C. E. SANDERS.

PROCESS OF FORMING SHAPED ARTICLES.

APPLICATION FILED FEB. 14, 1917.

1,269,220.

Patented June 11, 1918.

3 SHEETS—SHEET 1.

Fig. 1.

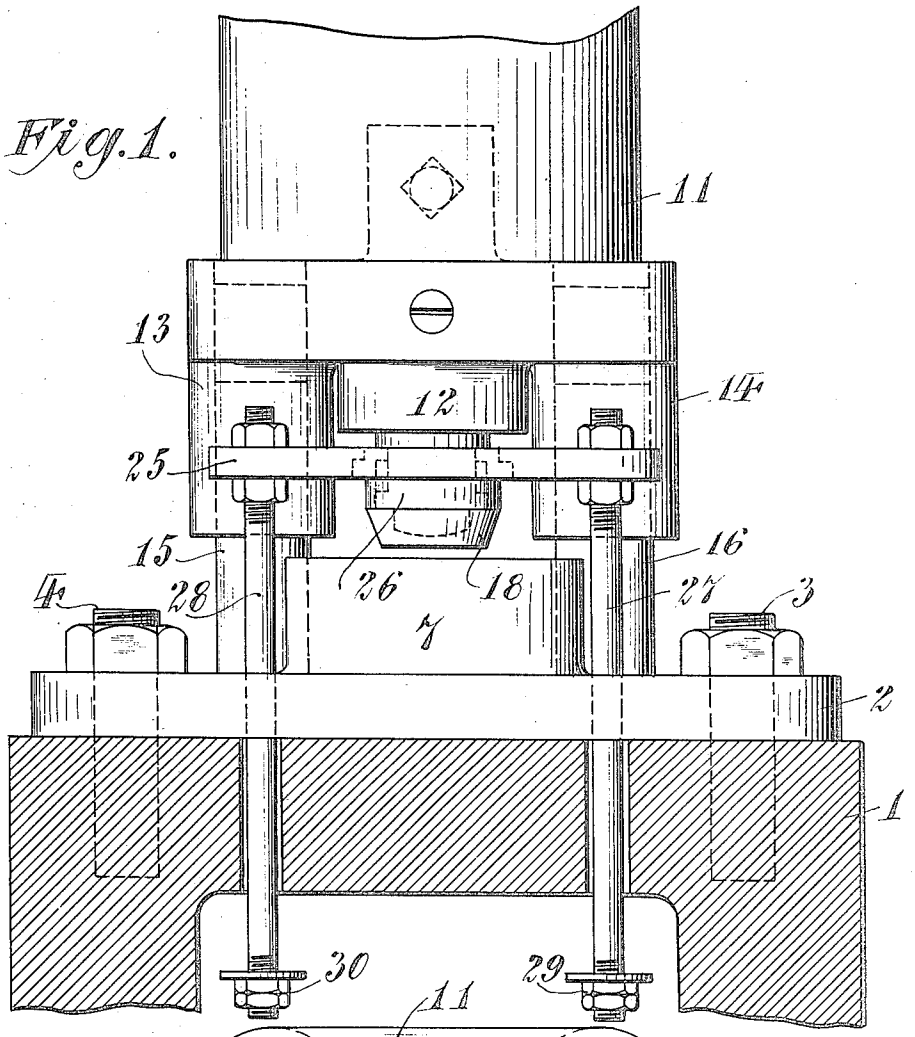
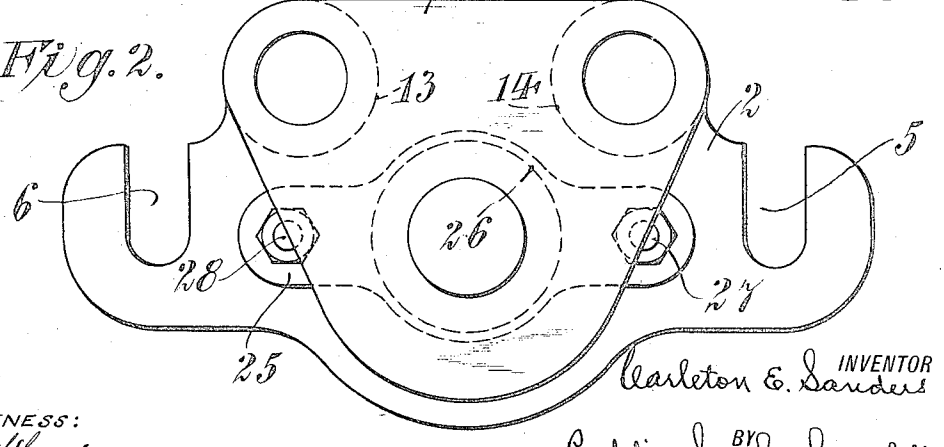


Fig. 2.



WITNESS:
Geo. Smarz.

Charleton E. Sanders INVENTOR

BY Redding, Greeley & Goodell
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3 SHEETS—SHEET 2.

Fig. 3.

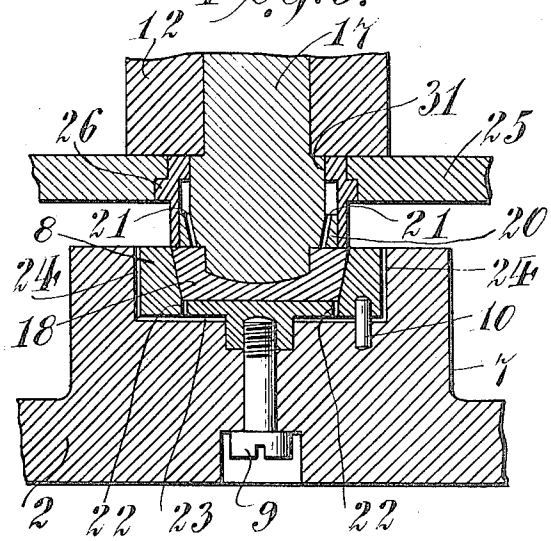


Fig. 4.

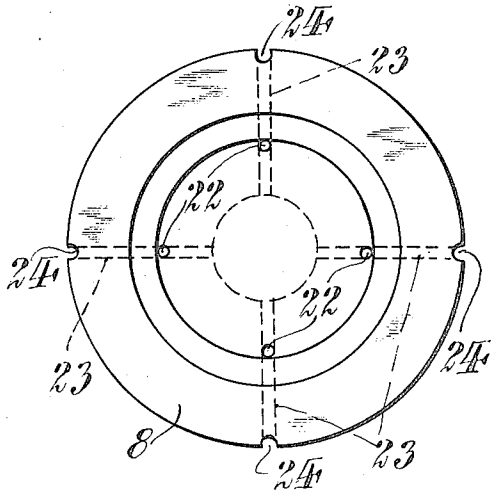


Fig. 5.

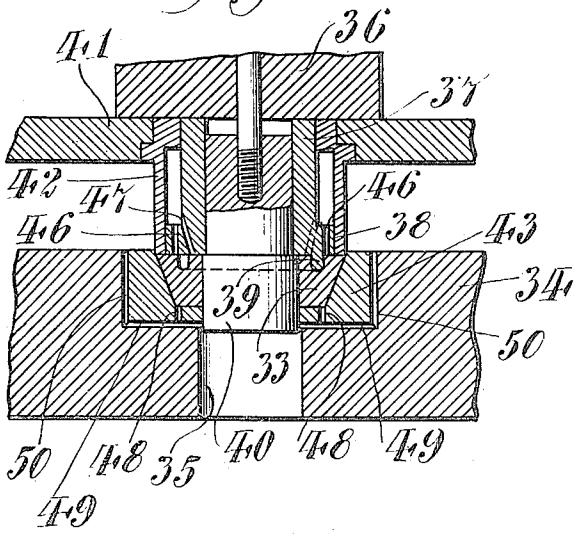
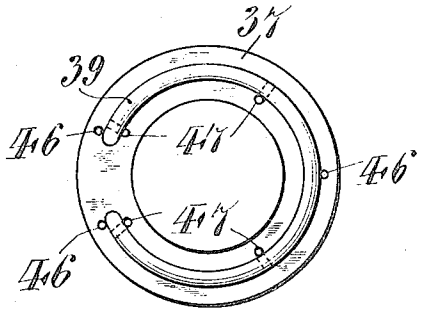


Fig. 6.



Witness:

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3 SHEETS—SHEET 3.

Fig. 7.

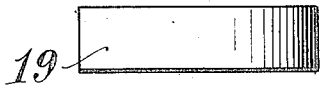


Fig. 9.

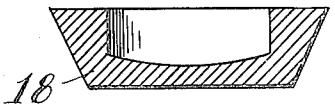


Fig. 8.

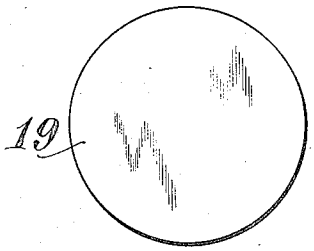


Fig. 10.

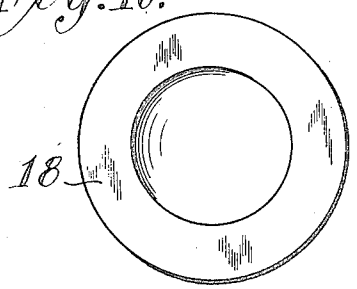


Fig. 11.

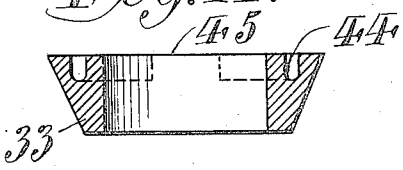


Fig. 12.

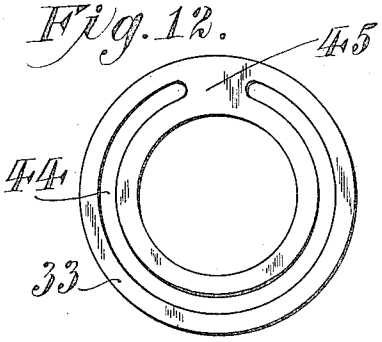


Fig. 13.

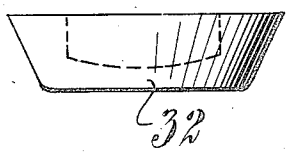


Fig. 14.

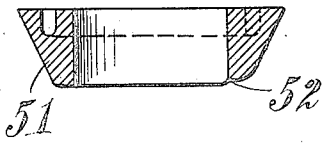
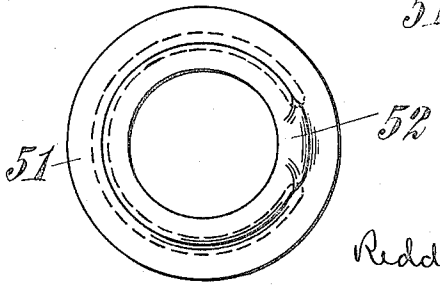


Fig. 15.



WITNESS:
Geo. H. Mays.

Carleton E. Sanders INVENTOR
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UNITED STATES PATENT OFFICE.

CARLETON E. SANDERS, OF PASSAIC, NEW JERSEY.

PROCESS OF FORMING SHAPED ARTICLES.

1,269,220. Specification of Letters Patent. Patented June 11, 1918.

Application filed February 14, 1917. Serial No. 148,647.

To all whom it may concern:

Be it known that I, CARLETON E. SANDERS, a citizen of the United States, and residing at Passaic, county of Passaic, and State of New Jersey, have invented a certain new and Improved Process of Forming Shaped Articles, of which the following is a specification, reference being had to the accompanying drawings, forming a part hereof.

This invention relates to a process for pressing material into shapes. It proposes to deal especially with metal having the requisite toughness and which may be softened and rendered plastic by heat, such for example as brass. Other materials, however, may be dealt with, such as clay or other plastic material.

The purpose of the invention is to attain a greater accuracy and uniformity in the contour of the shaped article than has heretofore been possible and to produce the same with facility and despatch and with resultant economy in material consumed and time saved.

A field in which the invention is of special utility at present is in the manufacture of the brass parts of time fuses for explosive shells. These parts require to be made with great accuracy and uniformity and with speed to insure economy. Prior to my invention these fuse parts have generally been made by means of cutting tools operating upon a suitable blank, in order to insure the required accuracy and uniformity in the product. Such method of manufacture, however, is expensive and entails a high percentage of waste material. If, by utilizing methods heretofore known, the attempt should be made to form these parts by pressing them out from brass blanks rendered plastic by heat and subjected to the action of dies, the parts thus formed would be lacking in that sharpness and accuracy of contour that is required to make reliable and accurate the timing of the fuse when in use. The corners and edges of the parts would be rounding, instead of sharp and well defined, and the plane surfaces would not be true or uniform. It would be necessary, therefore, to use an excess of metal in pressing the parts to shape and then subject these shaped parts to a machining process, requiring great care and precision to cut away the excess metal and properly true and finish the parts.

According to the present invention the metal, after having been sufficiently heated, is pressed with reliable uniformity by the dies into the desired shape with all the sharpness and accuracy of contour required in the finished article, and subsequent machining to produce such sharpness and accuracy is thus obviated. In thus forming the parts, moreover, the metal operated upon corresponds exactly in amount, or substantially so, to that in the shaped parts, so that there is no excess of metal used and none be cut away or otherwise lost. The economy effected in material and labor is therefore obvious.

I have discovered that when plastic material, such as brass softened by heat, is pressed into shape by means of dies, a small quantity of air is trapped between the material and the die and forms a cushion between the material and the walls of the die which prevents the material from accurately conforming to the shape defined by the die. In most instances rounding instead of sharp corners are thus produced in the pressed article. In other cases the trapped air seems to gather in a pocket and produce a corresponding depression in the surface of the pressed material. I therefore arrange to remove the air from between the die and the material under pressure and am thus able to produce by pressing a product which is free from the defects noted and does not require the initial employment of an excess of metal nor any machining to make it true and sharp in contour.

In the accompanying drawings forming part of this specification and in which like reference numerals designate corresponding parts, I have illustrated an apparatus for carrying out my new process.

Figure 1 is a side elevation partly in section of the head of a press for carrying out the invention.

Fig. 2 is a plan view thereof.

Fig. 3 is an enlarged sectional elevation showing the upper and lower dies and their associated parts in working relation in pressing a ring into its initial shape.

Fig. 4 is a plan view of the lower or bed die shown in Fig. 3.

Fig. 5 is a view similar to Fig. 3 but showing dies of a different form and which bring the ring into its final shape.

Fig. 6 is a plan view of the working face of the upper or plunger die shown in Fig. 5.

Figs. 7 and 8 are, respectively, a side elevation and plan view of a metal blank upon which the dies shown in Fig. 3 operate.

Figs. 9 and 10 are, respectively, a sectional elevation and plan view of the pressed ring after the same has been shaped by the dies shown in Figs. 3 and 4.

Figs. 11 and 12 are, respectively, a sectional elevation and plan view of the finished ring after the same has been pressed into shape by the dies shown in Figs. 5 and 6.

Figs 13, 14 and 15 are, respectively, a side elevation, a sectional elevation and a bottom plan view of a ring as the same would be made by means of dies from which the trapped air has not been removed.

Referring now more particularly to the structure as shown in the drawings, 1 is the bed of the head of the press to which is securely fastened the bed plate 2 by means of bolts 3 and 4 which pass through bolts 5 and 6 in the bed plate 2. Integral with the bed plate 2 is a nest or pedestal 7 provided with a recess for the lower die 8. As shown in Fig. 3, the die 8 is firmly secured to the bed plate by means of a screw 9 which passes through the bottom of the bed plate and into a central boss formed on the bottom of the die 8. The die 8 is circular in outline and the pin 10 entering into the recess in the bottom of the die and a corresponding recess in the bed plate 2 serves to hold the die from rotating on its axis when the screw 9 is screwed into the die.

The plunger head 11 is provided on its lower surface with a boss or nest 12 for the upper or plunger die. The plunger head 11 is moved to and fro by any suitable mechanism and is accurately guided in such movement by means of sleeves 13 and 14 formed thereon and which closely surround and work upon the columns 15 and 16 projecting upward from the bed plate 2. Securely fastened in the boss 12 is a plunger die 17 of such shape as is suitable to form, in conjunction with the bed die 8, the ring 18 shown in Figs. 9 and 10 from the plane cylindrical blank 19 shown in Figs. 7 and 8. The plunger die 17 which is cylindrical in shape is provided near its lower end with a flange or circular shoulder 20 whose lower surface provides part of the working face of the die. This shoulder 20 is pierced by a plurality of slender openings 21 forming vents for the outlet of air between the working face of the shoulder 20 and the material under compression in the dies. The lower die 8 is similarly provided with air vents. As shown in Fig. 4, there are four slender openings 22 leading through the bottom of the die 8 and communicating with four radial recesses 23 in the bottom of the die which terminate in vertical recesses 24 formed in the edge of the die whereby any air that may be trapped between the material under compression and the walls of the die may escape outward therefrom.

The upper or reciprocating die, as shown in Fig. 3, is provided with a stripper consisting of a stripper plate 25 to which is rigidly fixed the stripper ring 26. The stripper ring closely surrounds the shoulder 20 of the die 17 and its outer face lies flush with the outer face of the shoulder 20, when the material is under pressure, so that the two together form the working face which compresses the upper surface of the blank which is being shaped in the die. Secured to the stripper plate 25 are two rods 27 and 28 which pass through openings in the bed 1 and are provided with nuts 29 and 30 on their ends. The stripper ring 26 is loose on the die although it closely surrounds the same and is provided with a shoulder 31 which overlaps the shoulder 20 of the die. This arrangement permits the stripper to have a limited movement relative to the die. After the blank has been pressed to form the ring 18, as shown in Fig. 3, the reciprocating die retreats from the lower die, and carries with it the formed ring which adheres to the die. It also carries with it the stripper because of the engagement of the stripper ring by the formed ring. The three elements retreat together until the nuts 29 and 30 on the rods 27 and 28 come in contact with the lower surface of the bed 1 when the stripper is arrested from further movement. The plunger head 11 and die 17, however, continue to retreat for a short distance. This is provided for by the space between the shoulder 31 of the stripper ring and the shoulder 20 of the die. Inasmuch as the stripper ring is in contact with the upper surface of the formed ring, the latter is therefore stripped from the die 17 and may be quickly removed from the press.

Fig. 1 shows the parts in their relative position just after the plunger head 11 has begun its upward movement, the ring 18 still adhering to the die.

The ring 18, as thus shaped, is not in the final form desired although it is provided with a conical exterior surface, flat upper and lower surfaces and a central recess, as shown. Its surfaces are true and even and its corners sharp and well defined, as indicated in Figs. 9 and 10. This accuracy of the product is due to the presence of the air vents which permit air to escape between the die and the blank. If such air vents or other means for the escape of air were not employed, the ring would more nearly correspond to the ring 32 shown in Fig. 13, whose edges and corners are rounding instead of being sharp and well defined.

In order to bring the ring 18 into the final form desired so as to produce the ring 33 shown in Figs. 11 and 12, the ring 18 is again heated, if required, and it is inserted in another press wherein the dies have the arrangement shown in Figs. 5 and 6. In this second press the bed 34 has a central

opening 35. 36 is the reciprocating head of the press to which is securely fastened the die 37. This die is in the form of a ring and is provided with an outer shoulder 38 at its lower end and a lip 39 projecting outward from said shoulder. Closely fitting within the opening of the die and secured to the head 36 is a plunger 40 which projects below the working face of the die, as shown. 41 is the stripper plate and 42 the stripper ring. 43 is the lower die carried by the bed plate 34. It has a conical inner wall corresponding to the conical outer wall of the plate 18 and has a central opening just large enough to receive through it the plunger 40. This plunger acts to punch out the depressed center of the ring 18. The lip 39 acts to form a circular channel 44 in the upper surface of the plate of the form shown in Fig. 12 wherein the ends of the channel are separated from each other by a narrow plane portion 45 of the upper surface of the ring. The upper die is provided with slender openings to provide air vents. Some of these openings 46 extend through the shoulder 38 on the outer side of the lip 39. Others of such openings 47 extend from the inner side of the lip 39 through the die above the shoulder 38. The lower die is also provided with slender openings 48, 49 and 50 to provide air vents of the same general form as those shown in Fig. 4.

The dies and stripper shown in Figs. 5 and 6 work in substantially the same way as has been described with reference to Figs. 3 and 4 and need not be repeated.

The ring 33, as finished by the pressing operation of the dies, has its edges sharp and well defined and its surfaces true and even and no machining to produce sharp edges and true surfaces is required. This is due to the fact that the dies are provided with air vents which prevent the accumulation of air between the ring and the walls of the dies. If it were not for such air vents, the ring would more nearly correspond to the ring 51 shown in Figs. 14 and 15, wherein the upper and lower edges of the ring are rounding and a depression 52 is shown in the lower surface of the ring immediately beneath the portion 45. This depression or flaw is believed to be due to the accumulation of air in the form of a pocket which has prevented the metal from being forced evenly against the surface of the lower die.

In forming the ring 18, the blank 19 from which it is formed contains substantially the same amount of metal as the finished ring 18. It is not necessary, as has heretofore been the practice, to start with a blank containing an excess of metal and then after the ring has come from the press with edges and surfaces untrue to machine it to the required exactness of form. The presence of the air vents makes it unnecessary to use an excess of metal in the initial blank and unnecessary to resort to a subsequent machining operation.

In pressing plastic material into shaped articles by means of dies, as heretofore practised, the operation begins upon a quantity of material in excess of that desired in the shaped article. As the dies approach each other part of this excess material is squeezed out or expelled by the dies through the space between the dies. This overflow of material is known as "flash" and its egress from the dies is provided for by arranging the dies so that they never completely close. When they have reached the limit of their approach to each other there is always left a space between them for this necessary overflow of material. In accordance with the present invention the dies completely close on each other and there is no overflow of material from between them. And all the material used is formed into the shaped article. Such closed dies, so far as I am aware, have never heretofore been used in the practical art of forming shaped articles by pressing.

It will, of course, be understood that the means for venting the air between the dies and the material being operated upon may be variously formed or provided. It will also be understood that various changes in the steps of the process may be made without departing from the scope of the invention.

What I claim is:

1. The process of forming shaped articles from metal blanks which consists in taking a blank containing substantially the same amount of metal as that contained in the article to be formed, pressing the blank while hot into the desired shape in a closed die and permitting the escape of air from the die during the operation while preventing the escape of any of the metal at those points where air would be entrapped between the metal and the die.

2. The process of forming shaped articles from plastic material which consists in pressing the material into the desired shape in a closed die and permitting the escape of air from between the material and the die while preventing the escape of any of the material at those points where air would be entrapped between the metal and the die.

This specification signed this 1st day of February, A. D., 1917.

CARLETON E. SANDERS.