United States Patent

Kemp

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[54] DEVICE FOR FORMING SHEET METAL JOINTS AND SEAMS

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[52] **U.S. Cl.** **113/54,** 72/76

[51] **Int. Cl.** **B21d 31/06**

[58] **Field of Search** 113/54; 72/76; 29/243.5, 243.58

[56] **References Cited**

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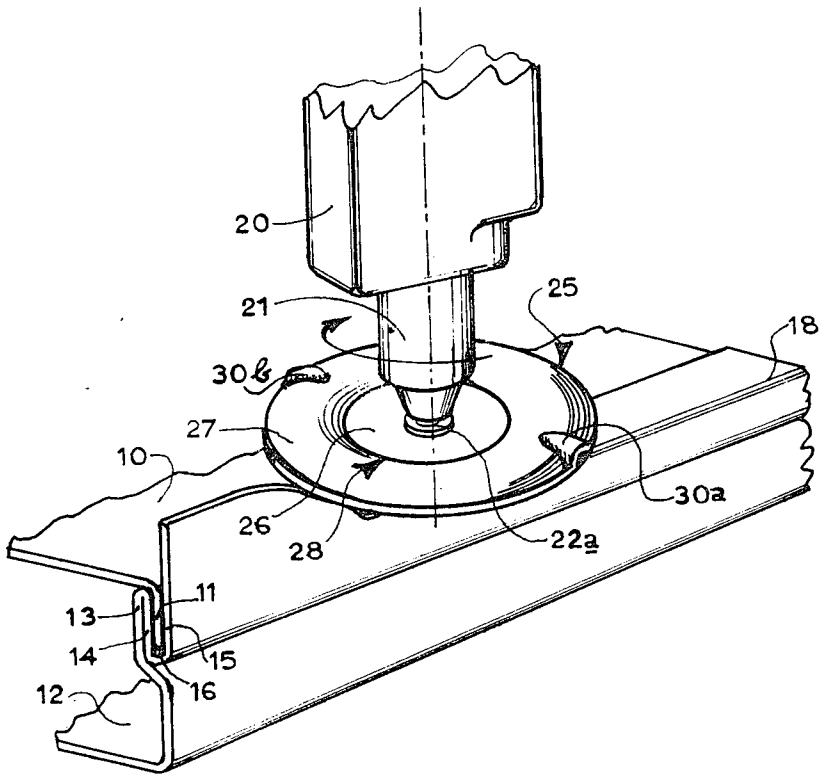
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Primary Examiner—Richard J. Herbst
Attorney—E. Hastings Ackley

[57] **ABSTRACT**

A rotary hammer device for working sheet metal, particularly for closing sheet metal joints of the type commonly known as "Pittsburgh Lock," wherein the hammer is reversible and is operable from both sides, so as to be movable in either longitudinal direction along the seam or joint.

10 Claims, 9 Drawing Figures



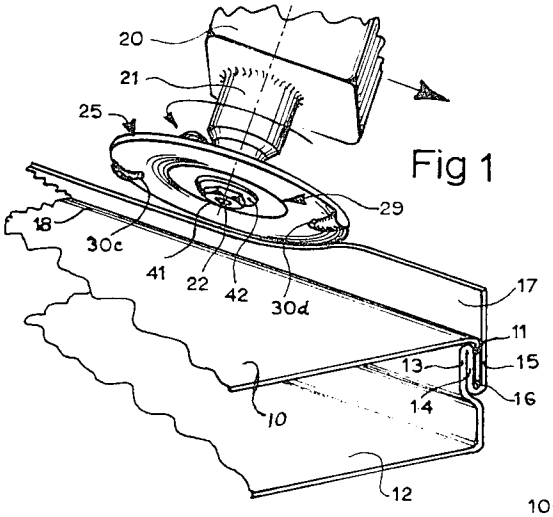


Fig 1

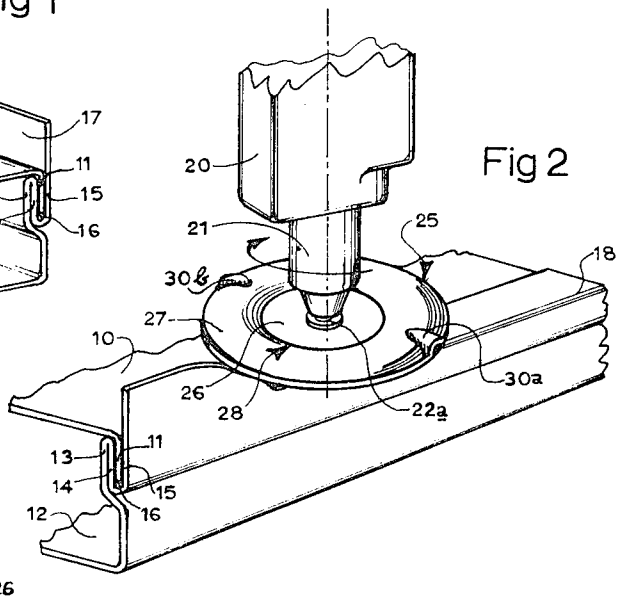


Fig 2

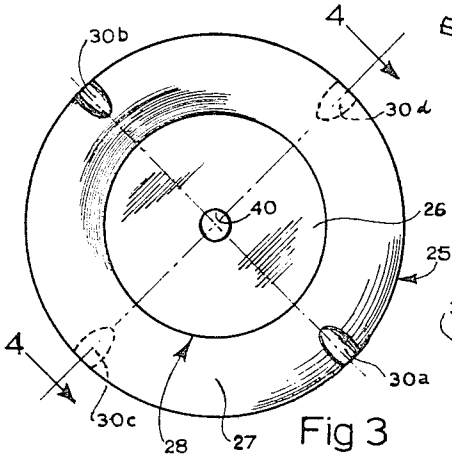


Fig 3

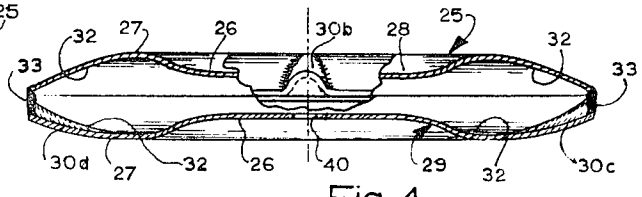


Fig 4

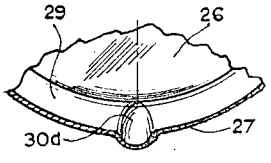


Fig 6

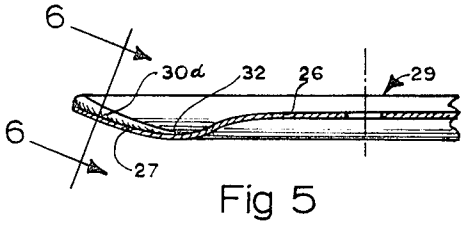


Fig 5

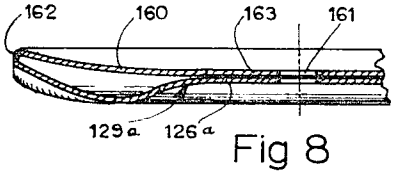


Fig 8

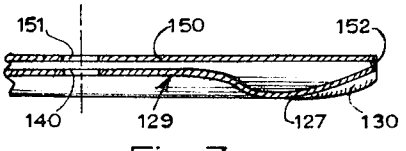


Fig 7

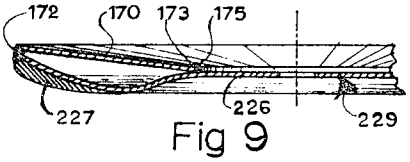


Fig 9

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DEVICE FOR FORMING SHEET METAL JOINTS AND SEAMS

OBJECTS AND SUMMARY OF THE INVENTION

This invention relates to metalworking devices, more particularly to a power hammer-type device adapted for use with a rotary power tool, such as a drill, rotary wrench, sander or the like, for bending sheet metal without scuffing or otherwise damaging the surface of the sheet metal, and without distorting or bending the metal other than to form the desired closure of the joint and provide a flat seam.

It is, therefore, one object of the device to provide a metalworking tool of the character set forth for bending sheet metal seams and joints adapted for use at a point remote from the metalworking shop.

A particular object of the invention is to provide a sheet-metal-working device which is simple and economical to manufacture and use, and which is of rigid and durable construction, which is adapted to be operated easily and efficiently on various gauges of sheet metal for bending the same, and particularly for closing and bending a metal joint such as a "Pittsburgh Lock" without damaging the metal.

It is an important object of the invention to provide a rotary hammer of the character described which has a pair of working surfaces, one on each side of a discuslike body, the sides being reversible in use so as to be movable in either direction along the seam to fold or bend the metal as desired at either end of the joint.

It is still another object of the invention to provide a device of the character described which may be carried to a remote job for use with rotary power tools such as electric drills, sanders, grinders, or similar portable hand-held power units. The device is likewise adapted to use with rotary air or pneumatic-type power units.

Still another object of the invention is to provide an improved hammer member of the character described having means for preventing vibration of the peripheral edge portions of the hammer member under heavy stresses and impacts.

A still further object of the invention is to provide a rotary hammer for forming sheet metal made in substantially the form of a discus, having metalworking surfaces on the marginal portions of opposite sides thereof, and formed by abutting the edges of a pair of saucerlike sections with their concave sides facing inwardly and welding or otherwise similarly rigidly joining the abutting edges to provide the unitary two-faced discus-shaped tool.

Additional objects and advantages of the invention will be readily apparent from the reading of the following description of a device constructed in accordance with the invention, and reference to the accompanying drawings thereof, wherein:

FIG. 1 is a fragmentary isometric view of a hammer member made in accordance with the invention operated by a rotary power tool and showing the hammer member being moved along a sheet metal joint to close the joint;

FIG. 2 is a view similar to FIG. 1 from another angle, showing the hammer member being used to completely fold down the bend and to complete the joint;

FIG. 3 is an enlarged plan view of the hammer member of FIG. 1;

FIG. 4 is a still further enlarged cross-sectional view taken on the line 4—4 of FIG. 3;

FIG. 5 is an enlarged fragmentary view of the work surface portion of one of the sections of the hammer member;

FIG. 6 is a fragmentary sectional view taken on the line 6—6 of FIG. 5.

FIG. 7 is a fragmentary cross-sectional view, similar to FIG. 4, of a modified form of hammer member;

FIG. 8 is a view similar to FIG. 7 of a further modified form of hammer member; and,

FIG. 9 is a fragmentary view of still another modified form of the device.

BACKGROUND, CONSTRUCTION AND OPERATION OF PREFERRED EMBODIMENT

Various types of machines have been used in the past for forming sheet metal to close joints such as the "Pittsburgh Lock," but most such machines have not been portable and have not provided for use in forming the sheet metal to close the joint at the installation point, or point of use, of the sheet metal construction. The joint of the type described is widely used in the sheet metal industry to fasten opposite edges of sheets of sheet metal together to form a duct corner, or to fasten two edges of different sheet metal together for other structures. The sheets to be joined each have their edge portion prefabricated in a particular manner, one sheet **10** (FIGS. **1** and **2**) having its edge portion bent at an angle to form a flange **11**, and this sheet is called the angled sheet. The other sheet of metal **12**, called the replaited sheet, has its edge portion folded back on itself to form a flat S-type fold having an inner portion **13**, a middle portion **14** and an outer portion **15**. The middle and outer folds **14** and **15** are spaced slightly from each other to form an outwardly facing channel or groove **16** which is adapted to receive the flange **11** of the angled sheet. The outer fold **15** has its edge portion projecting beyond the folds **13** and **14** to form a bendable flange portion **17**, commonly called the outstanding edge. In forming the "Pittsburgh Lock," the flange **11** of the angled sheet **10** is inserted fully into the channel **16** of the replaited sheet, then the projecting flange or outstanding edge **17** of the replaited sheet **12** is folded flat along the exposed surface of the angled sheet **10** at the bend between the sheet **10** and the flange **11** along the seam line **18**, so that the bent projecting flange or outstanding edge **17** lies flat against the angled sheet **10** to close the joint lock and hold the two sheets firmly together.

Obviously, the operation of bending the flange or edge **17** by hand, or by hammer or other tools, is a time consuming and inefficient operation, and may result in damage to the sheet metal flange portion, or provide an insecure and irregular lock joint, or both. Reciprocating hammers have the same objection, in that they may provide an irregular joint, or damage the material forming the flange. Other types of devices which are adapted to ride along the seam of the joint and press the outstanding edge into its locked position are difficult to operate, are complex and expensive and ordinarily can be used with only relatively limited ranges of metal thickness. Also, many of these machines are not portable or are not adequately sturdy to withstand continued usage, and require considerable maintenance. In addition, in many of the machines heretofore in use, the machine will not operate to close the joint at an internal angle, where the outstanding flange edge must be closed adjacent a projecting portion of the sheet metal structure. Heretofore, it has been necessary to complete the closing of the joint by hand or handtools on the job.

Referring to the accompanying drawings, a standard rotary power tool **20**, such as an electric or pneumatic drill, sander, or other type portable power device, having a nose portion **21** with a rotary shaft **22** projecting therefrom is provided with the discuslike hammer member **25** of this invention. In the preferred form, the hammer member **25** has a central substantially planar section **26** and an annular convex work surface **27** on its outer peripheral portion, one each of the two opposite side sections **28** and **29** thereof. A plurality of identical hammer elements **30***a*, **30***b*, **30***c* and **30***d* are formed on and spaced uniformly angularly about the exposed convex work surfaces to the two sides **28** and **29** of the hammer member. As shown in FIG. **4**, the discuslike body of the hammer member is formed by the two identical dishlike or dish-shaped sections or halves **28** and **29** each having a central planar disc portion **26** and an annular concavo-convex portion **32** on its outer circumferential or peripheral section, which provides the annular convex work surfaces **27** on each side of the hammer member having the plurality of hammer elements thereon. The two dishlike sections **28** and **29** are placed with their concave

peripheral portions 32 facing each other and are joined, as by welding at 33, around the outer circumferential edges of the sections to join the sections into a unit. Also, the hammer elements 30*a* and 30*b* of the first section 28 are disposed at substantially right angles with respect to the center of the hammer member to the position in which the hammer elements 30*c* and 30*d* of the other section 29 are disposed. Thus, as is clearly shown in FIG. 3, the hammer elements 30*a* and 30*b* of the section 28 lie on a diameter which is disposed at right angles to the diameter of the section 29 in which the hammer elements 30*c* and 30*d* are disposed. The impact sections of the hammer member adjacent the hammer elements are therefore spaced from each other on opposite sides of the hammer member, so the chance of cracking or failure in stress of any kind at the hammer elements or the hammer impact sections of the body sections is reduced, since each body section is welded or otherwise secured to the opposite body section in a position in which the hammer elements thereon are located at points uniformly spaced from the hammer elements on the opposite body section.

As shown in FIGS. 5 and 6, the preferred form of the device is made by die forming or pressing a sheet of metal to provide identical sections, such as the sections 28 and 29, each having the concavo-convex work surface portion 32 formed with the hammer elements made by deforming the metal to provide the projecting hammer element 30*d* in the shape of substantially a teardrop or conical bulbar projection protruding from the convex work surface 27 of the hammer member section 29. The protruding portion 30*d* extends completely to the marginal edge of the concavo-convex portion of the hammer section, the hammer element being formed by die shaping the same to project as shown in FIGS. 5 and 6. When the body sections 28 and 29 are joined in the manner shown in FIGS. 1 through 4, by welding along the peripheral edges of the sections as at 33, the open outer ends of the conical bulbar or teardrop-shaped hammer elements are closed by the weld and joined rigidly to the circular marginal edge portion of the opposite body section, and so the hammer elements are reinforced and strengthened to withstand substantial hammering.

The hammer member 25, is therefore, substantially hollow, having the annular concavo-convex portions 32 thereof providing a pair of opposed convex annular work surfaces 27 which carry the uniformly spaced hammer elements. The weight of the tool is therefore reduced, while the strength of the tool is increased by joining the two sections. Also, the central planar disc portions 26 of the body sections 28 and 29 are spaced from each other to provide a more stable means for supporting a bushing 22*a* for clamping the hammer readily on the shaft 22 of the power unit 20.

The device shown in FIGS. 1 through 4 is completely reversible in construction and operation. Either section 28 or 29 of the hammer member 25 may be secured adjacent the outer end of the shaft, and the device will be usable regardless of which section is exposed opposite the power unit. Furthermore, by providing the two identical opposed side sections, the hammer member may be reversed and the side nearest the power unit utilized as a hammer to deform or bend the flange, and so provide for closing a joint up to a projecting portion of the metalwork forming an internal angle between the portion on which the joint is being closed and an adjacent section. The hammer member is therefore reversible and may be used with either surface adjacent the power unit, and the other surface spaced from the power unit.

As will be seen, in FIGS. 1 and 2, the power unit or rotary tool 20 is so positioned in use that the hammer 25 is disposed at an angle to the plane of the upper surface of the angled sheet 10 and at an angle to the projecting flange or outstanding edge 17 of the replaited sheet. As the hammer member is rotated in a clockwise direction, as shown by the arrow in FIG. 1, the hammer elements 30*c* and 30*d* on the body section 29 will repeatedly and rapidly engage the upstanding flange portion 17 and bend the same toward the angled plate 10 by repeated blows against the upstanding flange portion as the device is moved in the direction of the arrow in FIG. 1 from the closed portion of the joint toward the upstanding unclosed portion. Since the hammer member is rotated at a relatively high speed, a large number of small hammer impacts or blows are transmitted by the hammer elements 30*c* and 30*d* to the sheet metal flange to form the same without damaging it and to provide a uniform smooth joint. To completely close the joint, the hammer and power unit are turned to a position substantially at right angles to the angled plate, to completely fold or bend the flange 17 flat against the angled plate, as shown in FIG. 2.

Should it be necessary, while forming the fold or bend in the sheet metal adjacent a structure extending upwardly at right angles to the angled plate 10 at the open end of the joint, when the leading edge of the hammer member would engage the upwardly extending structure before the hammer elements 30*c* and 30*d* can complete bending the flange 17 completely to such structure, it is apparent that the power unit and the hammer member 25 may be reversed in position to engage the hammer elements 30*a* and 30*b* on the body section 28 nearest the hammer with the outstanding flange 17 to bend the flange downwardly completely up to the projecting structure without the necessity of hand hammering or bending the flange. Thus, the two sections 28 and 29 forming the two opposed convex shapes of work surface portions 27 of the hammer member provide for hammering close to an angle joint where the flange portion 17 must be bent adjacent another section or sheet which is disposed at an angle to the surface of the angled sheet 10. Further, the two work surfaces 27 on opposite side sections 28 and 29 of the body of the hammer member permit the hammer to be used closely adjacent such angle joint at either end of the section on which the joint is being closed.

Obviously, also, the curved convex work surface portions of the hammer member provide, by controlling the angle at which the hammer member is held with respect to the flange portion 17, control of the force imparted to the flange portion of the sheet metal by the hammer elements. Furthermore, since the hammer member is formed of two body sections having their outer marginal edges joined, it will be seen that the opposed concavo-convex portions 32 of the hammer sections stiffen and reinforce the outer edge portions of the hammer member, particularly adjacent the hammer elements and so provide a more rigid and a satisfactory hammer member in which the hammer elements shaped in the metal from which the body sections are made is not likely to fail adjacent the hammer elements. Likewise, the hollow body member provides a lighter weight hammer member, and still a strong rigid member.

As is clearly shown in FIGS. 1 through 4, the hammer elements are formed in substantially teardrop shape, or a substantially conical bulbar shape, extending from the central portion of the convex surfaces 27 toward the outer peripheral edge thereof. The reduced or smaller portions are disposed medially inwardly along the diameter of the sections toward the center of the hammer and increase in size and thickness outwardly from that medial portion toward the circumferential edge of the section. This shape provides for variation in the hammer blow which can be effected by the hammer member by varying the angle of attack on the sheet metal flange portion 11 struck by the hammer elements, a larger and heavier blow being struck by the greater projecting outer portions than is the case when the sheet metal is struck by the lesser inner projecting portion. The surface of each of the hammer elements 30*a*, 30*b*, 30*c* and 30*d* is smoothly curved to prevent damaging the sheet metal, and may be formed of a die pressed portion, as shown in FIGS. 3 through 7, of the material of which the body sections are formed, or may be formed by welding or building the same up of a hardened material, such as tungsten carbide or the like, which will withstand wear and heavy impact of usage, as shown in FIG. 9.

The circular or disc portion 26 of the hammer member is provided with an aperture 40 which extends centrally through both central disc portions 26 of the body sections 28 and 29 by

means of which the hammer member may be attached to the shaft 22 of the power unit 20 in the usual manner by clamping the hammer unit on the shaft with a bolt 41 and a clamping washer 42 to the shaft 22 of the power unit to securely clamp the hammer member on the shaft for rotation thereby. If desired a suitable key slot may be provided, but is not necessary.

The central disclike portion 26 is planar, and is, as shown in FIG. 4, disposed inwardly toward the adjacent section in planes lying between the projecting convex portions 27 of the body sections 28 and 29, which prevents the central portion 26 of the hammer member on either side from contacting the sheet metal being formed.

While two hammer elements have been shown as provided on the convex work surface of each body section, it is obvious that any other number of such hammer elements may be formed on the work surfaces, so long as they are equal in number and uniformly spaced around the convex hammer work surfaces on each side section, so that a uniform hammering action will be effected as the hammer member is rotated.

It is preferable that the hammer elements be forged or formed as an integral part of the hammer sections 28 and 29 as shown in FIGS. 3 through 7, so that the hammer elements project from the convex surface. This produces a more economical structure in manufacture, and, when the two body sections are welded together in the manner illustrated in FIGS. 3 and 4 into a unitary body member, the strength of the hammer elements is the same as if the hammer elements had been deposited on the convex surface by welding or otherwise.

MODIFIED FORMS

The form of the hammer shown in FIGS. 3 through 6 is preferable. However, the hammer may be made with only one working surface, reinforced as shown in FIGS. 7 through 9.

As shown in FIG. 7, one body section 129, having the hammer elements 130 formed thereon, is welded to a plate or disc 150 of the same circumferential size as the body section and having a central aperture 151 therein aligned with the aperture 140 in the body section 129. The weld 152 joining the disc 150 to the body section 129 provides increased rigidity and strength to the dishlike body section 129 and prevents damage to the working surface portion 127 of the body section adjacent the hammer elements 130 in much the same manner as in the form illustrated in FIGS. 3 and 4, though without the convex opposed work surfaces provided by the body member formed of the two identical opposed body sections as shown in FIG. 4. Other construction of the body section 129 is identical to that of the body section 29 shown in FIGS. 3 through 6.

Also, if desired, as shown in FIG. 8, the single body section 129*a* may be provided with a rigidifying or reinforcing member 160 which is the same diameter and welded at its outer edges 162 to the body member 129*a*, but has its central disc portion 163 having an aperture 161 therethrough pressed downwardly in a frustoconical shape toward the central disc portion 126 of the body section 129*a* to lie adjacent and in engagement with the disc portion of said body section 129*a*. The marginal edges of the reinforcing member 160 are welded to the edges of the body section 129*a*, and, if desired, the central disc portion 163 of the reinforcing member may be spot-welded to the central disc portion 126*a* of the body section 129.

A further modification of the hammer member or device is shown in FIG. 9 wherein the reinforcing member 170 is in the form of an annulus shaped as a truncated cone, having its outer edge portion 172 welded to the outer edge of the body section 229 and having its inner truncated portion 173 welded as at 175 to the central disc portion 226 of the body section 229 to provide means rigidifying or reinforcing the concavo-convex work section 227 of the body member.

As shown in FIG. 9 the hammer elements 330 may be formed on the hammer section 229 by welding deposition to project from the work surface 227 if desired. Also, the hammer side section 229 may be reinforced in the same manner as in FIGS. 6 through 8.

These devices function in the same manner as the device of FIGS. 3 and 4 and provide a reinforced convex work surface in a rigidified and strengthened hammer member for forming metal bends.

From the foregoing, it is believed readily apparent that an economical, portable, forming tool or power hammer member has been disclosed which is particularly adapted for use in forming sheet metal, more particularly for closing sheet metal joints such as the "Pittsburgh Lock." It will also be apparent that the device is portable, economical to manufacture, easy to use, adapted for carrying to a remote job, and usable with standard power tool equipment such as drills, grinders, sanders or the like having a rotatable shaft. It will also be seen that an improved hammer member has been provided which is strengthened along its work surface to rigidify the work portion thereof and support the work surface adjacent the hammer elements. It is also particularly apparent that, in the preferred form, a hammer member has been provided which is reversible and has two opposed work surfaces, either of which may be used without reversing the hammer member on the rotating power unit.

The foregoing description of the invention is explanatory only, and changes in the details of the construction illustrated may be made by those skilled in the art, within the scope of the appended claims, without departing from the spirit of the invention.

What is claimed and desired to be secured by Letters Patent is:

1. A metal-forming tool adapted to be used to fold sheet metal flanges to close metal joints, including: a body member having a central disc-shaped body portion having an outer annular convex work surface portion; a plurality of projecting hammer elements disposed in uniformly spaced positions about the convex work surface portion of the body member and each projecting from said convex surface in exposed striking position; means formed centrally of the disc-shaped body portion of the body member for mounting the same on a rotatable shaft of a rotary power tool for rotation thereby, whereby the plurality of exposed projecting hammer elements are moved in a circular path to engage and deform or bend a portion of a sheet of sheet metal to fold said portion to a desired position; said body member being formed of a pair of opposed substantially identical dishlike body sections joined at their marginal edges and each having said annular convex work surface portion with said hammer elements formed thereon disposed on opposite sides of said body member with the hammer elements of each dishlike body section projecting therefrom opposite the hammer elements on the section forming the opposite side of the body member.

2. A metal-shaping hammer means including: a body member formed of a pair of substantially identical dishlike body sections joined together along their marginal edge portions to form a unitary hollow body member; each dishlike body section having an annular concavo-convex peripheral work surface portion and a disc-shaped central support portion, said central portion being disposed in a plane spaced from the plane of the convex surface of said peripheral work surface portion; a plurality of projecting hammer elements disposed to project from the convex work surface of each of said body sections, said projecting hammer elements being disposed at uniformly spaced positions about the center of said body and projecting from the outer convex portion of the annular peripheral edge work surface portion thereof, said hammer elements being substantially teardrop in configuration along the surface of the convex peripheral work surface portion of the body member, with the larger bulbar portion of the teardrop shape disposed outwardly from the center of the body section to the edge thereof; said body sections being joined to position the teardroplike hammer elements at uniformly spaced points around the circumference of the

outer marginal edge portion of the body member, so that hammer elements on one body section are spaced uniformly between the hammer elements on the opposite body section.

3. A hammer means of the character set forth in claim 2 wherein the hammer element on each body section is formed by forging the same integral with the body section.

4. A device of the character set forth in claim 2 wherein the body member and the hammer elements thereon are formed by die shaping the same to provide the body member with the annular convex peripheral work surface portion.

5. A device of the character set forth in claim 2 wherein a central aperture is provided in the disclike central portions of the body sections to provide means for securing said body member to the rotatable shaft of a rotary power unit for rotating the same.

6. A device of the character set forth in claim 1 wherein the hammer elements of each body section are formed of a body of hard material deposited on the convex surface of the annular outer work surface portion of the body section and having a shape flaring outwardly from the inner portion of the hammer element toward the outer edge portion thereof and projecting to an increased degree from said convex work surface from the inner portion of the work surface toward the outer marginal edge thereof.

7. A metal-forming tool adapted to be used to form sheet metal flanges to close metal joints including: a body member formed of two substantially identical opposed dishlike body sections joined along their edges, each said body section having a planar disk-shaped central portion and an annular dishlike concavo-convex outer work surface portion; a plurality of projecting hammer elements disposed in uniformly spaced positions about the convex surface of the work surface portion of the body section and each projecting uniformly from said convex surface in exposed striking position; means formed centrally of the disc-shaped central portion of the body section for mounting the body member on the rotatable shaft of a rotary power tool for rotation thereby whereby the plurality of exposed projecting hammer elements on the convex work surface portions of the opposed body sections are moved in a circular path to be used to engage and deform or bend a portion of a sheet of sheet metal to fold said portion to a desired position.

8. A metal-shaping hammer means including: a discuslike body member having an annular convex outer edge work surface portion on each side thereon and a central planar disclike portion disposed in a plane spaced from and within the planes of the projecting convex work surface portions; said planar disclike portion having a central aperture therein for use in mounting the body member on a rotary shaft of a power unit to be driven thereby; said body member being formed of a pair of opposed dishlike body sections of substantially identical configuration having their concave portions facing inwardly toward each other and joined rigidly along their circumferential edge portions into a unit to provide the body member; each of said body sections having a plurality of projecting hammer elements disposed to project from the convex surface of said concavo-convex annular work surface portion of said body section, said projecting hammer elements being disposed at positions uniformly spaced about the center of said disclike central portion and projecting from the outer convex portion of the annular outer work surface portion, said hammer elements being flared outwardly in shape along the convex surface of the convex work surface portion of the body section with the larger portion of the flared shape disposed outwardly from the center of the body and extending to the outer edge of said body section.

9. A metal-shaping hammer means of the character set forth in claim 8 wherein each of said sections is formed by die shaping the same to form the concavo-convex outer annular work surface section and to shape the hammer elements to project from the convex surface of said annular work surface section.

10. A hammer of the character set forth in claim 8 wherein the hammer elements on the annular convex work surface portions of each section are spaced uniformly circumferentially about the outer edge of the body sections to dispose said hammer elements on one body section spaced uniformly between the adjacent oppositely projecting hammer elements of the opposite work surface of the opposite body section.

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