July 10, 1962 C. SCHONDELMAIER 3,042,993

APPARATUS FOR COLD MOLDING METAL PRODUCTS

Filed March 7, 1956 3 Sheets-Sheet 1

Fig. 1

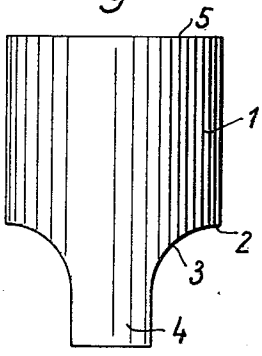


Fig. 2

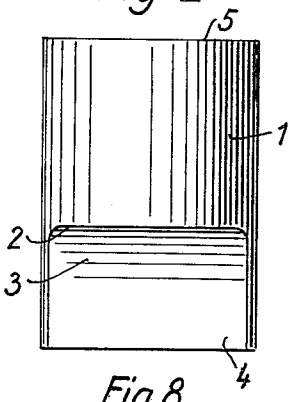


Fig. 3

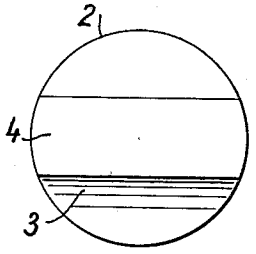


Fig. 4

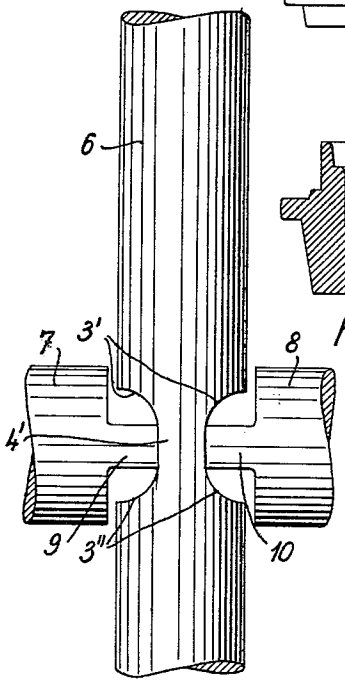


Fig. 8

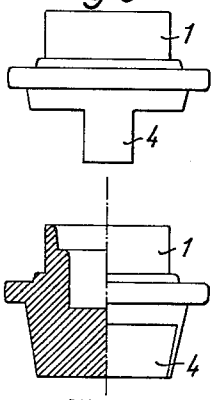
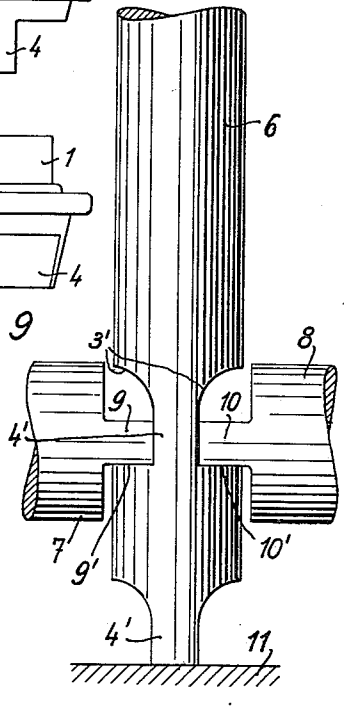


Fig. 9

Fig. 5



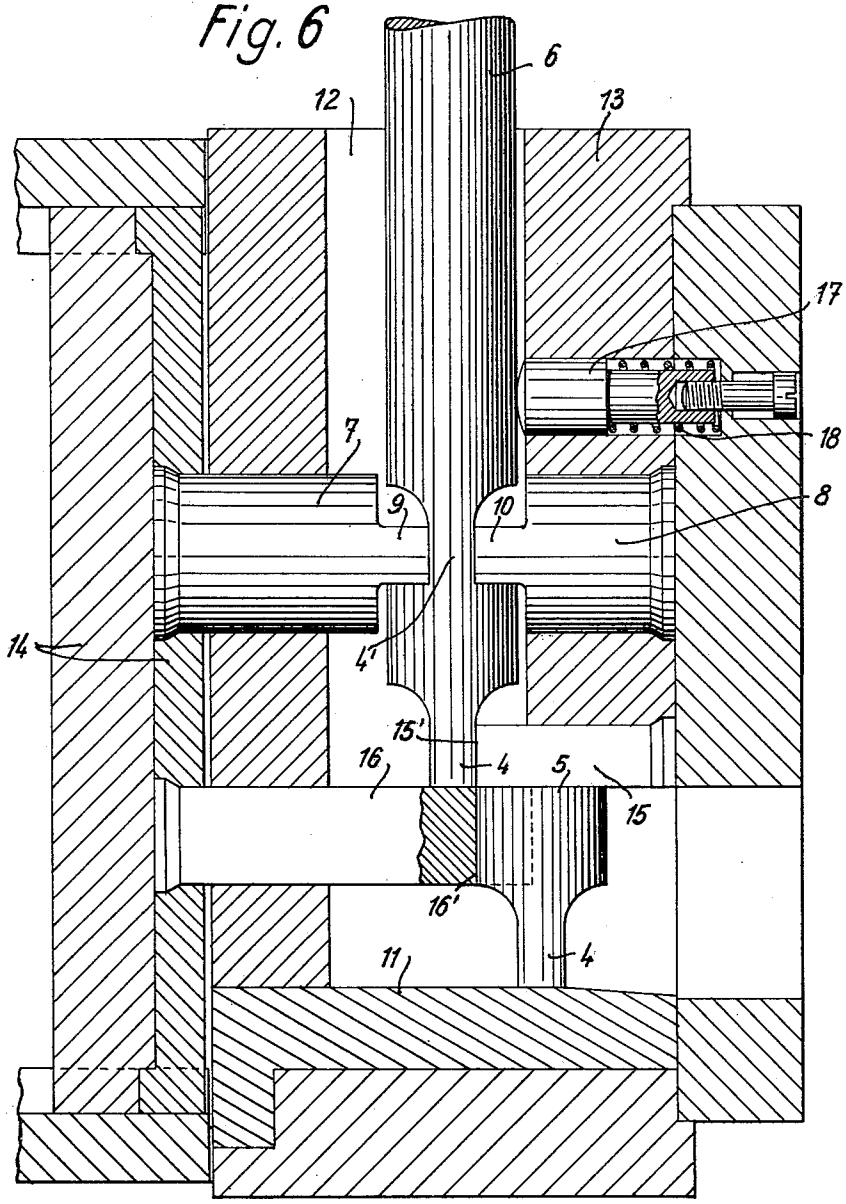
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July 10, 1962 C. SCHONDELMAIER 3,042,993

APPARATUS FOR COLD MOLDING METAL PRODUCTS

Filed March 7, 1956 3 Sheets-Sheet 2

Fig. 6



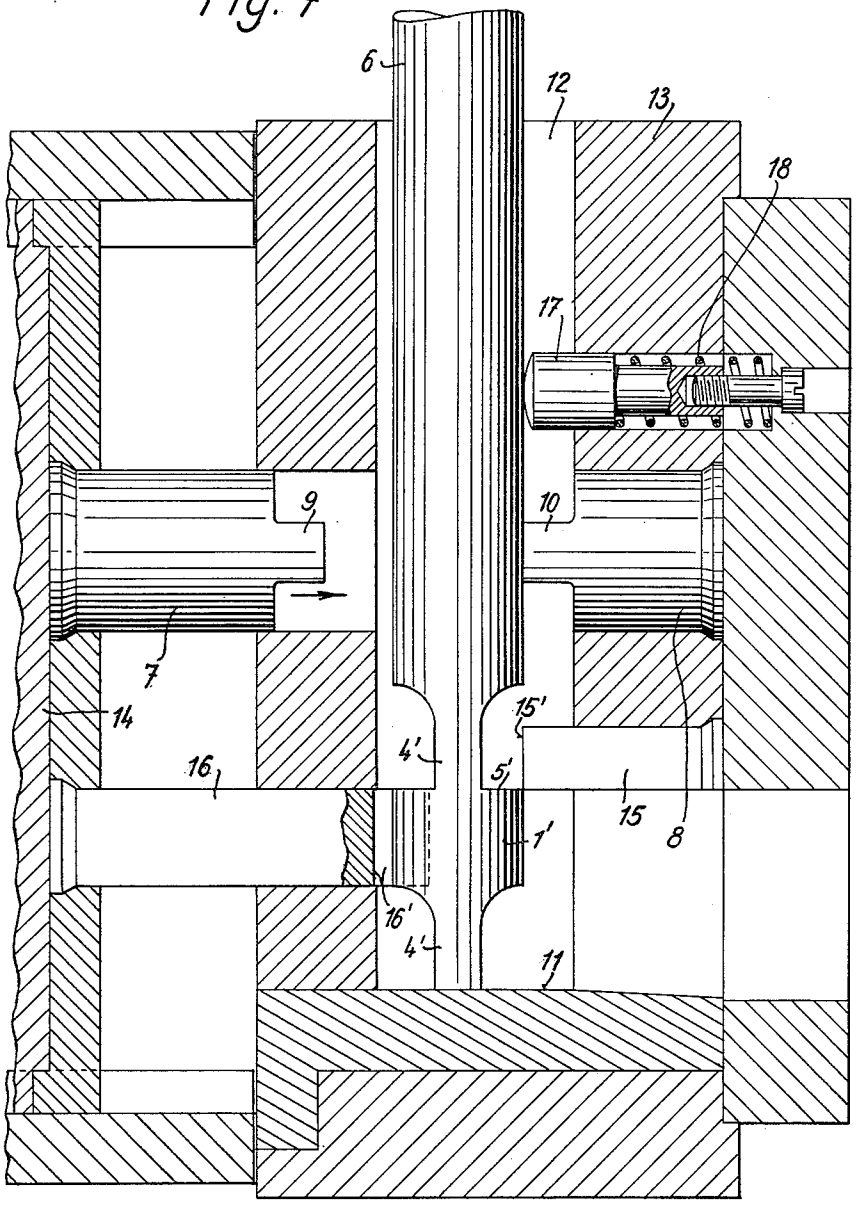
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APPARATUS FOR COLD MOLDING METAL PRODUCTS

Filed March 7, 1956 3 Sheets-Sheet 3

Fig. 7



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APPARATUS FOR COLD MOLDING METAL PRODUCTS

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3 Claims. (Cl. 29—34)

The present invention relates to a means for producing finished or semi-finished metal products from solid rods without resorting to any machining or cutting operations.

It is an object of the present invention to provide an apparatus for cold-pressing or cold-molding a solid rod into metal products, each of which comprises a solid shaft portion of a cross-sectional shape similar to that of such rod and provided with at least one flattened projection thereon which extends diametrally to the cross-sectional surface of the rod and may, if desired, be made of various shapes. The manufacture of such products merely by cold-pressing and without resorting to any cutting operation has been virtually impossible prior to this invention.

Another object of the invention is to produce a flattened projection on a metal body of cylindrical or other shape by cold-pressing the same without the use of any mold.

A feature of the invention for attaining these objects consists in moving a pair of die stamps transverse to the longitudinal direction of the rod-shaped blank of which the product is to be formed, and from opposite sides toward such blank, and in thus exerting at the particular point of the blank where the flattened web or projection is to be formed a pressure of such force that the material of the blank will yield or "flow" in a particular direction.

The invention is based upon the surprising discovery that when such transverse pressure is thus exterted from both sides upon a rod-shaped blank, the material of the blank will not yield in a lateral direction so that the flattened portion will then have a diameter greater than that of the original blank, but that it will rather stretch in a longitudinal direction, that is, transverse to the movement of the dies, even without the use of any mold or the like to retain those sides of the blank which are not engaged by the dies.

It is another object of the invention to provide an apparatus in which the blank to be cold-pressed into the desired product as described will be secured so as to be able to yield or stretch in only one longitudinal direction. This has the advantage that the blank while being cold-pressed from both sides will closely abut against that side of the dies which faces in the direction in which the blank is prevented from stretching, and that level surfaces will thus be formed on such side which extend perpendicular ot the flattened projection and have sharply angular outer and inner edges. Such level surfaces and sharp edges, in turn, have the advantage that the completed product may thereafter be sheared off at the end of the projection so that in a continuous operation, both the latter projection, as well as the end surface of the adjacent product will be flat.

The present invention admits a wide selection of dies for producing reduced projections of various shapes. It also permits the individual products to be cut off the main blank one after the other in another step of the same continuous operation, for example, at the point of their smallest cross section. Even rods of structural or profile iron or other hard metals of a relatively large cross-sectional area may thus be severed one piece at a time by cold-pressing it transversally without danger that the shape of the individual pieces will be deformed at the point of separation.

The products obtained according to the invention may either be used directly or be further worked on to attain their final desired shape. Thus, for example, it is very easily possible to produce inexpensive cylindrical or even cup-shaped elements, the closed end of which has a diametrally extending projection which may also be of conical or rounded shape particularly at its point of connection with the cylindrical portion. Such cup-shaped elements which may, for example, be used for primers or percussion fuses for projectiles, may thus be very quickly produced without the machining operations as were usually necessary prior to this invention.

Further objects, features, and advantages of the present invention will be apparent from the following detailed description thereof, particularly when read with reference to the accompanying drawings, in which—

FIGS. 1, 2, and 3 show front, side, and bottom views, respectively, of a product obtained with the method and apparatus according to the invention;

FIG. 4 shows a diagrammatic front view of an apparatus according to the invention wherein the rod-shaped blank of which the desired product is formed may yield in both longitudinal directions during the cold-molding operation;

FIG. 5 shows a view similar to FIG. 4, in which the rod-shaped blank may, however, yield in only one longitudinal direction;

FIG. 6 shows diagrammatically a vertical section through an apparatus according to the invention in its position after completing one complete operation;

FIG. 7 shows a view similar to FIG. 6 with the apparatus in its position at the beginning of the operation;

FIG. 8 shows a front view of a final product which may be obtained from the intermediate product as shown in FIGS. 1 to 3; while

FIG. 9 shows a side view, partly in section, of the product shown in FIG. 8.

Referring to the drawings, FIGS. 1 and 3 illustrate the product which is to be manufactured according to the invention without any machining operations involving the removal of material by cutting a solid blank to attain the desired shape. This product which is shown substantially in full size may consist, for example, of a solid cylindrical shaft portion 1 of a diameter which may even be slightly larger than the length thereof. This shaft portion 1, one end surface 5 of which is substantially flat, continues at the other end 2 into a flat projection or web 4 which extends diametrally to portion 1 and is connected therewith by rounded connecting portions 3. According to the invention, this product may be shaped by a single cold-pressing operation from a solid rod-shaped blank of the same diameter as the shaft portion 1, whereupon it may be severed from such blank in a second operation within the same apparatus while the shaping operation of another product is being carried out simultaneously.

FIGS. 4 and 5 illustrate diagrammatically the method of shaping a projection or web of the type as shown in FIGS. 1 to 3. For this purpose, a rod-shaped blank 6 will be compressed in a direction perpendicular to its longitudinal axis between a pair of die stamps 7 and 8 of equal size and each having a similar working end 9 and 10 of rectangular shape. As previously stated, it has surprisingly been found that such transverse compression of rod 6 from both sides thereof and in a cold state will produce practically no increase of the original diametrical size of the rod, but that the material will yield under such pressure uniformly and in both longitudinal directions only. Thus, a weblike portion 4' of reduced cross section will automatically be formed which merges into the original outer diameter of rod 6 by equally rounded portions 3' and 3".

If the apparatus according to the invention is modified

so as to allow rod 6 to yield under the transverse pressure of die stamps 7 and 8 in only one longitudinal direction, and preferably in the upward direction, for example, by resting its lower end upon a solid base 11, the product will then attain a shape as illustrated in FIG. 5 which, when severed from the remainder of blank 6, will form a final product as shown in FIGS. 1 to 3. The lower surfaces 9' and 10' of the die stamps 9 and 10 thus produce perfectly level end surfaces with sharply rectangular outer and inner edges, while the web 4' merges at its other end into the outer diameter of rod 6 by evenly curved portions 3'. This is due to the fact that rod 6 while being transversally compressed can only expand or yield in the upward direction.

Thus, in order to obtain the finished product as shown in FIGS. 1 to 3, it will then only be necessary to sever the workpiece as shaped according to FIG. 5 at the precise level of surfaces 9' and 10'. For this purpose, the invention provides an apparatus, the principle of operation of which is illustrated in FIGS. 6 and 7. This apparatus comprises a vertical channel 12 into which the rod-shaped blank 6 is inserted from above so as to rest upon a base 11. The opposite side walls of channel 12 serve as supporting elements for the die stamps 7 and 8. One of these dies 8 is rigidly mounted in wall 13 so that only its working end 10 projects therefrom. The rear end of the other die 7 is rigidly secured within a plate 14 which is reciprocated by the plunger of a strong power press (not shown). During its forward movement, the rectangular working end 9 of die 7 then forces rod 6 under great pressure centrally against the working end 10 of die 8 so as to form the web 4' on rod 6. Since the latter rests solidly on base 11, the material of rod 6 can yield or expand only in the upward direction, so that the blank will attain a shape as shown in FIGS. 6 and 7.

Since a new element 1' is to be produced at each forward movement of die 7, 9 in a continuous operation of the power press, the element 1' formed in the preceding movement and resting upon base 11 must be sheared off accurately along its upper surface 5'. For this purpose, a stationary cutting die 15 is solidly mounted in side wall 13 of the apparatus and at the required distance below the molding die 8, 10. The forward end 15' of die 15 projects from the surface of side wall 13 a distance which is identical with the projecting length of the working end 10 of die 8. Thus, when during the molding of the next element 4' rod 6 is fully compressed into die 8, 10 by die 7, 9, the end surface 15' of stop member 15 abuts solidly against web 4', while its sharply rectangular lower edge engages with the inner edge of the surface 5'. Plate 14 in which molding die 7 is mounted also has firmly secured therein a cutting die 16 of a height and at a level corresponding with the cylindrical shaft portion 1' of the lowest molded blank which rests on base 11. The forward end 16' of die 16 is concave in accordance with the radius of the blank and projects beyond the front end of molding die 7, 9 so that during the forward movement of plate 14, the end 16' of die 16 partly encompasses the blank and, in cooperation with stop member 15, shears off the finished blank, as shown in FIG. 6, while at the same time die 7, 9 in cooperation with the stationary die 8, 10 carries out another web-molding operation. The complete, evenly cut product may then either drop out toward the right of the apparatus of its own accord or be pushed out by web 4 of the following blank when the dies 7 and 16 recede and rod 6 drops down in preparation for the next molding and shearing operation.

The apparatus according to the invention is preferably designed so as to permit rod 6 at the beginning of the shearing operation to slightly incline. This will also result in a slight inclination of the working surfaces of dies 9 and 10 at their first engagement with rod 6 which improves the initial molding action. Immediately thereafter, however, the upper surface 5' of the lowest blank engages with the lower surface of the stationary cutting die 15, so that such blank is guided thereby in a straight direction and web 4' is cut off at a line exactly level with surface 5'.

After one molding and shearing operation has been completed and die plate 14, together with dies 7 and 16, recede toward the left, it will also be necessary to return rod 6 to its original position. For this purpose, a plunger 17 is mounted within the right side wall 13 of the apparatus and exerts under the action of a spring 18 a pressure upon rod 6 so as to move the latter toward the left to the position shown in FIG. 7. During the molding and shearing operation, when rod 6 is forced toward the right, it will also force plunger 17 toward the right, as shown in FIG. 6, thereby tensioning spring 18 for the next return of rod 6 toward the left. Plunger 17 will thus also free rod 6 from the rectangular working end 10 of die 8 so that rod 6 can then drop down of its own accord until the end surface of web 4' rests upon base 11, as shown in FIG. 7, when dies 7 and 16 again move toward the right for the next molding and shearing operation.

In place of the rectangular shape of the molding ends 9 and 10 of dies 7 and 8, respectively, as shown in the drawings, these dies may also be given a different shape. Thus, for example, the ends 9 and 10 may have steps or recesses therein or be curved. Also, the cross-sectional shape of the blank material does not have to be round, but may be of any other shape, for example, polygonal.

The finished blanks as shown in FIGS. 1 to 3 may either form final products or intermediate products which, however, are so well premolded as to permit them to be finished in a single additional operation. One type of product which may thus be made and which may be used, for example, as primers or percussion fuses for projectiles, is shown in FIGS. 8 and 9.

Although my invention has been illustrated and described with reference to the preferred embodiments thereof, I wish to have it understood that it is in no way limited to the details of such embodiments, but is capable of numerous modifications within the scope of the appended claims.

Having thus fully disclosed my invention, what I claim is:

1. An apparatus for cold-molding metal products comprising a body having a substantially vertical channel therein, and a base at the lower end of said channel, said channel being open at its upper end for inserting a solid rod-shaped blank therein so as to rest with its lower end on said base, said channel being so shaped that transverse expansion of a blank therein is unrestricted in all directions, a pair of molding dies disposed at substantially the same level transversally of said channel, one of said dies being stationary and extending into said channel, the second die being adapted to move into and out of said channel and transversally thereto, said channel having an inner width sufficient to accommodate said stationary die, means for reciprocating said second die relative to said stationary die for compressing said blank equally from opposite sides between said dies and within said channel so as to stretch said blank in a longitudinal upward direction only, and for simultaneously flattening said blank to form a diametrally extending web-shaped portion, whereby increasing the original diameter of said blank at said portion is not substantially increased in a transverse direction normal to the direction in which said dies compress said blank, the opposite lower edges and surfaces of said dies at the end of the compression stroke then engaging said blank and forming flat surfaces thereon, while the web extends between said dies and beyond the upper edges thereof and then merges into the uncompressed body portion of said blank, and means disposed between the level of said molding dies and said base for shearing the blank portion, which has been molded by said dies during the preceding compression stroke, off the remainder of said blank simultaneously with the next-fol-

lowing compression stroke of said second molding die.

2. An apparatus, for cold-molding metal products comprising a body having a substantially vertical channel therein, and a base at the lower end of said channel, said channel being open at its upper end for inserting a solid rod-shaped blank therein so as to rest with its lower end on said base, said channel being so shaped that transverse expansion of a blank therein is unrestricted in all directions, a pair of molding dies disposed at substantially the same level transversally of said channel, one of said dies being stationary and extending into said channel, the second die being adapted to move into and out of said channel and transversally thereto, said channel having an inner width sufficient to accommodate said stationary die, means for reciprocating said second die relative to said stationary die for compressing said blank equally from opposite sides between said dies and within said channel so as to stretch said blank in a longitudinal upward direction only, and for simultaneously to flattening said blank to form a diametrally extending web-shaped portion, whereby the original diameter of said blank at said portion is not substantially increased in a transverse direction normal to the direction in which said dies compress said blank, the opposite lower edges and surfaces of said dies at the end of the compression stroke then engaging said blank and forming flat surfaces thereon, while the web extends between said dies and beyond the upper edges thereof and then merges into the uncompressed body portion of said blank, a stationary cutting die extending

into said channel transversally thereto and below said stationary molding die, said stationary cutting and molding dies having substantially equal lengths within said channel, the lower edges of said stationary cutting and molding dies being spaced a distance corersponding to the length of the final product and a second cutting die below said second molding die and adapted to be moved transversally within said channel relative to said stationary cutting die and simultaneously with the movement of said second molding die for shearing the blank portion, which has been molded by said dies during the preceding compression stroke, off the remainder of said blank simultaneously with the next-following compression stroke of said second molding die.

3. An apparatus as defined in claim 2, further comprising resilient means within said channel for automatically pushing said blank off said stationary molding die and back to its original position after each molding and shearing operation and receding of said movable molding and cutting dies so as to permit said blank to drop of its own accord again upon said base ready for the next molding and shearing operation.

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