

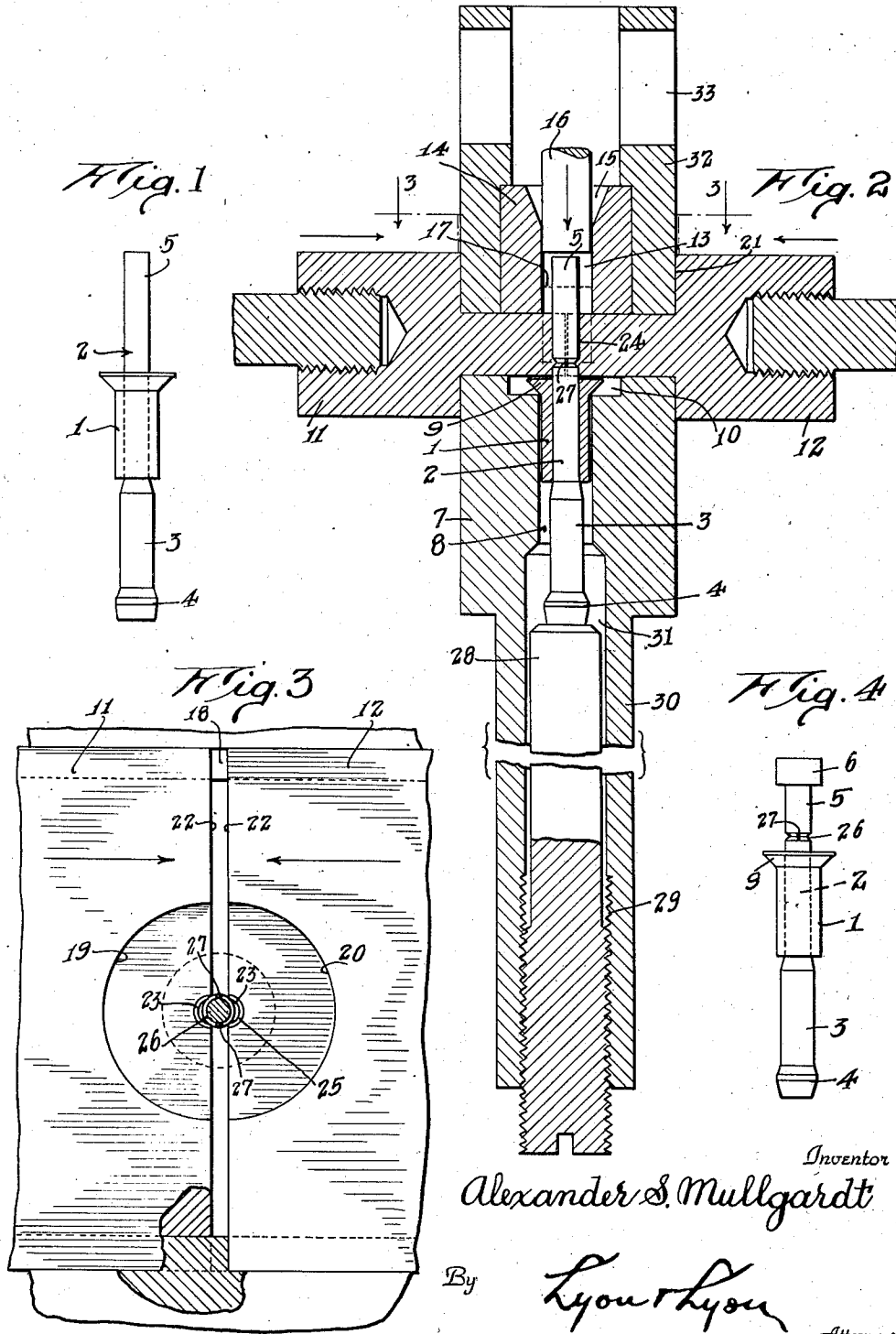
Oct. 2, 1945.

A. S. MULLGARDT

2,385,831

RIVET MANUFACTURE

Filed Nov. 7, 1942



UNITED STATES PATENT OFFICE

2,385,831

RIVET MANUFACTURE

Alexander S. Mullgardt, Los Angeles, Calif., assignor to Cherry Rivet Company, Los Angeles, Calif., a corporation of California

Application November 7, 1942, Serial No. 464,881

5 Claims. (Cl. 10—27)

This invention relates to a type of rivet popularly called blind rivets. These rivets are employed for riveting plates or other parts together where these parts are accessible only from the working side. Such rivets include a body of sleeve-form with a mandrel located within the same. The rivet, of course, is inserted from the outer side with the head of the sleeve-form body seated against the outer plate, and the mandrel is then forcibly pulled outwardly. In the type of rivet to which this invention relates, the mandrel is formed with an expander neck which is of slightly larger diameter than the shank or portion of the mandrel that lies within the rivet body when the same is inserted in the rivet hole. Beyond the expander neck an expander head is provided, and when the mandrel is pulled to set the rivet in the hole and head it, the expander neck expands the body of the rivet so that it effectively fills the rivet opening before the heading of the inner end of the sleeve is effected by the expander head at the inner end of the mandrel.

When the expander neck is being pulled into the rivet body, considerable resistance is offered to this movement by the rivet body, and the tensile stress or setting force applied axially in the expander neck, combines with this compressive force developed by the body sleeve, to produce resultant forces which may cause fracture of the expander neck within the body; and in normal operation when no fracture occurs, there is still a possibility that due to the action of these forces a slight reduction in diameter of the expander neck may occur. Due to this action of the forces at the moment of setting and heading such rivets, there is a tendency for a considerable variation to occur in the character of the contact between the expander neck and the body of the rivet, causing considerable variation in what is termed the "push-out values" of these rivets. In other words, there is a tendency to considerable variation in the plugging effect of the expander neck in the rivets.

One of the objects of the present invention is to provide a blind rivet having a construction which will overcome this difficulty, and which, when employed in the construction of the rivet, will insure that in setting the rivet no substantial variation will occur in the character of the contact between the expander neck and the rivet body.

Another object of the invention is to provide a simple and reliable method for constructing a blind rivet, which will overcome the objections mentioned above.

As regards the improved method that I prefer to employ in manufacturing such blind rivets, it should be stated that it has been my practice heretofore in forming the pulling head on the outer end of the rivet mandrel, to form this head by upsetting the end of the mandrel in suitable dies. In doing this, of course, the body of the rivet is already placed on the mandrel with its inner end lying adjacent to the expander neck of the mandrel. The upsetting is accomplished by forcing the plunger of the die against the end of the mandrel, and the thrust of this plunger is resisted by a back-stop or adjustable seat for the other end of the mandrel. In performing this operation considerable axial compressive stress is developed in the shaft of the mandrel, and there is a tendency to develop a flux or slight flow of the material within the shank, which tends to cause an expansion of the shank within the body of the rivet, and this has necessitated the provision of means for holding the rivet on its sides to prevent such expansion. Due to the "column load" on the mandrel under the action of the upsetting plunger, there is also a tendency for the rivets to bend laterally toward their middle portion, which necessitated providing dies to fit up against the side of the rivet to prevent this. One of the objects of my invention is to provide a method for overcoming these difficulties, and to provide a method to operate in such a way that the development of axial stress down through the rivet from the head at the moment of upsetting it, will be reduced or relieved.

Further objects of the invention will appear hereinafter.

The invention consists in the novel steps and combination of steps employed in my method of constructing a blind rivet, and also resides in the novel features and combination of features of the rivet, all of which contribute to produce improvements in rivet manufacture.

A preferred embodiment of the invention is described in the following specification, while the broad scope of the invention is pointed out in the appended claims.

In the drawing:

Fig. 1 is a side elevation of the blind rivet upon which my invention can be employed to complete the rivet.

Fig. 2 is a vertical section through the apparatus which I prefer to employ in practicing my invention, and showing the rivet in place and in the first phase of the operation of completing the rivet in accordance with my invention. In this view certain parts are broken away.

Fig. 3 is a plan view taken about in the plane of the line 3—3 of Fig. 2, and illustrating the relation of two opposed forming dies cracked open so as to illustrate how they operate upon the shank of the rivet. In this view certain parts are broken away.

Fig. 4 is a side elevation of the rivet completed in accordance with my invention.

Referring more particularly to the parts, Fig. 1 illustrates the "blank" rivet which I complete in accordance with my invention. In Fig. 2 this rivet is indicated set in position in the forming dies, and after one phase of the forming operation has been completed. The rivet includes a body 1 of sleeve-form, in which is received the shank 2 of the mandrel or stem, said mandrel including an expander neck 3 below which, that is to say, at the inner end of the rivet, an expander head 4 is formed. The upper end 5 of the shank extends considerably beyond the outer or upper end of the body of the rivet, so as to include sufficient material for forming the pulling head 6.

The dies include a block or base 7 which is held in a fixed position by means not illustrated, and this block has a central bore 8 of a suitable diameter to receive the sleeve or body 1 of the rivet with the head 9 of the body resting in a counter-bore 10 below the path of movement of dies 11 and 12 which move into position from each side, as indicated in Fig. 3. The rivet assembly is supported in position so that its upper end 5 is received in a die chamber 13 which is the bore of a ring die or cylindrical die 14 having an upwardly disposed mouth 15 through which the male die or plunger 16 moves downwardly to exert force upon the upper end face of the mandrel. In doing this, the upper end of the shank 2 will be forced down to form the head 6, the upper face of which is indicated by the dotted line 17.

Before this upset head 6 is formed, however, the material of the shank 2 is impressed by two or more die sections such as the dies 11 and 12 that slide into position on guideways such as the guides 18 (see Fig. 3). These dies 11 and 12 are in the form of blocks having semi-circular recesses 19, 20 on their upper faces, which come together to form a socket 21 when the meeting edges 22 of these dies abut together. (See Figs. 2 and 3). In order to enable these dies to impress the material of the shank 2 so as to form a weak point in a transverse plane adjacent the outer end of the body 1 of the rivet, I provide the inner edges 22 of these dies with grooves 23 to come together to form a bore 24 fitting closely to the shank. These grooves are provided with arcuate fins or projections 25 preferably of V-shaped cross-section as indicated in Fig. 2. As the dies 11 and 12 are forced inwardly, these fins 25 will form a peripheral groove 26 in the shank. In doing this, also at diametrically opposite points they pinch up the material to form two small studs 27 which project out slightly beyond the periphery of the shank and operate as stops to prevent the body 1 from moving outwardly on the shank beyond the groove 26 that has been pressed into the shank.

A socket similar to socket 21 is also formed in the lower surfaces of dies 11 and 12 as indicated in Fig. 1, which socket is adapted to receive the end of the base 7 when the dies 11 and 12 are in working position.

As these fins 25 are in position when the plunger 16 descends, they operate as an anvil or "dam" to resist downward movement of the material in the shank when the head 6 is upset.

This acts as a check to the upsetting force at this point, and tends to prevent any tendency for the impressing force in the mandrel from tending to bend the mandrel laterally below the level of the lower faces of the dies 11 and 12. This compression force, of course, is resisted by a back-stop or adjustable seat for the expander head 4, which seat is in the form of a plug 28 that may be screwed adjustably into threads 29.

The lower end of the block 7 may have a tubular extension 30 in which these threads 29 are formed, and preferably are formed with an enlarged counterbore 31 extending up below the bore 8.

The ring die 14 is in the form of a bushing placed in the lower end of a head 32 that is of cylindrical form, and which moves down so as to occupy the socket 21 before the plunger 16 descends to upset the head 6. This head 32 may have a transverse slot 33 in which means is located for moving the head 32 down at the will of the operator of the dies.

Referring to the complete rivet illustrated in Fig. 4, it should be understood that the "gun" or other riveter tool that is employed, takes hold of the upper end of the mandrel under the shoulder of the head 6, and exerts a tensile force axially in the mandrel to pull the expander neck 3 up through the body 1 of the rivet. When this occurs, of course, the upper or outer end of the body 1 is held against movement by a part of the riveter tool. In accordance with this invention the shank 2 is weakened by the peripheral groove 26, so that the section at this point is incapable of transmitting a tensile or setting force for the rivet, that would be sufficient to produce any elongation in the shank 3 as it passes up into the sleeve body 1 of the rivet, under the action of the considerable compressive resisting force that the body 1 will exert upon the neck 3 as it moves up into position to set the rivet. As a result of this, these rivets are quite uniform as to the condition of the material composing the rivet at any section through the body 1 and the expansion neck 3.

Many other embodiments of the invention may be resorted to without departing from the spirit of the invention.

What I claim is:

1. A method of forming a blind rivet of the kind described, having a body of sleeve-form and a mandrel, said mandrel having a shank within the body and projecting outwardly beyond the same; said method consisting in supporting the projecting end of said shank in an upsetting chamber within upsetting dies, applying pressure to the end face of the shank to upset the same in the upsetting chamber; forcing die extensions into the material of the shank at its side and maintaining the same in that position during the said upsetting operation, said extensions operating to resist axial flow of the material in the shank toward the rivet body during the upsetting operation.

2. A method of forming a blind rivet of the kind described, having a body of sleeve-form and a mandrel having a shank within the body with its outer end projecting beyond the same; said method consisting in holding the said projecting end of the shank in an upsetting chamber within upsetting dies, forcing a plurality of die sections with arcuate fins at their forward ends into the material of the shank at its side and adjacent to the end of the body, and maintaining said fins in that position; and applying pressure to

the end face of the shank to upset the same in the upsetting chamber, said fins operating to resist the axial upsetting force and thereby reduce lateral bending of the rivet.

3. In the manufacture of a blank blind rivet 5 having a sleeve-form body and a stem having a shank lying in the body and projecting beyond the end of the body to present material to be upset into a pulling head for the rivet; the step of pressing complementary arcuate die tips into 10 the shank to form a circular groove therein and holding the die tips in position to resist flow of metal past the location of the die tips and upsetting the projecting end of said shank to form the pulling head.

4. A method of forming a blind rivet having a body of sleeve-form and a mandrel with a shank within the body and projecting outwardly beyond the same, said method consisting in supporting the projecting end of the shank in a fixed position, 20 forcibly pressing dies to opposite sides of

the shank so as to project the inner ends of the dies through the superficial face of the shank, and then applying pressure to the end face of the shank to upset the same, said forward ends of said dies operating to resist axial flow of the material in the shank toward the rivet body during the operation of upsetting the pulling head.

5. A method of manufacturing a blank blind rivet having a shank and a sleeve fitting slidably thereon, characterized by: engaging a projecting portion of said shank by complementary arcuate die faces and forcing complementary arcuate die tips into said shank to form an annular channel therein; then upsetting the projecting portion of said shank while held by said die faces and die tips, said die faces and die tips operating to resist axial flow of material of said shank into the portion thereof contained within said sleeve, whereby said sleeve remains slidable.

ALEXANDER S. MULLGARDT.