# United States Patent [19]

**Peterson**

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[54] **HINGE WITH TORSION BAR**


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[52] **U.S. Cl.** ..... **16/184**

[51] **Int. Cl.** ..... **E05f 1/12**

[58] **Field of Search** ..... 16/184, 180



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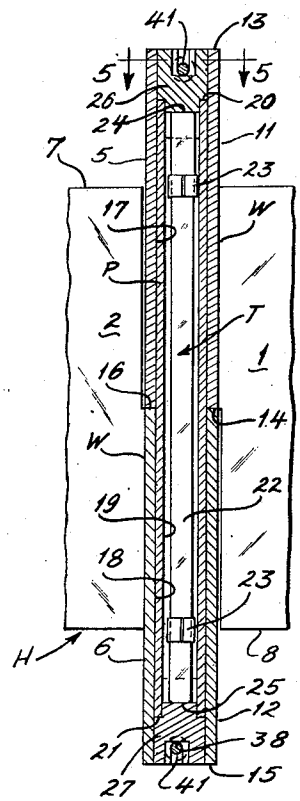
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[57] **ABSTRACT**

A torsion bar is provided within a hinge having leaves which fit on the same door as leaves presently used in this country, so as to bias the door toward a closed or open position. The torsion bar is mounted within a tubular pivot pin portion of the upper knuckle and the lower portion of the lower knuckle. The plugs do not extend above the upper knuckle or below the lower knuckle. The torsion bar is made from a plurality of thin spring steel members of predetermined length, which are connected together by bands. The ends of the torsion bar fit within slots in the inner ends of said plugs, which inner ends fit within the tubular pivot pin.


**3 Claims, 8 Drawing Figures**



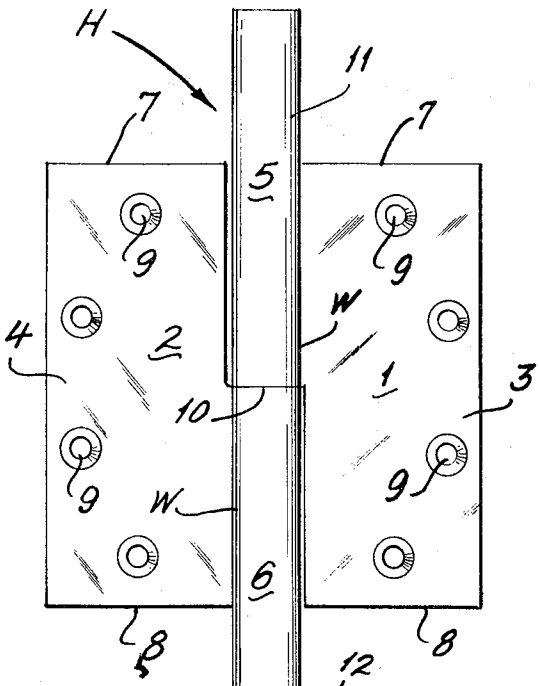



FIG. 1

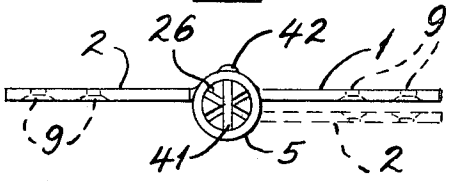



FIG. 2

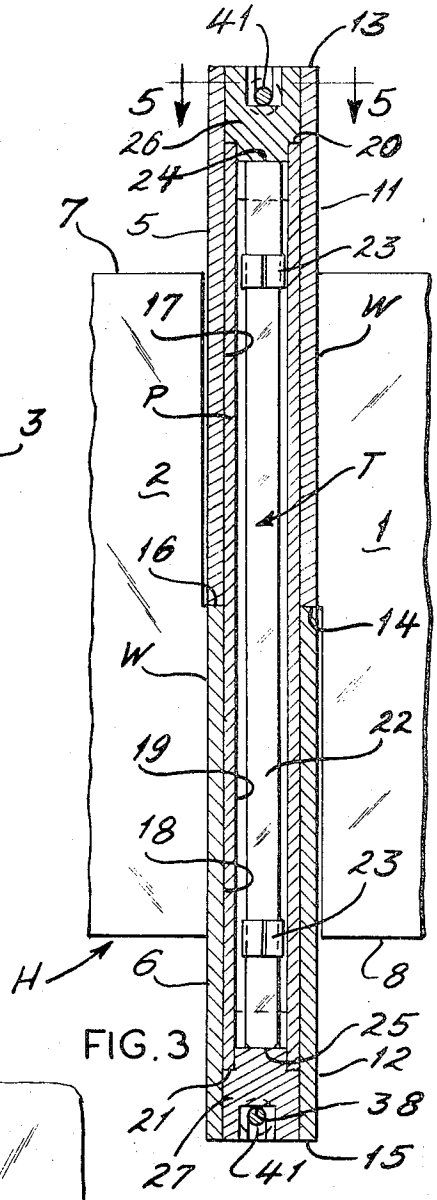



FIG. 3

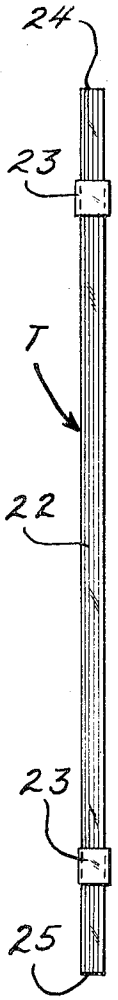



FIG. 4

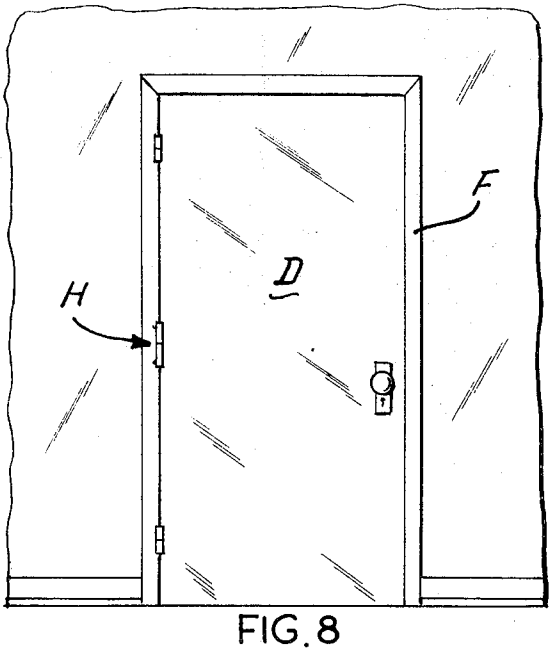



FIG. 8

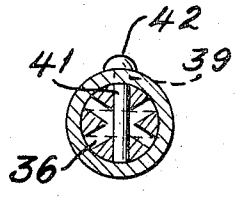



FIG. 5

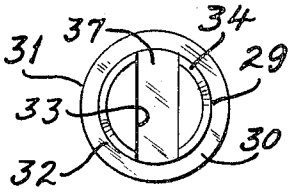



FIG. 7

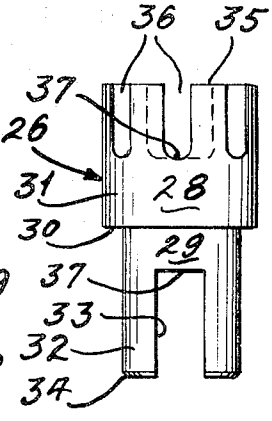



FIG. 6

# HINGE WITH TORSION BAR

This invention relates to door closer hinges in general, and in particular, to a door closer which functions as a hinge, which can be used on the same door with other standard type hinges, and which has a torsion bar positioned within a tubular pivot pin.

As used herein, the term door closer includes a devide for closing or opening a door, either fully or partially. The present invention may be used to bias a door to its fully closed or to its fully open position. It may also be used to cause a door to spring open partially upon release of the door lock, such as in a private club or business where the door is kept locked but is unlocked by remote means by a person.

Spring hinges are generally old in the art, and hinges with torsion bars therein are also known. There are several types of door closers available today. Some of these are separate from the hinges which pivotally mount a door on a door frame. Some present door closers include springs connected to said hinges, usually above the hinge pin and knuckles. Some present door closers utilize a torsion bar within the knuckles of a hinge for biasing a door to a closed position. However, such prior arrangements contained plugs or other members which extend above the upper edge of the upper knuckle and/or below the lower edge of the lower knuckle of the hinge or were not compatible with other hinges used on the same door. In addition, these prior hinges contained leaves which were unacceptable for a standard door construction today. Further, these prior art plugs could be adjusted by means of a screwdriver.

The hinge and door closer embodying the present invention is adapted to be used on factory built or mass produced doors and on other doors, which doors will require one or more additional hinges with leaves of about the same size. The present hinge and door closer is compatible with existing hinges on the market today.

The principal object of the present invention is to provide a door closer within one of the hinges which will be used on a door for biasing said door to a closed position, or to an open position should that be desired. Another object of the present invention is to provide a door closer which has few parts and which fits completely within the confines of knuckles of substantially the same diameter as other hinges that are used on the same door. Another object is to provide such a door closer which fits completely within the confines of said knuckles and does not extend upwardly or downwardly from the ends thereof. Another object is to provide such a door closer having knuckles with upper and lower plugs which are identical, which receive a torsion bar, and which can be adjusted. Another object is to provide a construction that is compatible with hinges of the slip butt type so that each leaf of a hinge can be installed separately, one on the door and the other on the frame, so that the door may simply be lifted and hung onto the hinge leaf previously connected to be already installed door frame. Another object is to provide a door closer within a hinge whose amount of torque can be adjusted by means of a screwdriver. These and other objects will become apparent hereinafter.

The present invention is embodied in a hinge having a pair of hinge leaves with knuckles thereon, a tubular pivot pin extending into each of the knuckles, a plug



mounted in contacting relation with each end of the tubular pivot pin, said plugs being positioned within the knuckles and not extending above the upper edge or below the lower edge thereof, the inner portion of each of said plugs having a slot therein for receiving a torsion bar of predetermined length made from a plurality of twistable metal strips, and means for preventing rotation of said plugs within said knuckles.

The invention further consists in the part and in the arrangements and combinations of parts hereinafter described and claimed. In the accompanying drawings which form part of this specification and wherein like numerals and symbols refer to like parts whenever they occur:

FIG. 1 is a side elevational view of a hinge and door closer embodying the present invention,

FIG. 2 is a top plan view of the hinge and door closer shown in FIG. 1, with one leaf shown also in dotted lines in its door closed position which is the position to which this leaf is normally biased,

FIG. 3 is an enlarged fragmentary vertical cross-sectional view taken along the line 3—3 of FIG. 2 and showing the assembly of the parts with the torsion bar in an untwisted position,

FIG. 4 is a side elevational view of the torsion bar taken at 90° from the position of the torsion bar as shown in FIG. 3,

FIG. 5 is a horizontal cross-sectional view of the hinge taken across the upper knuckle along the line 5—5 of FIG. 3,

FIG. 6 is an enlarged side elevational view of one of the two identical plugs used in said hinge and door closer,

FIG. 7 is a view of the inner end of a plug which fits within said knuckle, which inner end cannot be seen when assembled into a knuckle, and

FIG. 8 is a side elevational view of a door having the present hinge and door closer mounted thereon with conventional hinges shown above and below said hinge and door closer.

Referring now to the drawings in detail, it will be seen that the embodiment of the invention which has been illustrated comprises a hinge H which is similar in size and dimension to hinges used in the trade today in the United States and can be used on the same door with said hinges. This hinge H has a torsion bar T therein, so that the hinge H functions not only as a hinge but also as a door closer. Or conversely, the door closer functions as a hinge in addition to biasing a door to either a normally closed position or to a normally open position. As best seen in FIG. 1, the hinge H comprises two cooperating hinge leaves 1 and 2 having flat base portions 3 and 4 with knuckles 5 and 6 thereon. The knuckles are connected to the base portions by any suitable means. At present, it has been found that steel base portions with tubular knuckles welded thereto, at W, are preferable. The knuckles 5 and 6 may be made from conventional steel tubing of the proper specification and dimensions. The knuckles may also be joined to the base portions by other means or may be integral therewith, but such is generally more expensive than welding a tubular knuckle to a base portion.

The hinge leaves 1 and 2 have upper edges 7 and lower edges 8. The base portion of each hinge leaf is of a height, width and depth which is compatible with other hinges which are adapted to be placed on the door to be hung and biased to a closed (or open) posi-

tion. Each hinge leaf has a plurality of holes 9 therein for receiving screws (not shown) or other means for securing the hinge leaf to a door or door frame.

The present invention is shown in a hinge of the slip butt type for ease in mounting a door D to a door frame F (FIG. 8). At present, there is increasing use of prebuilt or factory built doors hingeably mounted in door frames. The unit is shipped from a factory to a building construction site and the door is removed from the door frame if it is not shipped in separate parts. The door frame is mounted in the wall in permanent position. The door frame F already has one hinge leaf mounted thereon in each place where the door is to be hinged. This may be two or more hinges. The door, which has the other cooperating hinge leaf secured thereto at the factory is then merely lifted into position so that the bottom of the hinge pin in each knuckle of the hinge mounted on the door is directly over the opening of the knuckle of the hinge leaf on the door frame, and the door can then simply be lowered until the hinge pin is fully received in the knuckle of the hinge leaf on the door frame and the knuckle on the door is in abutting relation with the knuckle on the door frame. The hinge and door closer embodying the present invention can be installed on doors having hinges thereon of the type described, or may be a substitute for one of two hinges on a door, or if desired, may be a middle hinge with other conventional hinges above and below the same, as shown in FIG. 8. In short, the present hinge and door closer can be be a substitute for a hinge since it performs the usual functions of a hinge in addition to being a door closer. The present door closer can also be used in addition to the regular number of other hinges on a door.

FIG. 2 shows the present hinge and door closer H with its hinge leaves 1 and 2 apart 180°. FIG. 2 further shows one hinge leaf 2 in dotted lines, which represents the position to which said hinge leaf 2 may be normally biased.

FIG. 3 shows the invention in detail with the knuckles 5 and 6 in an edgewise abutting relation, at 10. An annular bearing (not shown) may be included between the two knuckles 5 and 6 if desired to further reduce friction. However, the contacting annular surface of the knuckles 5 and 6 are flat and provide a bearing surface which reduces friction. The upper knuckle 5, which is connected to and forms a part of one of said hinge leaves 1, has an upper portion 11 which extends above the upper edge 7 of the hinge leaf 1. Similarly the lower knuckle 6, which is connected to and forms a part of the other hinge leaf 2, has a lower portion 12 which extends below the lower edge 8 of the hinge leaf 2. The height of the knuckles 5 and 6 is greater than the height of hinge leaf 1 or 2. The upper knuckle 5 has an upper edge 13 and a lower edge 14. The lower knuckle 6 has a lower edge 15 and an upper edge 16. The knuckles 5 and 6 are tubular and have aligned openings 17 and 18 therethrough.

A tubular pivot pin P is positioned within the knuckles 5 and 6 to hold the two leaves 1 and 2 in assembled relation. The pin P has an opening 19 therethrough, an upper edge 20, and a lower edge 21. The outside diameter of said pin P is such that it forms a slip fit within the openings 17 and 18 in the knuckles 5 and 6. The tubular pivot pin P is made from any suitable material which can be used as a hinge pin. Preferably this is steel, as are all of the other parts, so that the hinge may be used on a fire rated door.

As best shown in FIGS. 3 and 4, the torsion bar T is mounted within the opening 19 in the pin P. The torsion bar T is made from a plurality of twistable metal strips 22, preferably of similar size and dimension, which are connected together by means of bands 23 positioned inwardly of the upper edge 24 and lower edge 25 of the torsion bar T. It has been found that seven twistable metal strips 22 made from spring steel, each about 0.021 inches thick and .265 inches wide and 6.25 inches long, gives satisfactory results. The length of these strips 22 is critical. The strips 22 must be at least 6 inches long for the hinge H used on a normal door. If the torsion bar T is too short, some permanent stress or set may be set up in the torsion bar T in normal use in some installations and this is not desirable. If the torsion bar T is too long, then it will not have sufficient torque or biasing force to move the door to the desired position.

The torsion bar T is mounted within the hinge H solely by its ends 24 and 25 which are received in an upper plug 26 and a lower plug 27, best shown in FIGS. 3, 6 and 7. Preferably the plugs 26 and 27 are identical so as to be interchangeable, although if desired, the plugs may be of different heights. The upper plug 26 will be described, although the lower plug 27 is identical thereto. Each plug 26 and 27 has an upper or outer section and a lower or inner section 29, there being an annular inner shoulder or bearing surface 30 therebetween. The outer section 28 is of greater diameter than the inner section 29 and has a cylindrical surface 31 that slip fits into the opening 17 in the upper knuckle 5. The inner section 29 has a cylindrical surface 32 which slip fits into the opening 19 in the tubular pivot pin P. The inner section 29 is provided with a slot 33. The slot 33 receive the ends 24 and 25 of the torsion bar T in slip fit relation. The inner section 29 may have a bevel 34 at the bottom edge thereof for ease in guiding the plugs into the knuckles. The outer section 28 of each plug contains means on its outer surface 35 for adjusting the rotatable position of the plug within the knuckle, which means comprises a plurality of radial or diametral slots 36 having bottoms 37 positioned at or below the inner edge 38 of a hole 39 in the knuckles 5 and 6. Each hole 39 is adapted to receive a locking pin 40 (FIG. 5) having a shank 41 and a head 42 thereon. The pin 40 extends through the hole 39 and into a radial slot 36 when said slot 36 is aligned with the hole 39. In this manner, the upper plug 26 is secured within the upper knuckle 5 against rotation by means of the locking pin 40. That is, the upper plug 26, locking pin 40, and upper knuckle 5 move as a unit with the base portion 3 and do not move with respect to each other when the hinge H is in operating use. However, the plug 26 is adjustably mounted within the knuckle 5 so as to be able to adjust the amount of twist to be placed on the torsion bar T to provide the proper force of torque desired to bias a door to a closed position, or to an open position, if that is desired.

To adjust the plug 26, the locking pin 40 is pulled outwardly until the locking pin shank 41 is completely out of the radial slot 36. The locking pin 40 may be grasped by the locking pin head 42 or said head 42 may be pried outwardly with a screwdriver or other tool. The locking pin 40 can be completely removed or its outer end may be retained within the thickness of the

knuckle wall. If radial or diametral slots **36** provided the adjustinc means, a screwdriver or other tool (not shown) can be inserted into one of said slots **36** to rotate the plug **26** in increments of 30° until the plug **26** is in the desired position in which it provides the desired torque or twist for closing the door. The locking pin **40** is then reinserted into the hole **39** and radial slot **36** to hold the upper plug **26** in fixed relation in the upper knuckle **5.**

The lower plug **27** is of indentical construction and is received in the lower knuckle **6** in the same fashion as the upper plug **26** is received in the upper knuckle **5.** One or both of the plugs **26** and **27** may be adjusted if desired. The outer surface **35** of the upper plug **26** is flush with the upper edge **13** of the upper knuckle **5.** The outer surface **35** of the lower plug **27** is flush with the lower edge **15** of the lower knuckle **6.**

To assemble the hinge H, which is apparent from the drawings, the pin P is slipped into the knuckle **5,** such as through the lower edge **14.** The lower knuckle **6** is then slipped upwardly on the pin P until its upper edge **16** contacts the lower edge **14** of the upper knuckle **5.** The lower end **25** of the torsion bar T is slipped into the slot **33** of the lower plug **27** which is then slipped upwardly through the opening **19** in the pin P until the outer surface **35** is flush with the lower end **15** of the knuckle **6.** The plug **27** is then rotated until a radial slot **36** is aligned with the lower hole **38** and a locking pin **40** is then inserted. The upper plug **26** is then inserted into the upper knuckle **5** so that its slot **33** receives the upper end **24** of the torsion bar T. The upper plug **26** must then be rotated or adjusted to provide the torsion bar T with any suitable pre-loading or twist that might be desired. This is done by rotating the upper plug **26** with a screwdriver which is slipped into a diametral slot **36** until the proper pre-loading is reached. This is in 60° intervals if six radial slots are provided. The screwdriver rotates the plug **26** until the proper radial slot **36** is opposite to the hole **39** in the upper knuckle **5.**

The hinge H may be assembled in other ways, either prior to mounting the hinge H on a door D or after it is mounted on the door D. If any event, once the door D is hung on a door frame F, the twist or torsion which the hinge H exerts can be adjusted by removing the locking pin **40,** rotating the plug **26** or **27,** and then reinserting the locking pin **40.**

The present arrangement permits what appears to be an ordinary hinge H to function also as a door closer without the use of coil spring or other means which add additional expense, which gather dirt and dust, and which have other disadvantages. Nothing in the hinge H extends above the upper edge **13** of the upper knuckle **5,** and nothing extends below the lower edge **15** of the lower knuckle **6.** The edges **20** and **21** of the pin P are positioned to be in edgewise abutting relation with the shoulders **30** of the two plugs **26** and **27.** This arrangement firmly positions the ends of the pin P between the knuckle and the inner section **29** of the plug and prevents vertical movement of the pin P. If desired, an annular bearing collar (not shown) may be positioned between each end of the pin P and the annular shoulder **30** of each plug **26** and **27** to reduce friction. Such a collar may be made from bearing bronze impregnated with oil or from plastic material.

As indicated, the hinge H may be made of any suitable material but steel is preferred so that the hinge may be used on a fire rated door. While each hinge leave shown contains only one knuckle, the present invention can be used with leaves each containing one or more knuckles as desired.

This invention is intended to cover all changes and modifications of the example of invention herein chosen for the purpose of the disclosure, which changes do not constitute departures from the spirit and scope of the invention.

What is claimed is:

**1.** A hinge having a pair of hinge leaves, each of said leaves having a knuckle thereon, said knuckles each having an opening therein aligned with an opening in the other knuckle, a tubular pivot pin extending into each opening of said knuckles, said tubular pin having an opening therethrough, a plug mounted within each end of said aligned knuckles, each of said plugs being identical and positioned within a knuckle, each of said plugs having an outer surface substantially flush with the outer end of the knuckle in which said plug is positioned, said outer surface having an opening therein for receiving a tool, each of said plugs having an inner portion with a slot therein, a torsion bar made from a plurality of thin twistable metal strips which are shorter in length than the combined length of said knuckles and which are longer in length than the height of the base portions of said leaves, said torsion bar having ends each of which is mounted within said slot in the inner portion of said plugs, and means for preventing rotation of said plugs within said knuckles.

**2.** A hinge having a pair of hinge leaves, each of said leaves having a knuckle thereon, said knuckles each having an opening therein aligned with an opening in the other knuckle, a tubular pivot pin extending into each opening of said knuckles, said tubular pivot pin having an opening therethrough, a plug mounted within each end of said aligned knuckles, each of said plugs being identical and positioned within a knuckle, each of said plugs having an outer surface substantially flush with the outer end of the knuckle in which said plug is positioned, said outer surface having an opening therein for receiving a tool, each of said plugs having an inner portion with a slot therein, a torsion bar made from a plurality of twistable metal strips, said torsion bar having ends each of which is mounted within said slot in the inner portion of said plugs, and means for preventing rotation of said plugs within said knuckles, said plugs having inner shoulders and said tubular pivot pin having ends, said ends of said tubular pivot pin being in abutting relation with said inner shoulders of said plugs when said hinge is in assembled relation, and wherein the height of said tubular pivot pin is greater than the height of said torsion bar.

**3.** A hinge having a pair of identical hinge leaves, each of said leaves having a base portion and a knuckle thereon, said knuckles each having an opening therein aligned with an opening in the other knuckle, a tubular pivot pin extending into each opening of said knuckles, said tubular pivot pin having an opening therethrough, a plug mounted within each end of said aligned knuckles, each of said plugs being identical and positioned within a knuckle, each of said plugs having an outer surface substantially flush with the outer end of the knuckle in which said plug is positioned, said outer surface having an opening therein for receiving a tool, each of said plugs having an inner portion with a slot therein, a torsion bar made from a plurality of twistable metal strips, said torsion bar having ends each of which

is mounted within said slot in the inner portion of said plugs, and means for preventing rotation of said plugs within said knuckles, said knuckles on said hinge leaves extending above the top edge of the base portions of said leaves and below the bottom edge of the base portions of said leaves, so that the combined height of said knuckles is greater than the height of a hinge leaf, said knuckles being tubular in cross-section, said identical leaves each having a base portion which is flat, said knuckles being welded to base portions along one half of a vertical edge of each of said base portions, said knuckles each being shorter in height than the height of the base portion to which it is secured.

* * * * *