

Dec. 3, 1935.

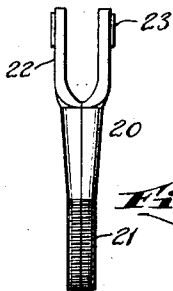
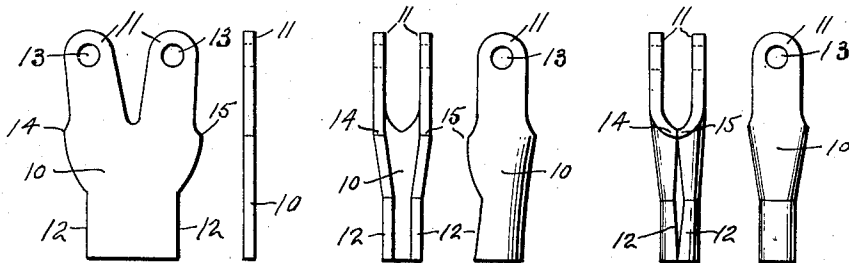
E. A. CONNER

2,022,801

SHEET METAL YOKE AND PROCESS OF MAKING SAME

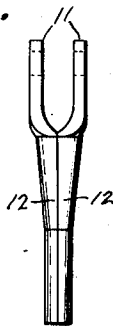
Filed June 15, 1932

*Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6.*

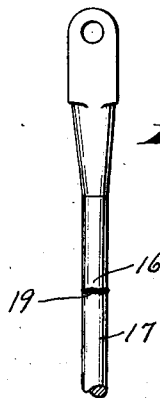


*Fig. 8.*

*Fig. 11.*



*Fig. 10.*



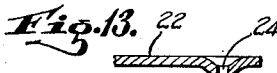
*Fig. 9.*



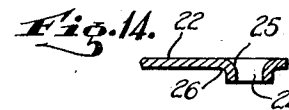
*Fig. 7.*



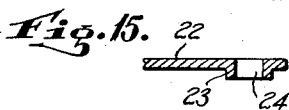
*Fig. 12.*



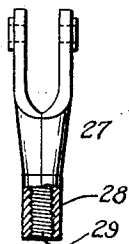
*Fig. 13.*



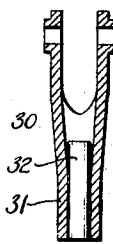
*Fig. 14.*



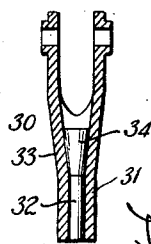
*Fig. 15.*



*Fig. 16.*



*Fig. 17.*



*Fig. 18.*

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# UNITED STATES PATENT OFFICE

2,022,801

## SHEET METAL YOKE AND PROCESS OF MAKING SAME

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Application June 15, 1932, Serial No. 617,268

16 Claims. (Cl. 29—148)

This invention relates to attachments for such articles as wires, rods and the like, and has for its general object the provision of an attachment in the nature of a yoke with a shank of rod-like form which can be readily secured metal-  
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ically in butt relation with the rod, wire or the like to which it is to be united, as by a butt welding operation.  
A more particular object of the invention is to provide an improved process for making yokes or like attachment members with rod-like shanks of the above character from blanks of sheet metal, in such manner and by such steps that great economy of labor and material is secured.

Another object of the invention is to provide a yoke or attachment of the above improved type with an attaching shank which can be so welded to the rod, wire, or other article to which it is to be united, that the union will develop a strength equal to, or exceeding, that of said wire or rod.

The above and other features of the invention are illustrated and described fully in the accompanying drawing and specification and are pointed out in the claims.

In the drawing;

Figure 1 is a view in plan, and Fig. 2 is a view in side elevation, of a blank suitable for use in forming the attachment of the present invention;

Figs. 3 and 4 are similar views showing the blank partly shaped;

Figs. 5 and 6 show the blank at a subsequent stage of its formation; and Fig. 7 is a view in end elevation looking toward the bottom of Fig. 6;

Fig. 8 is a view in side elevation of the yoke or attachment in final form;

Fig. 9 shows the same secured metal-  
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lically by a butt weld to the end of a rod or wire;  
Fig. 10 is a view in end elevation looking toward the bottom end of Fig. 8;

Fig. 11 is a view in side elevation of another form of attachment having flanged eyelets in the yoke portion and having an externally threaded shank;

Figs. 12 to 15 inclusive are fragmental views in section showing progressive stages in the formation of the eyelets;

Fig. 16 is a view in side elevation of still another form of attachment having an internally threaded tubular shank; and

Figs. 17 and 18 are views in longitudinal section showing two stages in the formation of an attachment having a completely solid shank.

In a now preferred embodiment of the invention selected for illustration and description, an attachment or yoke is illustrated which, in its final form, may be desirably of substantially the general shape shown in Fig. 8, comprising a yoke portion adapted for removable attachment to any suitable article with which such attachment is to be effected, and a shank or portion which is

adapted to be permanently secured metal-  
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lically in butt relation with a rod, wire or the like.  
In pursuance of the invention, the above attachment is made of sheet metal by an improved process which in its preliminary stages may be substantially that disclosed in U. S. Letters Patent No. 1,770,971, these earlier stages being briefly as follows:

In Figs. 1 and 2 there is shown a flat metallic blank 10 of a shape suitable to be formed into an attachment having the final form illustrated in Figs. 8 and 9; and Figs. 3 to 7 inclusive, illustrate several stages in the formation of such an attachment.

The first stage, shown in Figs. 3 and 4, includes the bending of the blank 10 into a form having a substantially U-shaped cross-section, which brings into spaced relation the lug portions 11, these portions having apertures 13, as illustrated, which, when brought into axial alignment, are adapted to receive a bolt (not shown), or other suitable form of means by which the device may be secured removably to any article with which it is desired to effect such a union.

The next stage comprises the further bending or folding of the longitudinal margins 12 of the blank around to form a shank which is of substantially cylindrical cross-section as shown in Fig. 7, this bending being carried to an extent which brings into contact the marginal protuberances 14 and 15 which are provided to enable this bending operation to be accomplished rapidly, with accuracy, and without special care or expenditure of time and skill by the operator.

At this stage of the process the sheet metal of the blank at the end of the shank presents a form when viewed from a direction looking toward the bottom of Fig. 6, that is substantially like the ring shown in Fig. 7, with walls 18 which are relatively thin as compared with the central space left by the bending operation up to this stage.

In general, the above stages may be, and preferably are, substantially as recited in the above-mentioned Patent No. 1,770,971.

In the further treatment of the blank, according to the present invention, the folded sheet metal shank portion of the attachment member is subjected to an impacting or compressing operation which is preferably carried out by a series of rapid velocity blows, the impacting forces being applied successively around the periphery of the shank, as for example, in a rotary swaging machine of the type known as a "Flo-former", disclosed in copending application Serial No. 500,710.

The impacting operation is carried to an extent which results in flowing the material of the sheet metal walls inward increasing the wall thickness and reducing the bore until the shank consists wholly of the material of the walls, the

bore being reduced to the negligible size shown in Fig. 10.

This final stage is accompanied by a reduction in peripheral diameter and an elongation of the shank to a certain extent, and the final effect is to present a substantially solid end 16, as shown in Fig. 10, available to be secured metal-  
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lly in butt relation with a wire rod or similar article to which it is desired to effect the permanent attachment of the yoke herein illustrated. The rotary swaging machine also produces a substantially uniform thickening of the wall of the shank in any cross-section.

In Fig. 9, the said yoke is shown as butt welded to the end of a metal rod 17, the weld being indicated at 19.

From the foregoing description, it will be evident that by this novel process, provision has been made for making rapidly and accurately from sheet metal a yoke or attachment with a shank composed of a bent-up and compacted portion of the sheet metal and which has all the desirable characteristics embodied in a yoke made by the relatively more expensive manufacturing process of forging, the present invention making it possible to utilize sheet metal not only for the yoke portion, but also for the shank portion, both of which can be bent up readily in dies by a preliminary operation which brings the material of the shank into shape for the swaging operation, the latter being accomplished as above described rapidly and accurately by the fio-forming of the shank.

It has been found that it is not desirable to butt weld the cylindrical form of shank which exists at the stage shown in Fig. 7, as that yields at best a union of relatively low strength, but that by carrying out a process of impactment such as that hereinbefore described, until the shank is impacted into a substantially solid rod, a yoke is provided with an integral sheet-metal shank adapted to be butt welded and which will yield a union of maximum strength.

In Fig. 11, I show an attachment 20 similar in general form to that shown in Fig. 8, but differing therefrom in two details: the shank 21 of the attachment 20 is externally threaded so that it may be screwed into a socket, while the yoke 22 of said attachment is formed with flanged eyelets 23. The threads in the shank may be either rolled or cut, as desired. The shank 21 like the shank 16 is nearly solid, and, as a result of the impacting or swaging process, the wall thickness is increased. The thread is cut or otherwise formed in the shank to a depth approximately equal to the increase in wall thickness so that there is no weakening of the shank by the threads.

The eyelets 23 are preferably formed in successive stages, as illustrated in Figs. 12 to 15 inclusive. First the metal is punched as shown in Fig. 12 to form an aperture 24. In the next step the metal surrounding the aperture is cupped outwardly, as shown in Fig. 13. In the third stage, the metal is belled outward enlarging the aperture 24 and forming a substantially cylindrical flange with a well-rounded inner shoulder 25 and a fillet 26 on the outside of substantial radius. In the fourth and final step, the flange is compressed axially in dies, reducing the fillet to negligible radius, and squaring the inner shoulder so that the finished eyelet has the form shown in Fig. 15. This form of eyelet provides a broad bearing surface for a bolt or pin.

The attachment 27 shown in Fig. 16 differs from attachment 20 only in the form of its shank,

and in making the attachment, the steps illustrated in Figs. 1 to 6 are employed. However, that portion of the blank which is to form the shank 28 is wider, so that when the blank is folded to substantially the form shown in Fig. 6, a shank of larger diameter is provided. This shank is then put through a swaging operation on a mandrel (not shown) and is reduced in diameter by such swaging operation, so that the wall thickness of the shank is increased, while at the same time an inner bore 29 is maintained therein by the mandrel. The swaging operation is such as to increase the thickness of the wall sufficiently to permit of cutting a thread in the bore of the shank 28, such increase in thickness approximating the depth of the thread.

Figs. 17 and 18 show how an attachment 30 may be made with a completely solid shank. The construction of the attachment is similar to that shown in Fig. 16, but, in place of swaging its shank 31 upon a removable mandrel, a pin 32 is inserted in the shank and the latter is then swaged down upon the pin. In the swaging operation, not only is the outside diameter of the shank reduced, but the pin also is reduced in diameter in the main body portion of the shank. However, the pin extends upward into the outwardly flaring portion 33 of the shank and during the swaging portion, a head 34 is formed on the pin 32, said head conforming in taper to the tapered portion 33 of the shank. The pin is thus firmly anchored in the shank and is retained therein not only by frictional engagement with the shank, but also by reason of the head 34 formed thereon. The finished attachment thus provides a completely solid shank which may be welded to a rod, or other member, as shown in Fig. 9, or, which may be externally threaded for engagement with the socket member.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is as follows:

1. The process of forming an attachment member of the class described, said process comprising the steps of bending a portion of a blank of flat sheet metal into the form of a cylinder, compacting said cylinder radially inward to increase the wall thickness thereof substantially uniformly and cutting a thread in said thickened wall to a depth approximately equal to the increase in thickness of the wall, whereby the effective thickness of the sheet metal member will remain substantially uniform throughout.

2. The process of forming an attachment member of the class described, said process comprising the steps of bending a portion of a blank of flat sheet metal in the form of a split cylinder, compacting said cylinder radially inward to increase the wall thickness thereof substantially uniformly, and cutting an internal thread in said cylinder to a depth approximately equal to the increase in thickness of the wall.

3. The process of forming an attachment member with a threaded shank, said process comprising the steps of bending a portion of a blank of flat sheet metal into the form of a split cylinder, compacting said cylinder radially inward to increase the wall thickness thereof, continuing the compacting until the increase of wall thickness is at least substantially equal to the desired depth of thread in the shank, and thereafter forming the thread in said shank.

4. The process of forming an attaching member of sheet metal with a substantially solid cylindrical shank, said process comprising the

steps of bending a portion of a blank of flat sheet metal into the form of a split cylinder, compacting said cylinder radially inward without a core in the cylinder to reduce the diameter of the cylinder and increase the wall thickness thereof, and continuing the impacting until said cylinder is formed into a substantially solid shank.

5. The process of forming an attachment member of the class described, said process comprising the steps of bending a portion of a blank of flat sheet metal into the form of a split cylinder, inserting a metal rod in the bore of said cylinder, compacting a portion of the cylinder and the enclosed rod, leaving a portion of said rod and of the enclosing cylinder uncompactcd whereby the compacted portion of the cylinder and rod will constitute a solid cylindrical shank and the uncompactcd portion will resist lengthwise displacement of the rod and cylinder relatively to each other.

6. The process of forming an attachment member of the class described, said process comprising the steps of bending a portion of a blank of flat sheet metal to form a split cylinder, inserting a metal rod in the bore of said cylinder, compacting a portion of the cylinder and the rod radially inward to form a solid cylindrical shank and compacting another portion of the cylinder and rod in such manner as to produce a tapering region of engagement between the rod and the cylinder.

7. An attachment member of the class described, said member being composed of an integral piece of sheet metal and comprising a yoke portion and a shank portion, the yoke portion having a pair of spaced coaxial apertures for receiving a connecting device, said shank portion being in the form of a split cylinder having a greater wall thickness than that of the yoke portion.

8. An attachment member of the class described, said member being composed of an integral piece of sheet metal and comprising a yoke portion and a shank portion, the yoke portion having a pair of spaced coaxial apertures for receiving a connecting device, said shank portion being in the form of a split cylinder having a greater wall thickness than that of the yoke portion, said shank portion being threaded.

9. An attachment member of the class described, said member being composed of an integral piece of sheet metal and comprising a yoke portion and a shank portion, the yoke portion having a pair of spaced coaxial apertures for receiving a connecting device, said shank portion being in the form of a split cylinder having a greater wall thickness than that of the yoke portion, the shank portion being threaded, and the depth of the thread being approximately equal to the excess in wall thickness of the shank portion over the yoke portion.

10. An attachment member of the class described, said member being composed of an integral piece of sheet metal and comprising a yoke portion and a shank portion, the yoke portion having a pair of spaced coaxial apertures for receiving a connecting device, said shank portion being in the form of a split cylinder having a greater wall thickness than that of the yoke portion, the shank portion being internally threaded.

11. An attachment member of the class de-

scribed, said member consisting of an integral piece of sheet metal comprising a yoke portion and a shank portion, the yoke portion having a pair of spaced coaxial apertures for receiving a connecting member, the shank portion being in the form of a split cylinder having a wall of uniform thickness greater than that of the yoke portion, said cylinder being internally threaded, and the depth of the thread being approximately equal to the excess in wall thickness of the shank portion over the yoke portion.

12. An attachment member of the class described, said member consisting of an integral piece of sheet metal comprising a yoke portion and a shank portion, the yoke portion having a pair of spaced coaxial flanged eyelets for receiving a connecting device, the shank portion being in the form of a split cylinder having a greater wall thickness than that of the yoke portion.

13. The combination with a metal rod, wire or the like, of an attachment comprising a member composed of a piece of sheet-metal stock having an attaching shank comprising a portion of said sheet-metal piece disposed in the form of a compact, substantially solid cylinder with a substantially solid end united metallically in butt relation with said rod, wire or the like, as by butt-welding.

14. The combination with a metal rod, wire or the like, of an attachment comprising a member composed of a piece of sheet-metal stock having an attaching shank comprising a portion of said sheet-metal piece disposed in the form of a compact, substantially solid cylinder with a substantially solid end united metallically in butt to butt relation with said rod, wire or the like, as by butt-welding, said sheet-metal piece having its free end formed with an eye adapted to be connected removably with an article with which said rod, wire or the like is to be associated.

15. The combination with a metal rod, wire or the like, of an attachment comprising a member composed of a piece of sheet-metal stock having an attaching shank comprising a portion of said sheet-metal piece disposed in the form of a compact, substantially solid cylinder with a substantially solid end united metallically in butt to butt relation with said rod, wire or the like, as by butt-welding, said sheet-metal piece having its free end formed with a plurality of eyes in spaced relation and having the eye apertures in coaxial alinement, constituting a yoke adapted to receive a connecting member, such as a bolt, pin or clevis, to permit removable attachment between said rod, wire or the like and an article to be associated therewith.

16. The combination with a metal rod, wire or the like, of an attachment comprising a member composed of a piece of sheet metal stock having an attaching shank comprising a portion of said sheet metal piece, disposed in the form of a compact, substantially solid cylinder with a substantially solid end united metallically in butt to butt relation with said rod, wire or the like, as by butt welding, said sheet metal piece having its free end formed with a pair of flanged eyelets in spaced co-axial alinement, constituting a yoke adapted to receive a connecting device, such as a bolt, pin or clevis, to permit removable attachment between said rod, wire or the like and an article to be associated therewith.

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