over the anvil to form a high bridge.

Fig. 5 also represents, at the right in the figure, coacting shear elements for cutting a staple length of wire from a longer wire, and simultaneously forming beveled or tapered driving points on both severed ends. The dotted line represents the rear edge of the shear element on the forming member 42 for coacting with the relatively stationary shear element shown below the wire at the right in Fig. 2.

While I prefer to form my staple over an anvil having a concave face that merges with the flat opposite faces, as in Fig. 5, or where the anvil has a flat upper face, as in Fig. 10, the upper face of the anvil can be otherwise constructed, as for instance, in Fig. 12. In this figure, the anvil 94 has thin upstanding ribs 96 that are on opposite sides of an inverted channel 98 in which a part of the bridge material is depressed. This anvil produces a satisfactory staple, especially where the staple has a high arch prior to the inversion and the legs of the staple are clamped against the anvil so that the staple does not move downwardly when the bridge is shaped. The hammer 100 in this instance can be in the form of a relatively thin bar having a slightly rounded lower face so as not to cut the bridge material. The hammer moves downwardly against the arched bridge and forces the ends of the bridge outwardly and upwardly so as to produce a sharp bend at the junction between the bridge and the leg with elevated striking points that are close to or entirely within the outline of the leg. The bridge bends up over the rib 96 of the anvil so that the rib, with proper dimensions thereof, does not receive any particular pressure thereon but merely serves to locate the arch of the staple at the time the staple is clamped against the anvil. There is no particular advantage to be employed in using this type of anvil over the flat faced anvil of Fig. 10 or the concave-faced anvil of Fig. 6, and the construction as illustrated is shown to illustrate that a considerable variation of anvil and hammer configuration can be employed to produce a highly satisfactory staple.

From the above description it is apparent that the staple of the present invention has two striking points or heads; that the bridge is depressed below these points; and that the strik-

ing points are so close to the legs of the staple that the upper part of the staple leg will not bend or curl over when the adjacent striking point is hit by the hammer. It is not sufficient merely to have the striking point close to the line of the staple leg. The material between the vertical leg and the striking point must be so resistant to deformation that it will not bend when the striking point is hit. This is accomplished by having as sharp a bend as possible at the junction of the bridge and the leg, this junction making something less than a right angle. If the junction is gradual, as by being a curve or a right angle, where the line of impact on the striking point is outside the outline of the leg, the relatively gradual curvature thus produced between the striking point and the leg permits the material to bend easily under impact.

In accordance with the construction herein described, the line of junction between the bridge and the leg is abrupt and hence bending is not liable to take place.

Furthermore, the shape and condition of the bridge must be such that when one striking point alone is hit and the adjacent leg penetrates the supporting surface, the other leg should not be deformed. With the described construction, the inverted bridge does not change its shape or flatten when one striking point alone is hit and hence there is no tendency to force the unstruck leg away from the struck leg. Thus, the two legs remain parallel with each other throughout their lengths regardless of whether one striking point or both striking points are hit. It sometimes happens that a staple leg tends to move in an undesired direction when driven especially into grainy hardwood. With the present staple the direction of penetration of the legs can be changed by hitting one striking point or the other so that the position of the staple can be corrected and the staple can be driven more accurately than with any other staple with which I am aware.

I claim:

1. The method of improving the driving quality of a staple having spaced legs connected by a bridge member integral with said legs, which method consists in providing the staple with two driving heads located above all other parts of the staple and each so close to the line of a separate leg that the resistance of a leg to bending under impact on a head is more than its resistance to penetration of a penetrable supporting material, by forcing the bridge member downwardly between the legs and laterally toward the legs and causing the tops of the legs to upstand above the bridge member and provide the aforesaid driving heads.

2. The method of making a staple of improved driving ability having parallel legs and a bridge integral with and connecting said legs, which method consists in joining the ends of the bridge and legs abruptly at the inside of the legs by positioning the bridge below the ends of the legs where they join the bridge and forcing bridge material laterally toward the legs.

3. The method of making a staple of improved driving ability having legs connected integrally at their one ends by a bridge member, which method consists in bending a straight staple wire into staple shape and providing a bridge member that is upwardly arched between the legs, and then inverting the arch in such manner that the convex side of the arch faces in the same direction as the free ends of the legs and the ends of

the arch abruptly join said one ends of the legs and said one ends stand above the body of the arch.

4. The method of making a staple of improved driving ability having legs connected integrally at their one ends by a bridge member, which method consists in bending a straight staple wire into staple shape and providing a bridge member, and then forcing the body of the bridge member below the said one ends of the legs to position said one ends above the body of the bridge member.

5. The method of making a staple of improved driving ability having legs connected integrally at their one ends by a bridge member, which method consists in forming the staple with the body of the bridge member arched above the legs, holding the staple against movement in the direction of the length of the legs, and forcing the body of the bridge member inwardly of the legs and flattening the arch and forcing the ends of the bridge member outwardly toward the legs.

6. The method of making a staple of improved driving ability having legs connected integrally at their one ends by a bridge member, which method consists in forming the staple with the body of the bridge member arched above the legs, holding the staple against movement in the direction of the length of the legs, and forcing the body of the bridge member inwardly of the legs and flattening the arch and forcing the ends of the bridge member outwardly toward the legs, and causing the bridge member to assume an inverted arch form the length of which is not materially greater than the initial length of the bridge member.

7. The method of making a staple of improved driving ability having legs connected integrally at their one ends by a bridge member, which method consists in forming the staple with the body of the bridge member arched above the legs, holding the staple against movement in the direction of the length of the legs, by confining the legs between rigid surfaces, and forcing the body of the bridge member toward the free ends of the legs and the ends of the bridge member outwardly and against said rigid surfaces and upwardly above the legs and providing striking heads close to the line of the legs and elevated above the body of the bridge member.

8. The method of making a staple of improved driving ability having legs connected integrally at their one ends by a bridge member, which method consists in forming the staple with the body of the bridge member arched above the legs, holding the staple against movement in the direction of the length of the legs and forcing the body of the bridge member toward the free ends of the legs and the ends of the bridge member outwardly and upwardly above the legs and providing striking heads close to the line of the legs and elevated above the body of the bridge member.

9. A staple formed of a single length of wire bent into approximately U-shape providing two substantially parallel legs pointed at their one ends and connected integrally at their other ends by a bridge of lesser length than a leg, the wire at the juncture of the bridge and the legs being abruptly bent inwardly of the legs providing driving heads substantially over the legs and upstanding above the intervening parts of the bridge, the driving heads being close together and shaped and adapted to be struck simultaneously by an ordinary hammer, each leg-point being in a line perpendicular to the driving plane of the heads and

passing through the associated driving head, and the legs being substantially parallel to and lying in said lines.

10. A staple having two substantially parallel legs pointed at their one ends and connected integrally at their opposite ends by a bridge of lesser length than a leg, the staple at the bridge-end thereof having driving heads substantially over the legs and upstanding above the intervening

parts of the bridge, the driving heads being close together and shaped and adapted to be struck simultaneously by an ordinary hammer, each leg-point being in a line perpendicular to the driving plane of the heads and passing through the associated driving head, and the legs being substantially parallel to and lying in said lines.

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