May 16, 1961 G. A. LYON 2,984,001

METHOD OF FORMING SOCKETS FOR DROP RINGS

Filed Nov. 4, 1955

2 Sheets-Sheet 1

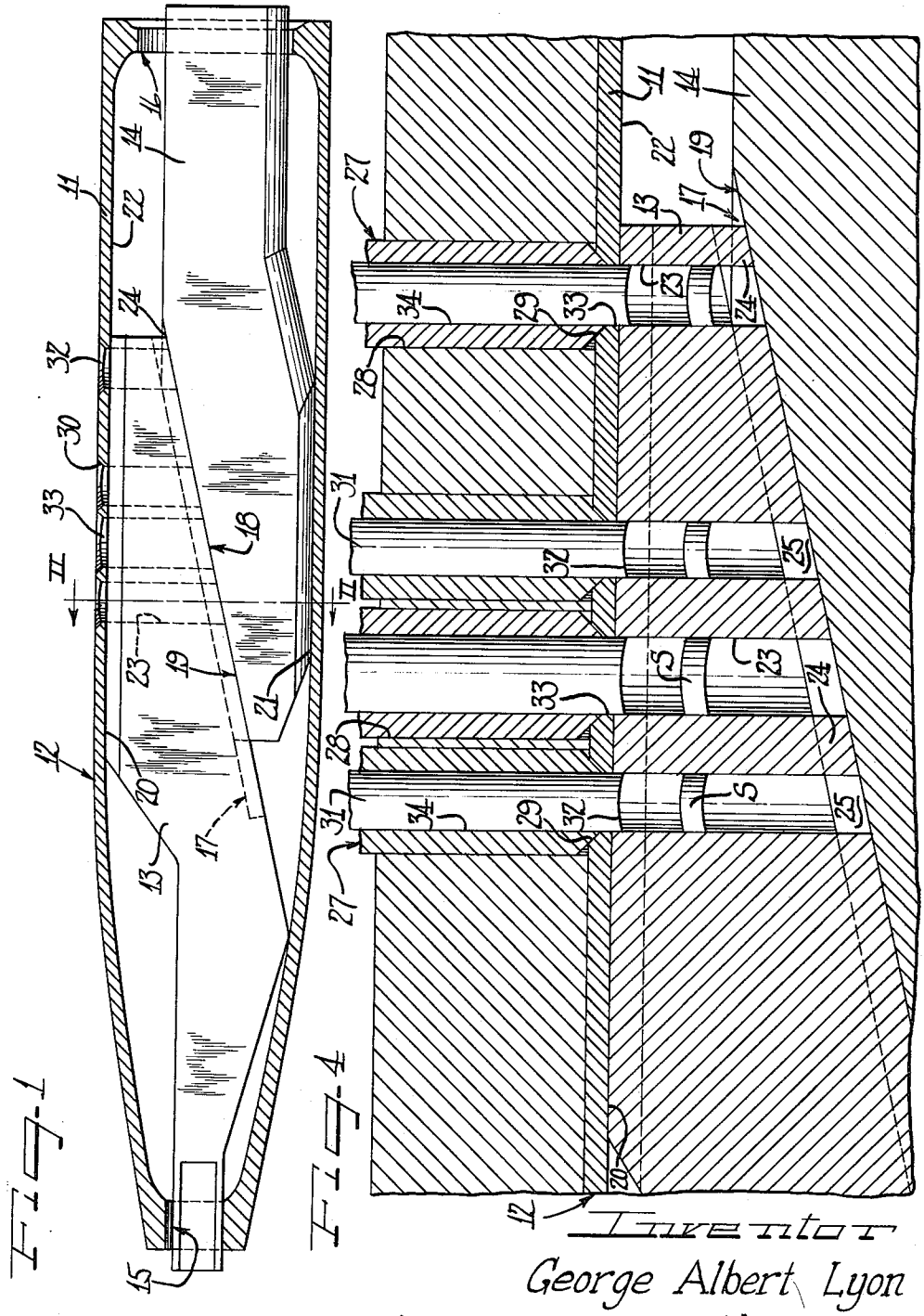


Fig. 1

Fig. 4

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2 Sheets-Sheet 2

Fig. 2

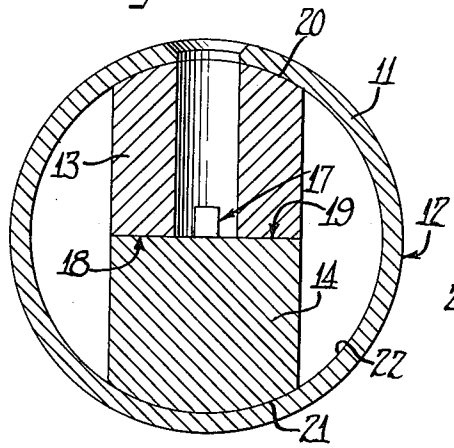


Fig. 3

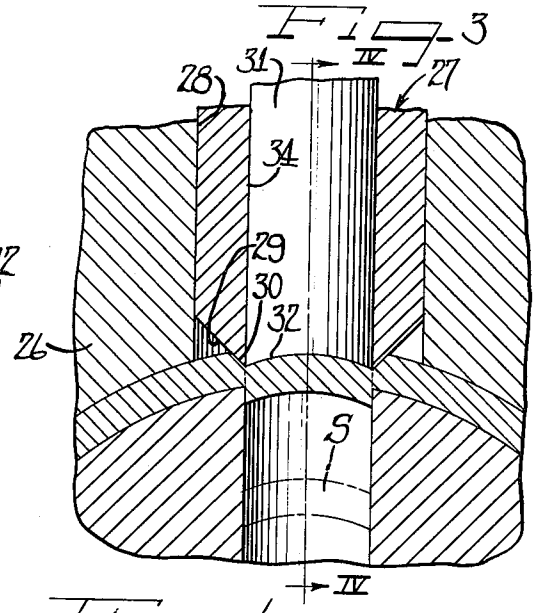


Fig. 5

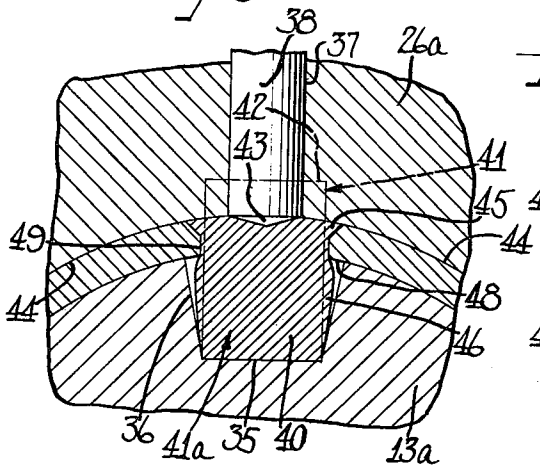


Fig. 6

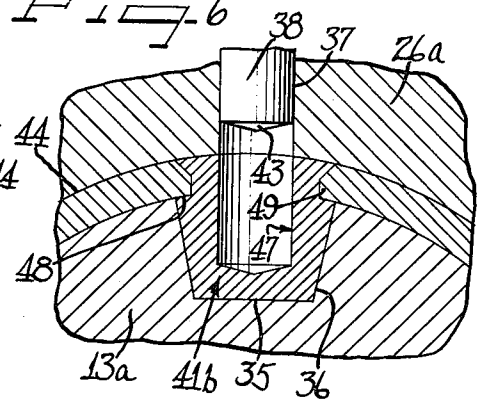
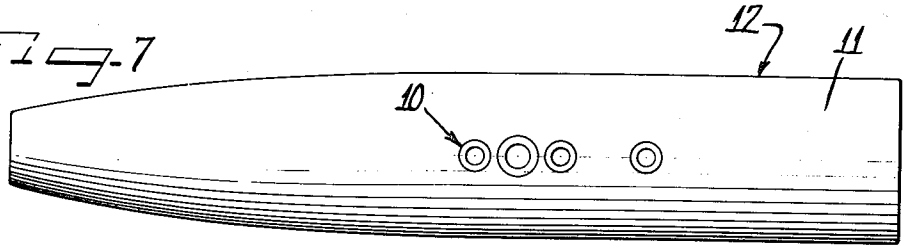


Fig. 7



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2,984,001

METHOD OF FORMING SOCKETS FOR DROP RINGS

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2 Claims. (Cl. 29—522)

This invention relates generally to a novel method and an apparatus for forming hanger sockets.

Specifically, this invention relates to a method and an apparatus for forming moisture proof bomb hanger sockets in the wall of the bomb so as to provide means by which the bomb can be suspended from the underside of the wing of an airplane or the like.

Bomb manufacturers for some time now have been in the process of developing a new typ of streamlined low drag bombs of the 500–2000 lb. type. It will be appreciated that due to the faster air speeds being developed by presently existing airplanes and further in view of the higher altitudes now attainable by them, conventional bomb constructions must be streamlined and modified so as to allow precision bombing under these more exacting conditions.

Accordingly, it is an object of this invention to provide a novel method and an apparatus capable of producing streamlined low drag type of bombs.

A further object of this invention is to provide a new and improved method and apparatus for forming bomb hanger sockets in the wall of a bomb which may be cheaply and efficiently carried out so as to lend itself to large scale production techniques.

Yet another object of this invention is to provide a novel method and apparatus which is capable of forming contemporaneously a plurality of bomb hanger sockets in the wall of the bomb.

Still another object of this invention is to provide a novel method and apparatus for formulating and attaching bomb hanger studs to the wall of a bomb casing through the utilization of presses capable of developing the required punching power.

Another and still further object of this invention is to provide a novel method and apparatus which is capable of producing a moisture proof stud socket and bomb wall connection.

In accordance with the general features of this invention there is provided in a method of providing moisture proof bomb hanger studs on the wall of the bomb casing, the steps of punching and repunching the wall of the bomb to form a counter sunk apertured wall portion, inserting a die member within the casing, inserting a rivet slug through the aperture resting same on the die member, and compressing the slug to mushroom same on radially inner and outer surfaces of the casing wall thereby interlocking the components in unitary relation.

Other features relate to the provision of one form of apparatus adapted to carry out my method and which includes wedgingly cooperable die or anvil members insertable into the interior of the bomb casing for use in the riveting operation.

Other objects and features of this invention will more fully appear from the following detailed description taken in conjunction with the accompanying drawings which illustrate a single embodiment thereof and in which:

Figure 1 is a longitudinal cross-sectional view with parts

in elevation showing a bomb casing having apparatus therein for affecting my novel invention;

Figure 2 is an enlarged cross-sectional view taken on the line II—II of Figure 1 looking in the direction indicated by the arrow;

Figure 3 is an enlarged fragmentary cross-sectional view showing the upper and lower die members in engagement with the wall of the bomb casing and showing a punch striking one of the holes in which a stud is to be inserted;

Figure 4 is an enlarged fragmentary cross-sectional view taken on the line IV—IV of Figure 3 showing in greater detail my apparatus and illustrating how the ram strikes the casing wall in effecting my movel method;

Figure 5 is an enlarged fragmentary cross-sectional view similar to Figure 3 but showing a later step in my novel method and other apparatus for carrying out same;

Figure 6 is an enlarged fragmentary cross-sectional view similar to Figure 5 illustrating how the stud socket is interlocked to the bomb wall; and

Figure 7 is a plan view of a bomb casing showing the stud sockets in a completed state.

As shown on the drawings:

The reference character **10** (Figure 7) indicates generally one of a series of bomb hanger stud sockets which are riveted to the cylindrical wall **11** of the bomb casing **12**. It will be appreciated that after the bomb hanger stud sockets have been formed in the wall of the bomb casing **12** that the other component parts of a completed bomb may be then assembled with the casing **12** including the tail assembly, the power charge and the war head (not shown).

In order to aid in the understanding of my invention I shall now proceed in detail to describe same following generally the steps carried out in my novel method along with a description of my novel apparatus as effecting each step.

As seen in Figure 1, a pair of slidably adjustable interlocking complementally beveled-type die or anvil members **13** and **14** are disposed in the casing and have opposite ends projecting through the longitudinally opposed openings **15** and **16** of the bomb casing **12**. They may be inserted in the casing **12** through openings **16** and are thereafter adjustably assembled within the confines of the casing wall by means of a tongue and socket connection indicated generally at **17** (Figures 1 and 2) connecting the opposed inclined sliding surfaces **18** and **19** of the die members **13** and **14**. The members **13** and **14** not only serve as a lower die member in my method but also can support the casing **11**.

Each of the wedging die members **13** and **14** have a wedging arcuately curved surface **20** and **21** (Figure 2) which engages in an opposed relation against the radially inner surface **22** of the cylindrical wall **11**.

The socket connection **17** is utilized to minimize radial and axial slippage of the die members **13** and **14** relative to one another and in addition, serves to bring the respective arcuately curved surfaces **20** and **21** of the die members **13** and **14** into firm nested engagement with the inner surface **22** of the bomb wall **11** so as to minimize any undesired distortion of the bomb wall as a consequence of working the cylindrical wall **11** as hereinafter will be more evident.

Provided on the die member **13** are suitably four vertical or transverse openings or bores **23** extending through the die member **13**, one for each socket **10** to be formed. It will be noted that tongue **24** of socket connection **17** has suitably four openings **25** alignable with bores **23** for purposes hereinafter described.

The dies **13** and **14** are adjusted so that the bores **23** are positioned in a predetermined location relative to the cylindrical wall **11**. This predetermined location pref-

erably constitutes the center of mass area of the bomb so that the bomb may be suspended from the underside of a plane in such a manner that there is a uniform distribution of mass relative to the hanger elements (not shown).

The next step of my novel method after the assembly of the dies **13** and **14** within the bomb casing **12** is the insertion of a bomb or casing **12** into a suitable press, a part of which is shown in Figures 3 and 4 in the form of a hold-down die **26**. It will be appreciated that the die members **13** and **14** may be assembled within the bomb casing **12** before or after being placed in the press as desired; and that the press may be any conventional double toggle or double acting hydraulic press.

After the bomb casing **12** has been positioned in the press, it will be noted that the hold-down external member **26** is adapted to engage nestingly with the cylindrical outer surface of the wall **12** to prevent any undesired deformation thereof as a result of the steps to follow.

Press rams **27** of predetermined variable diameters as desired are each contemporaneously urged radially inwardly through vertical bores **28** in die member **26**. The rams each have a tapered striking terminal **29** and as they strike the wall **11** four countersunk depressions **30** are made with a portion of the metal wall **11** bulging downwardly (Figure 3) and carried by each of the rams **27** is a second punching ram **31** having a concave striking head **32**. Rams **31** are utilized to punch out suitably four openings or slots **33** from the wall **11** as they move in their respective bores **34**. Since the bores **23** and **34** (Figures 3 and 4) are in vertical alignment each of the punched out slugs S is urged into the bores **23** and are adapted to lodge in openings **25**. It is in this manner that the slugs S may be readily removed as the die member **13** is withdrawn from the interior of the casing after the rams **31** have been retracted. In other words, the slugs S drop out of the bores after the die members **13** and **14** are disengaged. It is in this manner that the slugs are precluded from jamming and causing difficulty in the disassembly of the die members **13** and **14**.

The instant invention concerns itself with having an especially constructed ram **27** which has a first punching head **29** capable of providing counter sunk depressions **30** and a second ram **31** movable within ram **27** to strike out slugs S to form openings **33** each concentric with a counter sunk opening **30** cooperating together to each provide a seat. It will be appreciated that through utilizing a striking ram **31** having a concave striking head **32** that the striking operation is greatly facilitated. As a result of the striking out of the slugs S, counter sunk depression **30** is merged to provide a counter sunk opening **33**.

In the next step of my invention, structurally different die and hold-down members **13***a* and **26***a*, respectively, are utilized as shown in Figures 5 and 6. The die member **13***a* is adjustably mounted on the die member **14** in place of member **13** but in the same manner as in the case of die member **13**.

The principal difference in the construction between the die member **13** and the die member **13***a* is that in each case where bores **23** were formerly employed in the die member **13**, pockets **35** having radially projecting outwardly inclined or tapered walls **36** are now utilized in the die member **13***a*.

With respect to the hold-down member **26***a*, vertical bores **37** of varied diameter are now employed. These bores **37** are not only of a varied diameter different than that of the bores **28** but are also adapted to have projecting therethrough rivet forming rams (Figures 5 and 6).

Another feature of the hold-down member **26***a* is that it is arcuate in configuration so as to be capable of snugly nesting with the outer cylindrical surface **37** of the wall **11** and thereby prevent any undesired deformation in the rivet forming operation.

Since the formation of rivets in the respective sockets or pockets **45** is substantially the same in each case, the rivet forming operation has only been illustrated in connection with the formation of a single rivet (Figures 5 and 6).

The next step of my novel method after the removal of die member **13** and the insertion and adjustment of die member **13***a* along with the substitution of hold-down member **26***a* for member **26**, is the insertion of one end **40** of a preferably pre-heated annealed rivet blank or slug **41** through the slot **33** with the end **40** resting in the socket **35** of the die member **13***a*. The other end **42** (Figure 5) of the rivet blank **41**, when the end **40** is in bottomed relationship with the socket **35**, projects radially outwardly beyond the confines of the cylindrical wall **11** (Figure 5).

The hold-down member **26***a* which is carried by the press is then brought into contact with the rivet blank **41**. It will be noted that the radially innermost convex tapered end or head **43** of the ram **38** lies slightly below the plane of the lowermost concave surface **44** of the hold-down member **26***a* so that the ram is utilized in the forming of the rivet blank **41** into an intermediately formed rivet **41***a* (Figure 5) capable of nesting in countersunk opening **33**.

In view of the foregoing, it will be appreciated that the press is first actuated with the hold-down member **26***a* urged downwardly with the tapered ram head **43** engaged against the blank **41** and the die members **13***a* and **14** to compress and mold the rivet blank **41** into an intermediately formed rivet **41***a* (Figure 5).

It will be noted that head portion **45** (Figure 5) of the rivet **41***a* is mushroomed out in the countersunk opening **33** with the shank **46** collapsed or mushroomed radially outwardly on the underside of opening **33** along surface **22**. It is in this manner that the rivet **41***a* is interlocked with cylindrical wall **11**.

After the innermost surface **44** of the hold-down member **26***a* is brought into nesting engagement with the outermost surface of the cylindrical wall **11**, ram **38** is then forcibly urged against and into the rivet **41***a* and a socket **47** is thereby formed in the rivet **41***b* thereby forming a completed stud socket **10**. As the socket **47** is formed, the metal of the rivet **41***a* is further deformed from the position shown in Figure 5 to that of Figure 6 where it is forced into snug contact with the under surface **22** about opening **33** into interlocked moisture proof relation therewith. It will be noted that the circular edge **48** is utilized as a die in the formation of the completed stud socket **10**.

As is shown in Figure 6, the exterior surface of the rivet head **45** is convexly curved in the curved cylindrical plan of the outer surface of casing **11** so as not to detract from the streamlined characteristics of same.

In view of the foregoing it will now be perceived how the stud is formed and interlocked with the wall **11** and more particularly how portions of the stud interlockingly bear against an intermediate reduced and tapered annular abutment **49**.

It is in this manner that moisture proof stud sockets **10** may be provided in the wall of a bomb casing so that the dry powder charge may be preserved in wet weather and the like. Also, the smooth lines of the bomb casing will remain substantially unaltered thereby meeting the need for streamlined bombs.

A further advantageous result which arises in the practice of the instant method and the apparatus used therefore is that a plurality of studs sockets may be contemporaneously formed and secured to the streamlined bomb thus permitting more rapid large scale production.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

I claim as my invention:

1. In a method of forming a socket in the cylindrical wall of a casing, the steps of first providing an outwardly opening transverse countersunk hole in the wall, disposing a stud in said hole, radially spreading the outer

end of the stud to engage same in the countersunk portion of the hole, spreading radially an intermediate portion between the ends of the stud beyond the inner edge of the hole to engage such intermediate portion with the inner surface of the wall, and thus lock the stud to the wall and contemporaneously forming an outwardly opening socket in the stud.

2. In the method of claim 1 the step of spreading the outer end of the stud being further characterized by the forming of the outer end surface of the stud so that it is in cylindrical alignment and flush with the outer surface of the cylindrical wall.

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