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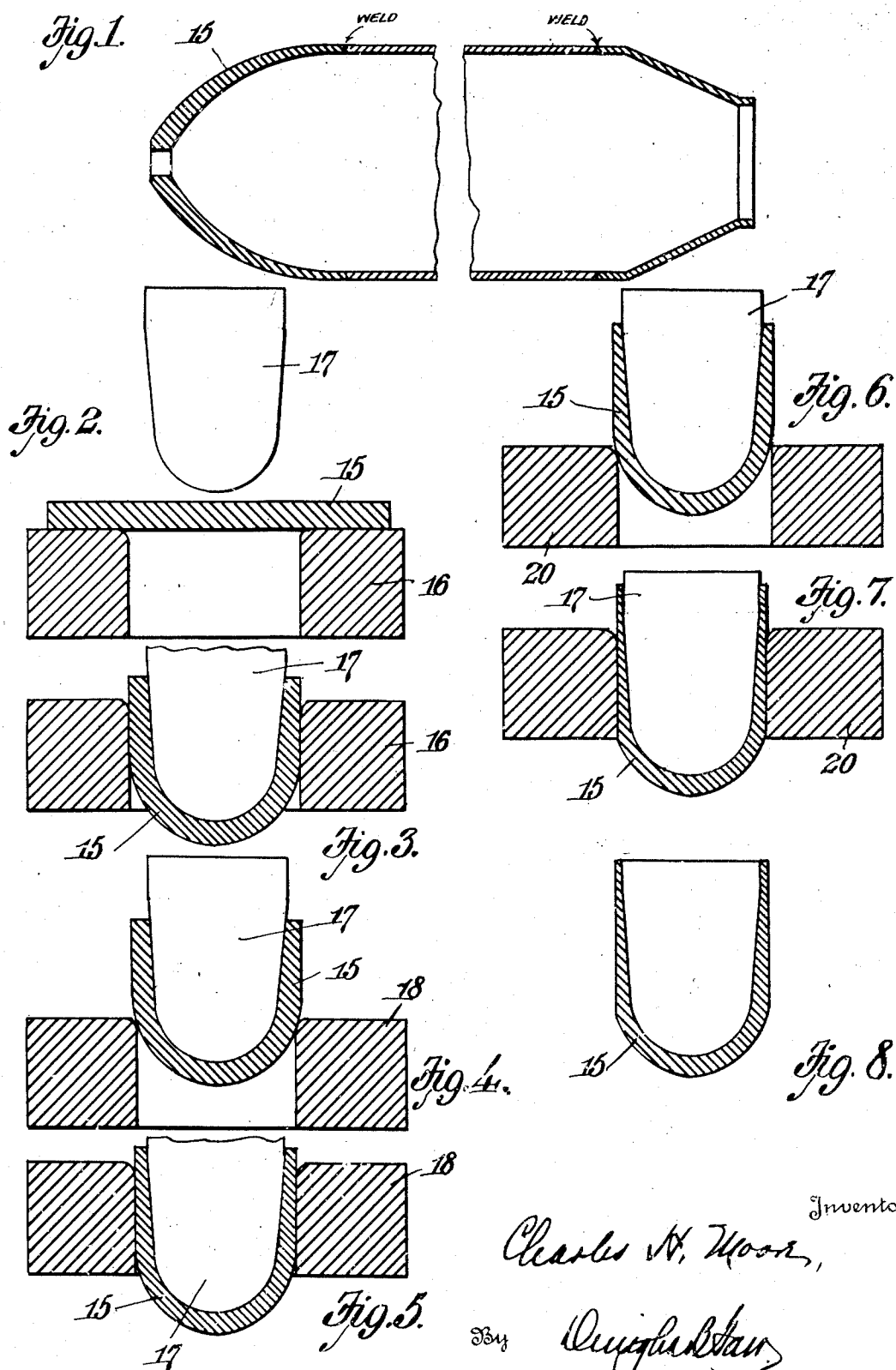
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2,301,507

METHOD OF MAKING NOSE PIECES FOR EXPLOSIVE BODIES

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2 Sheets-Sheet 1



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2 Sheets-Sheet 2

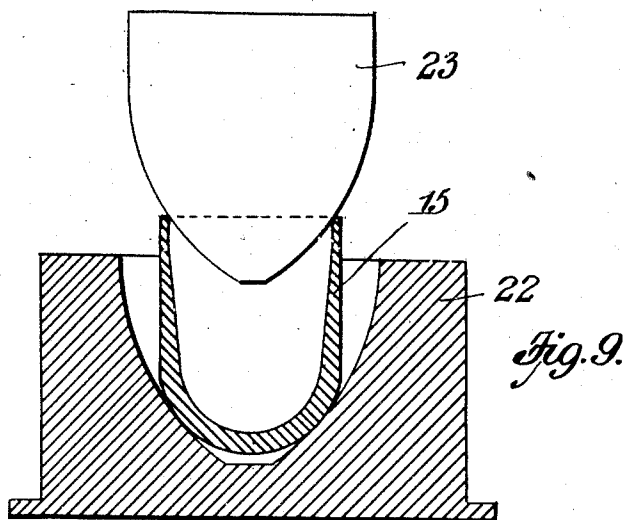
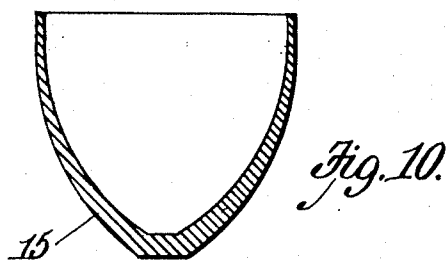
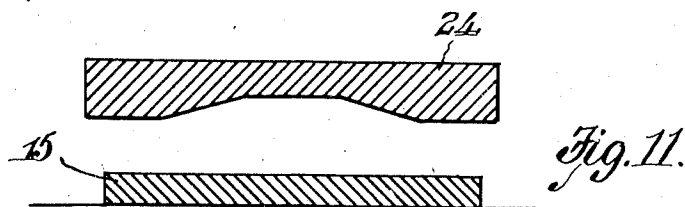


Fig. 12.

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METHOD OF MAKING NOSEPIECES FOR
EXPLOSIVE BODIES

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5 Claims. (Cl. 29—1.21)

This invention relates to method of forming steel shapes, and particularly to the formation of nose pieces for explosive bodies.

Explosive bombs to be dropped by aircraft for demolition purposes usually comprise elongated cylindrical bodies charged with high explosive or flammable material and equipped with detonating or ignition means operable to explode or ignite upon contact of the bomb with the target.

It is desirable that these bodies be so constructed as to offer the least possible resistance to external pressures or influences, to travel true to the target at which they are directed with a minimum of deviation, and to withstand the shock of impact without collapsing upon reaching the objective. To these ends, the body is usually rounded or ogival and reenforced at its forward or contact end, and is equipped with fins or a tail piece to accurately steer the body in its flight.

Originally, these bombs were made of a seamless one-piece steel forging, similar to gas or bottle tanks, but experiment showed that a bomb of greater strength could be more easily made in sections and welded together at considerable saving in time and expense. Such proposal includes a body, a tail piece, both of comparatively thin steel, and a nose piece, all separately formed and then assembled and welded together in a unitary body. The construction of the body and tail piece is a simple matter, but problems have presented themselves in the practical and economical formation of the nose piece, due principally to the fact that the tip or contact part of the nose piece must be sufficiently thick to withstand the shocks of impact, and the side walls thereof must be of gradually diminishing thickness as they round off and expand to the diameter of the body.

It has been proposed in the manufacture of such a nose piece to forge or cast the part to its approximate shape and dimension, and to then machine it to true form. Such procedure is attended with objections; principally, that it is difficult to cast such a shape, with its varying thicknesses and irregular shape, without producing defects and weaknesses in the finished piece, and also that the product requires considerable machine work before it can be assembled upon the body. Other proposals include the shaping of the nose piece from a circular disk having a relatively thick center portion, the disk becoming progressively thinner toward its edges, and this blank has been spun or worked into a nose piece, the center of the disk forming the nose tip. It has been further proposed to form the nose piece

from a flat circular disk of uniform thickness throughout, cutting away the surface from adjacent the center to the edges to produce a gradual thinning of the metal at the edges, and then

forming the disk into the proper ogival shape. It is the purpose of the present invention to produce a nose piece having the required nose and side wall thicknesses, variations and shapes entirely by forging and extruding steps and to overcome the objections to the methods or processes heretofore adopted or proposed, and particularly to eliminate all expensive and time consuming machining operations, except for drilling and tapping the nose center for the application of the detonator. While the following is a description of the method as carried out in the construction of the nose piece of an explosive bomb, it will be understood that the invention may be equally as well employed in the formation of incendiary bombs, explosive shells and other bodies where a relatively heavy or thick nose tip and gradually diminishing or tapering side wall structure is required with a maximum of strength in all parts of the piece.

In the drawings:

Figure 1 is a longitudinal section through a typical three-piece welded explosive bomb, showing particularly the desired shape and approximate proportions of the nose piece and its association with the bomb body,

Figure 2 is a sectional view taken through a ring die and showing the application thereto of a flat plate in the act of being operated upon in the first step of my improved process,

Figure 3 is a view similar to Figure 2 and showing the plate as it will appear after the first operation,

Figure 4 is a view similar to Figure 3 and showing the start of the next extruding operation,

Figure 5 is a similar view showing the shape of the nose piece after the said extruding operation,

Figure 6 is a similar view showing the start of the next extruding operation,

Figure 7 shows the shape and the approximate proportions of the nose piece after the said extruding operation,

Figure 8 is a sectional view showing the shape of the nose piece after the third extruding operation,

Figure 9 is a sectional view through a shaping die preparatory to expanding the side walls of the nose piece to the desired diameter,

Figure 10 is a sectional view through the nose

piece after the various shaping, extruding and expanding operations,

Figure 11 is a sectional view through a plate and a die of a coining press and illustrating a step which may be taken preliminary to the initial bowling or shaping step as above described, and

Figure 12 is a sectional view of the plate as it will substantially appear after the coining operation.

As has been above stated, it is desirable in a structure of this type to provide a relatively thick wall at the tip of the nose piece, becoming progressively thinner toward the open end of the blank. This is in order that a maximum of strength is possessed by the contact part of the nose piece, and at the same time it is equally desirable that the thinner side walls of the nose piece possess a maximum of strength, or at least a strength equal to that of the body of the bomb.

In carrying out the invention, the nose piece is made of a single piece of metal, initially of uniform thickness throughout, and preferably in its initial form is of circular shape. This piece will be of a thickness slightly greater than the tip or contact end of the nose piece in its finished form. The plate 15 is first heated to a proper degree and is placed upon a ring die 16 with its center coaxial with the latter. The internal diameter of this die which is uniform from one end to the other, will be such as to bowl or cup-shape the plate when pressure is applied to the nose plug 17 centrally of the plate. This nose piece will be of the shape and configuration generally approximating the internal surface of the end of the nose piece, but the said nose plug has straight slightly outwardly diverging walls as shown, to facilitate stripping as well as to produce a desired taper or flare in the side wall of the nose piece. Upon the application of pressure to the plate by the nose plug 17, the plate will assume cup-shape as shown in Figure 3, and in so doing will be slightly drawn and thinned in being forced through the ring die. After this operation the piece will be stripped from the ring die 16 and applied to a ring die 18, having slightly smaller internal diameter, and forced through the said ring die by the same nose plug 17. This operation produces a shape in the plate 15 as substantially shown in Figure 5, that is, the tip of the nose piece and the metal immediately adjacent thereto will be slightly reduced in thickness, while the side walls 19 will be somewhat thinned and extruded along the side of the nose plug 17. The nose piece 15 is then removed from the ring die 18 and is applied to ring die 20 of still smaller internal diameter, the same nose plug 17 being used to force the nose piece through the restricted opening of the ring die 20. This operation produces a further slight thinning of the tip of the nose piece and the parts immediately adjacent thereto, but further extrudes and works the metal of the sides along the surfaces of the nose plug 17. These several thinning and extruding steps are carried out in order to bring the side walls to substantially the thickness of the cylindrical bomb body, and, if desired or further necessary, the foregoing steps may be repeated with additional ring dies of decreasing internal diameter. The same nose piece 17 is employed in forcing the cup through the restricted die openings, and it will be observed that while the lower end of the cup obtains but slight difference in its original thickness, the side walls have been materially thinned, extruded and out-

wardly flared along the side walls of the nose plug 17.

It will be understood that throughout the several operations here described, the plate 15 and the nose piece which is developed therefrom will be heated to a proper temperature in order that the desired results be accomplished. It will be appreciated that in these several operations upon the nose piece through the several dies of progressively smaller internal diameters, the metal drawn in the bowl portion and extruded along the sides of the nose plug will be worked and the fabric of the metal will be thus materially improved. Moreover, any flaws or defects inherent in the metal plate will be corrected by these working and extruding operations.

After the last of the extruding steps, the resultant nose body 15 is applied to a shaping die such as is shown in Figure 9 and indicated at 22. This die will have a cavity or recess of substantially the size and contour the finished nose piece should assume, and an expanding plug 23 conforming to the shape and size the interior of the completed piece shall be when properly centered in the nose piece, will expand the latter to shape in the die to substantially the shape shown in Figure 10 of the drawings. Any minor irregularities, deformations or bulges in the shape of the nose piece will be corrected by this final pressing operation, and it will be found that little, if any, machine work upon the nose piece will be required. It will also be found that the texture and tensile strength of the thinned side walls of the nose piece will be materially strengthened due to the drawing and extruding operations above described, and after the edges of the nose piece are trimmed, the piece may be readily and securely welded to the body to assume the final shape as shown generally in Figure 1 of the drawings. It is apparent that the application of pressure by the expanding plug 23 in a downward direction will, in its expanding operation, spread the metal and will also return metal to the side walls of the nose piece in a direction reverse of that in which the metal was worked in the earlier steps of the process. At the same time, the nose piece will be shortened somewhat in this expanding operation, as will be obvious.

The several steps of the process may result in a nose piece whose relatively thin side walls too abruptly join the thicker portion of the body, or wherein a bulge may develop from metal in the piece which is not sufficiently thinned or worked in the extruding process. To obviate such occurrence, the metal blank, prior to the first of the above described shaping and extruding steps, may be subjected to a coining operation. This coining step is indicated generally in Figure 11, wherein 15 represents the circular blank and 24 indicates the die of the coining press. This die will be recessed substantially as shown at its central portion in order that the thickness of the corresponding portion of the blank 15 will not be disturbed, and it will be understood that the application of proper pressure by the die 24 will expand the plate 15 and reduce the thickness of the outer portions thereof as shown generally in Figure 12 of the drawings.

From the foregoing it is apparent that the objections referred to in connection with known processes of producing nose pieces are generally overcome. The combined thinning and extruding operations upon the side walls of the nose piece, without appreciably disturbing the thickness or fabric of the operative end of the nose piece,

creates in the side walls such strength as will reduce to a minimum the possibility of failure or collapsing of such walls upon the bomb striking its target.

Having thus described my invention, what I claim as new and useful is:

1. The method of shaping steel bodies from a circular plate, consisting first of forcing the plate through successive dies each smaller than the preceding die with a die nose whose diameter is less than that of the smallest of said dies, and then expanding the edges of the body thus formed by application of pressure by a plug larger than the diameter of the body in a direction opposite to that of the forcing operations.

2. The method of shaping a steel body from a steel plate, consisting of forming the body into cup-shape, forcing said cup through a ring die by an axially moving nose die whose clearance from the ring die is less than the thickness of said plate whereby the side walls are thinned and elongated, forcing said cup through additional ring dies of successively reduced diameters by the same nose die to further thin and elongate said side walls, and flaring the side walls of the resultant body and simultaneously returning a part of the metal to said side walls.

3. The method of shaping a nose piece from a circular flat plate of substantially uniform thickness, which consists of bowling the plate to sub-

stantially cup-shape, forcing the bowled plate through a ring die of less diameter than the cup with a nose plug of predetermined diameter, further forcing the cup with the same nose plug through a ring die of smaller diameter than the first, flaring the side walls of the cup to the desired finished diameter, and machining excess metal from the exterior of the nose piece thus formed.

4. The method of shaping a body from a steel plate of substantially uniform thickness, consisting first in bending the plate into substantially cup-shape and at the same time thinning and drawing the metal of the side walls of the cup in one direction without appreciably disturbing the thickness of the bottom, and then expanding the open end of the cup and simultaneously forcing some of the metal of the side walls toward the closed end of the cup.

5. The method of shaping a body from a steel plate of substantially uniform thickness, consisting first in bending the plate into substantially cup-shape and at the same time thinning the side walls by drawing the metal thereof in one direction and without appreciably disturbing the thickness of the bottom of the cup, and then forcing some of the metal of the side walls toward the closed end of the cup.

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