Nov. 22, 1960 E. F. PFAFF ET AL 2,961,210

FASTENING ASSEMBLY

Filed Oct. 1, 1956 2 Sheets-Sheet 1

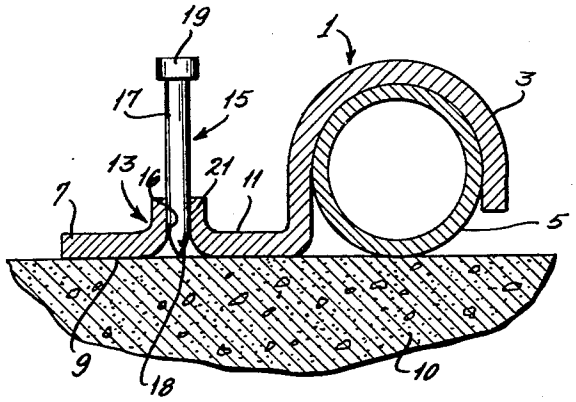

FIG.1.

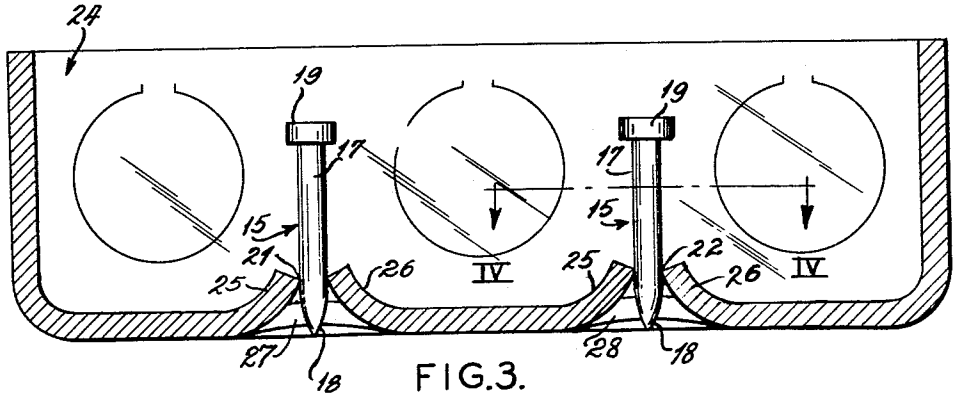

FIG.3.

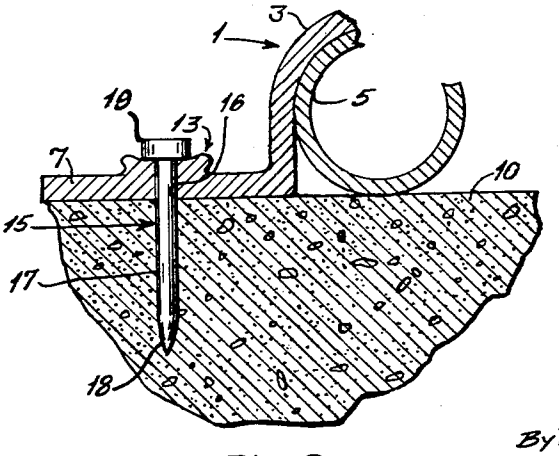

FIG.2.

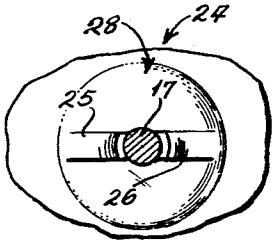

FIG.4

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FASTENING ASSEMBLY

Filed Oct. 1, 1956 2 Sheets-Sheet 2

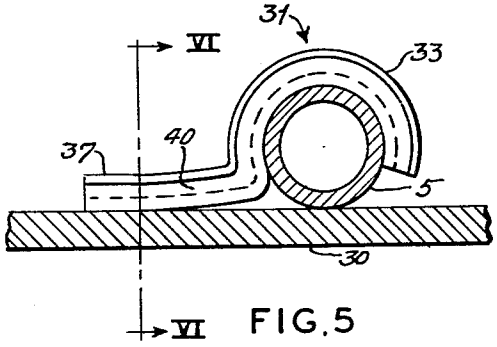

FIG.5

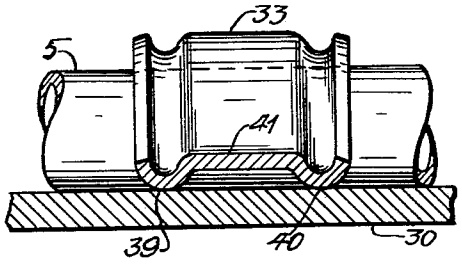

FIG.6

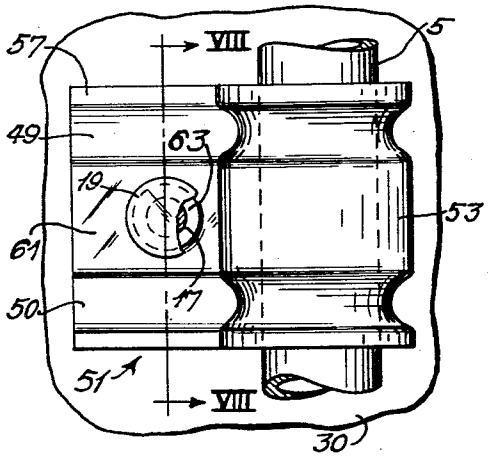

FIG.7

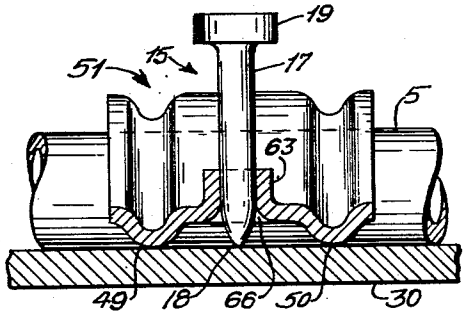

FIG.8

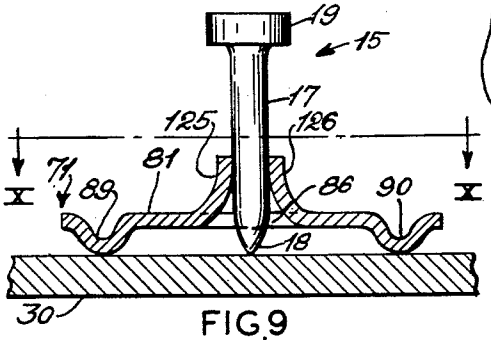

FIG.9

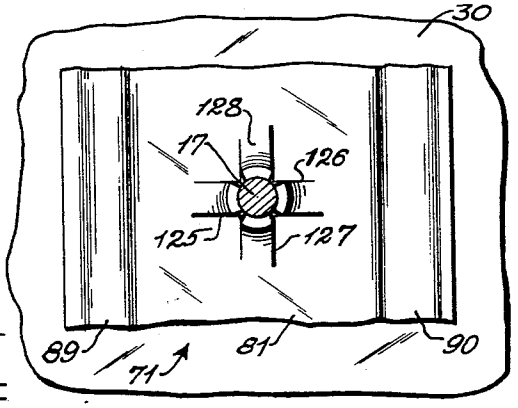

FIG.10

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2,961,210

FASTENING ASSEMBLY

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Filed Oct. 1, 1956, Ser. No. 613,268

7 Claims. (Cl. 248—74)

This invention relates to a fastening assembly and more particularly to a fastening system for conduit clips or other structural members including attaching or holding parts in which a fastener is adapted to be driven by means of an explosive cartridge type of tool.

In securing a structural member to a base by means of a fastener, such as a stud or the like, it has been found an advantageous practice to drive the stud through a portion of the structural member and into the supporting base with a suitable explosive powered tool. Such explosively-powered stud driving tools may be of either of two types. One type is a piston type wherein a ram member is directly driven to strike and in turn drive a stud positioned at the tool muzzle. In the other and more common type, the stud is a projectile directly driven by an explosive cartridge through the barrel bore of the tool. The use of either type of tool is contemplated.

Prior to the advent of these tools, it was the general practice to first provide a hole in the structural member for receiving a stud or anchor bolt and then to drive such fastener into the supporting base with either a conventional manually operated driver or power-driven tool. Regardless of how it is driven, the stud is forced through the member and into the base until its enlarged head abuts against the structural member.

There has been the disadvantage with explosive actuated driving tools, that the stud head is often driven against the structural member with too great a force and that a portion of the member will be deformed. This penetrated portion then tends to be flared outwardly on the side opposite the side engaged by the head, while adjacent parts of the member are warped in the opposite direction, resulting in a relatively weak and distorted fastening assembly which is subject to loosening when a force such as a work-load is applied to the structural member. For example, the curved portion of a conduit clip will be backed off from the conduit which then is free to rattle and move. There is the further disadvantage, in driving fasteners of heretofore known systems using explosive cartridges, that the stud will be driven askew of its intended direction and fail to be secured to the base.

In accordance with this invention these disadvantages are avoided by providing an assembly wherein a pointed stud is associated with a sheet metal structural member in such a manner as to be properly guided therethrough and into a supporting body or base during permanent attachment of the structural member to the base and in which the driven fastener is firmly seated in the structural member without any serious distortion of the latter tending to impair its holding function. More specifically, for a piston type tool the studs are preset in a structural member by jamming one or as many studs as are required into preformed holes in the structural member to a depth leaving the tapering points of the undriven studs initially flush with one surface so that each stud engages the wall of a hole with a press fit and also engages the base in desired relationship. It is then easy

to properly locate the assembly with respect to the muzzle of the tool barrel and locate the structural member on the base member and proceed to drive the preset fasteners into the supporting base, eliminating any necessity for handling and properly positioning the studs before or at the time that the structural member is being permanently fastened to the base. For the other type of tool, which directly drives a stud, the structural member of this invention is imperforate in a boss portion being in upraised relationship with respect to the surface of the supporting base by means of ribs or flanges on the member and extending on one side so as to be positionable between the base and member. In still another embodiment the upraised boss portion with ribs is provided together with the special perforation and preset fastener. All embodiments have a yieldable or plastic boss portion for taking up excess energy which otherwise causes distortion of the structural member. Such portion preferably is also elastic so as to tend to contact the base resiliently. The resulting member may take the form of thin metal members such as conduit clips, tubing brackets, lathing channels, furring strips, electrical outlet boxes and the like.

It is therefore an object of this invention to provide a fastening assembly in which a headed fastener firmly driven into a clip or other structural member as the head of the fastener is tightly driven against the structural member without causing undesired distortion of the structural member.

Another object of this invention is to provide a fastening assembly in which a fastener is preset in a structural member in such a manner as to be positively guided therethrough at least at the beginning while being driven into a base member.

Another object of this invention is to provide a fastening assembly in which a fastener is properly guided by even a relatively thin structural member through which it is driven and is firmly embedded in the structural member.

Another object of this invention is to provide a fastening assembly in which a fastener may more safely and accurately be driven through a structural member.

Additional objects and advantages will be apparent from the following description with reference to the drawing in which:

Figure 1 is a sectional view of one embodiment of the invention, including a conduit clip, having preset therein a fastener;

Figure 2 is a sectional view through a portion of the conduit clip of Figure 1 after the fastener has been driven through the clip into a base member;

Figure 3 is a sectional view of a structural member, in this instance an electrical outlet box, having a pair of preset fasteners received in fastening tabs on the box, and illustrative of another embodiment of the invention;

Figure 4 is a fragmentary view taken on line IV—IV of Figure 3;

Figure 5 is a side view of another embodiment;

Figure 6 is a sectional view on line VI—VI of Figure 5;

Figure 7 is a plan view of still another embodiment;

Figure 8 is a sectional view on line VIII—VIII of Figure 7;

Figure 9 is a sectional view of one more embodiment; and

Figure 10 is a sectional view taken on line X—X.

This invention involves driving and preferably presetting a fastener such as a stud or a nail into a relatively plastic portion of a structural member such as a conduit clip, electrical outlet box, or the like. The exact nature of the invention will be understood from the description

of the various embodiments shown in the figures of the drawing.

Referring to Figure 1, a conduit clip 1 has an arcuated portion 3 for engaging conduit 5 and also an attaching tab flange 7 having a base engaging side 9 for abutting the base member 10 and also having an outer or stud receiving side 11. A boss 13 having hole 16 is pierce extruded to extend on the outer side 11 on the flange 7. This may be done by a suitable punch driven through the flange from the side 9 toward the side 11. The boss 13 is preferably extruded into a forming die to assure its having the desired shape and smooth even surfaces and edges. A fastener 15 having a shank 17 is press fitted into the hole 16 with its point 18 flush with surface 9. The end 18 of the shank which is received in the hole 16 is tapered and an enlarged head 19 extends radially outwardly from the other end of the fastener shank 17.

The conduit clip 1 is fabricated from a deformable material which is sufficiently elastic so that it will not rupture when it is being extruded or when the fastener head is driven against the boss. Suitable materials for this purpose include low-carbon steels such as SAE 1010–1020, copper, brass, or bronze, and certain classes of vinyl, polyethylene, chlorinated rubber or Saran-type plastics. The fastener 15 is harder than the clip so that the boss 13 will be deformed rather than the fastener 15. Suitable fasteners may have a Rockwell hardness of from about R/c 48 to about R/c 56 and otherwise suitable for powder actuated tools. A steel fastener of the heat treatable type, for example, having a Rockwell hardness on the surface of R/c 53–56 and a core hardness of R/c 50–52 is satisfactory for use with any of the materials listed above. A stud having a shank diameter, for example, of about one-eighth to five-thirty-seconds of an inch diameter should be press-fitted in a hole of a diameter which may be smaller than the shank diameter by as much as about 0.020 of an inch in a metal structural member of the above indicated type, thus assuring a firm press-fit in the orifice 16. A difference in diameter as little as about 5% or over 2% is adequate for some materials. The total height through the boss 13 from the base engaging surface 9 to the outer surface 21 of the boss should preferably be at least about three times the thickness of the flange 7 between the surfaces 9 and 11 thereof so as to enable engagement with the shank 17 at least adjacent the ogival point 18. The diameter of the outer surface 21 of the boss may vary, but may advantageously be as high as about 2 or 3 times the diameter of the stud shank 17, i.e., it may be as wide or even slightly wider than the ordinary stud head 19.

Figure 2 shows the conduit clip after it has been fastened to the base member 10. The fastener has been driven through the boss hole 16 and into the base member in any appropriate manner until the head 19 engages the outer surface 21 of the boss 13 and thereafter until the boss has been compressed to approximately half its original height to the conditions shown in Figure 2. The material forming the boss 13 is thus jammed about the shank 17 of the fastener, and due to resulting flow and the inherent resilience of the material, the clip fastener 1 is free from warpage and is firmly held at the orifice 16 about the driven stud 15. As a further result pipe or conduit 5 is held quite firmly upon base 10.

While driving the preset fastener the orifice 16 acts as a guide member for the fastener shank as shown in Figure 1. The bearing surface between the fastener shank 17 and the orifice 16 in the boss is spaced from the work engaging surface 9 of the structural member 1 so that as the shank is being driven through the guide hole its shank 17 adjacent ogival point is more effectively guided at a location spaced substantially farther outwardly from the penetrated surface of the base member 10 than would occur, if the orifice 16 was merely formed through the relatively thin flange 7 rather than through a boss on the flange. Because of the press fit between the stud shank 17 and the hole in the boss 13, any tendency of the stud to turn askew of the intended direction in which it is to be driven into the base member will be counteracted both by a substantially tighter fit and the inherent resiliency of the boss tending to maintain both the stud and structural member in proper alignment.

Figure 3 shows an electrical outlet box 24 having similar fastener assemblies formed in connection with a plurality of attaching fingers 25 and 26 on the box in certain areas. These fingers preferably with upraised attaching ears or blisters such as 27 and 28 are stamped from the material of the box 24 in these areas and are inherently resilient so that the box is more firmly held against the base member after the studs are driven. The functioning of the fingers in the ears is precisely the same as the boss in the previously described embodiments of Figures 1 and 2 and their formation by bending leaves the openings 21 and 22 for reception of the stud points 18. The materials from which the box may be fabricated are also the same as the materials, preferably metal, from which the conduit clip may be fabricated.

Figure 4 shows the opposing relationship of fingers 25 and 26 at ear 28. These fingers serve to hold the stud shank 17 in desired upright relationship with its point 18 in opening 22 flush with the lower surface of box 24. In this position the point 18 of stud 15 may advantageously be further constrained in the opening by the adjoining material of ear 28, while head 19 is held in position ready for reception in the socket at the muzzle of a tool bearing in its barrel an explosively driven ram or piston.

Figures 5 and 6 show another embodiment of the structural member of this invention in the form of a conduit clip 31. It has an arcuate portion 33 for engaging conduit 5 and also an attaching ear or tab 37 having base engaging protrusions such as ribs or flanges 39 and 40 for abutting the base member 30. These flanges may be advantageously embossed in the material of clip 31 adjacent lateral edges thereof at least in tab 37 and even in portion 33. Tab portion 37 also has an outer or stud receiving up-raised section or platform 41. This embodiment is adapted for use with the type of explosive actuated tool which directly projects a fastener or stud from the muzzle of the bore of a barrel portion of the tool inasmuch as platform 41 acts as a shock absorber and stud penetration limiter. The up-raised section 41 is adapted to be pierced and penetrated by the ogival point of such a stud in its passage from the bore of the barrel into the supporting base 30. The up-raised portion 41 together with the flanges 39 and 40 provide the desired yieldable portion in the tab 37 of the clip 31 so as to substantially prevent distortion caused by the impact with the head of the stud. The advantage of this embodiment is that the arcuate portion 33 remains unwarped and in firm contact with the member 5 to be secured on the surface of the base 30 by means of an explosive or any other suitable impact actuated stud-driving tool even though both ribs 39 and 40 are pressed completely and firmly against the supporting base into which the stud has been driven.

In the embodiment of Figures 7 and 8 conduit clip 51 has arcuate portion 53 for engaging a conduit 5 and also has an attaching tab 57 for placement against base 30. Tab 57 is similar to the tab of the foregoing embodiment in that it is also provided with an upraised section 61 having the ribs 49 and 50 for abutment with support 30. Tab 57, however, is further modified in accordance with the embodiment of Figures 1 and 2 in that the upraised section 61 is provided with an elongated boss 63 orificed at 66 for assembly with the shank 17 of projectile fastener 15 adjacent the ogival penetrating point 18. Thus studs 15 and 51 are preassembled so that the point 18 is flush with ribs 49 and 50 and so that the shank 17 is in upright position with the head 19 of stud 15 positioned for engagement in desired alignment with the muzzle of any suitable driving tool.

In the embodiment of Figures 9 and 10 only part of the structural member is shown and is characterized by an attaching portion **71** having upraised resilient section **81** with the ribs **89** and **90** for abutment with the supporting base **30** and acting as a host for the headed stud **15**. In lieu of the boss structure of the foregoing embodiment section **81** is orificed at **86** and provides the orifice with upraised fingers **125** and **126** in opposition with each other and also fingers **127** and **128** in opposition with each other. Included in the structural unit is a projectile fastener **15** assembled as shown by mounting the shank **17** adjacent the point **18** between the four surrounding fingers with the stud point **18** flush with the ribs **89** and **90** and with the stud shank **17** held by the fingers in desired upright relationship ready for driving substantially squarely into the base **30**.

Although this invention has been described with particular reference to certain embodiments, materials, and details, various modifications therein will be apparent to one skilled in the art. The invention is applicable to many structural members other than conduit clips and outlet boxes; for example, similar fastening assemblies may be incorporated into lathing strips and channels, furring strips or ram-clips. The invention is therefore not to be limited to such embodiments, materials, or details except as set forth in the appended claims.

What is claimed is:

1. A structural member adapted to be secured to a base by an explosively operated stud-driving tool, having an attaching plate-like tab portion of strong but impact workable metal such as steel and the like adapted to bear against said base and amenable to impaling penetration by a pointed and headed exposive driven stud, said tab portion having in the area of stud penetration an integral plastically deformable section for projecting away from said base with spacing from said base at least adjacent said base and the point of said stud, said tab portion also having foot means disposed adjacent said section and remotely from said stud point for contacting said base thereby providing said spacing said section being adapted to be permanently deformed at least with reduction of said projected section spacing by the head of said stud, thereby absorbing the excess energy of the stud as its head is driven into contact with said section as its point is driven into said base substantially without concomitant excessive distortion of the rest of said member by said section.

2. A fastening assembly adapted to be secured to a difficultly penetrable base by an explosive operated stud-driving tool comprising in combination a structural member having an attaching tab portion thereon of strong but impact workable metal such as steel and the like, one side of said portion being adapted to bear against said base, a pre-formed boss integrally formed on the other side of said portion to project away from the base bearing side, said boss and portion having an orifice therethrough, and foot means on said portion integrally formed remotely from said boss for contacting said base to space the rest of said portion adjacent said boss from said base, and a stud having a shank, an ogival penetrating point on one end thereof and an enlarged head on the other end, said stud shank adjacent said point being snugly pre-set in said orifice for retention in substantial squareness with respect to said portion and with its point substantially flush with the side of said portion opposite said boss said orifice being enlarged on said one side for formation of said spacing adjacent said shank.

3. A fastening assembly adapted to be secured to a base by an explosive operated stud-driving tool comprising a metal structural member having a plate-like attaching tab portion, an integral boss upraised on said tab portion to project from one surface thereof, an orifice through said boss, and a stud having an ogivally pointed shank press-fitted adjacent the point into said orifice for retention with said point forwardly at least substantially flush with the substantially planar surface of said portion opposite said first surface and a headed portion of said shank extending outwardly from said shank adjacent said first surface, said planar surface and boss forming a stud-surrounding relief space adjacent said shank, said boss having a dimension transversely of said shank about two to three times the diameter of said shank and said orifice having an unstretched diameter of not more than about 16% less than the diameter of said shank in contiguity with said shank.

4. A clip for attaching a conduit, pipe, strip or the like structure to a surface of a base with an explosive driven stud having an enlarged head at one end and an ogival point at the other, comprising a body portion shaped to conform to and partially circumscribe such structure in continguous holding relationship and at least one plate-like tab portion appended to said body portion, said tab portion having formed integrally thereon a deformable pre-set boss projecting on the same side of said tab portion as the body portion, said boss being spaced at least in part from said base and being provided with an orifice in said spaced part, and a pointed and headed stud press-fitted into said orifice for retention on said clip in substantial squareness with respect to said tab portion and with said point substantially flush with the side of said portion opposite said boss, whereby the tendency of said body portion to be deformed by said stud out of said relationship after driving is substantially reduced.

5. A fastening assembly adapted to be secured to a base by an explosive operated stud-driving tool, comprising a structural member having an attaching plate-like portion thereon one side of which is adapted to bear against said base, a boss on the other side of said portion comprising at least a pair of opposing fingers integral with said portion and bent out of the plane of said portion to extend on said other side so as to form an orifice in said boss, and a stud having an ogival point at one end extending into said orifice and having an enlarged head on the other end, said stud having a shank snugly received between said fingers adjacent said point, said stud being constrained by said fingers in preset substantial squareness with respect to said attaching portion with its point flush with the side of said portion opposite said fingers and adapted to also bear against said base.

6. A fastening assembly adapted to be secured to the surface of a base by an explosive operated stud-driving tool, comprising a structural member having an attaching plate-like portion thereon one side of which is adapted to bear against said base, at least said attaching portion having integral corrugations at least adjacent opposite edges of said portion projecting on said side for direct abutment with said surface whereby the rest of said attaching portion is disposed in up-raised yieldable relationship with respect to said surface, a boss on the other side of said portion integral therewith, an orifice in said portion and boss, and a stud having an ogival point on one end and an enlarged head on the other, said stud adiacent said point being press-fitted in said orifice in substantial squareness with respect to said portion with its point extending on the side of said portion opposite said boss but not beyond said flanges.

7. A fastening assembly adapted to be secured to the surface of a base by an explosive operated stud-driving tool, comprising a structural member having an attaching plate-like portion thereon one side of which is adapted to bear against said base, at least said attaching portion having opposed integral corrugations projecting on said side for direct abutment with said surface whereby the rest of said attaching portion is disposed in upraised yieldable relationship with respect to said surface, a boss on the other side of said portion integral therewith

and comprising a plurality of opposing fingers between said corrugations and integral with said portion, said fingers being bent out of the up-raised plane of said portion to extend on said other side so as to form an orifice in said boss surrounded by said fingers, and a stud having an ogival point at one end extending into said orifice and having an enlarged head on the other end, said stud having a shank snugly received between said fingers adjacent said point, said stud being constrained by said fingers in pre-set substantial squareness with respect to said attaching portion with its point flush with the side of said portion opposite said fingers for bearing against said base.

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