Sept. 15, 1959 F. W. BRAUN ET AL 2,903,721

APPARATUS HAVING SPRING URGED DIE FORGING MEMBERS FOR MAKING EXTRUDED HOLLOW ARTICLES OF EXTERNAL POLYGONAL FORM

Filed March 2, 1956 3 Sheets-Sheet 1

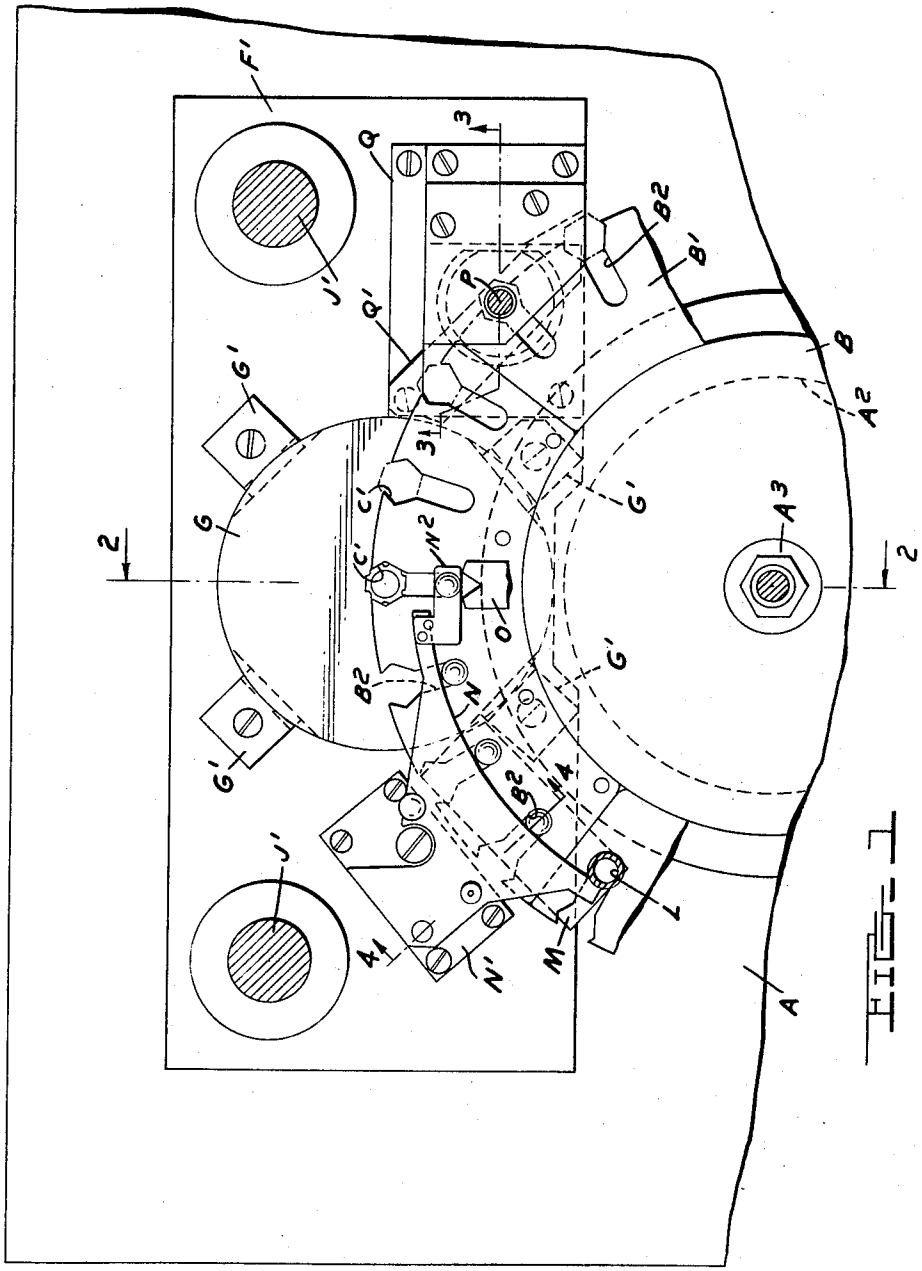

FIG. 1

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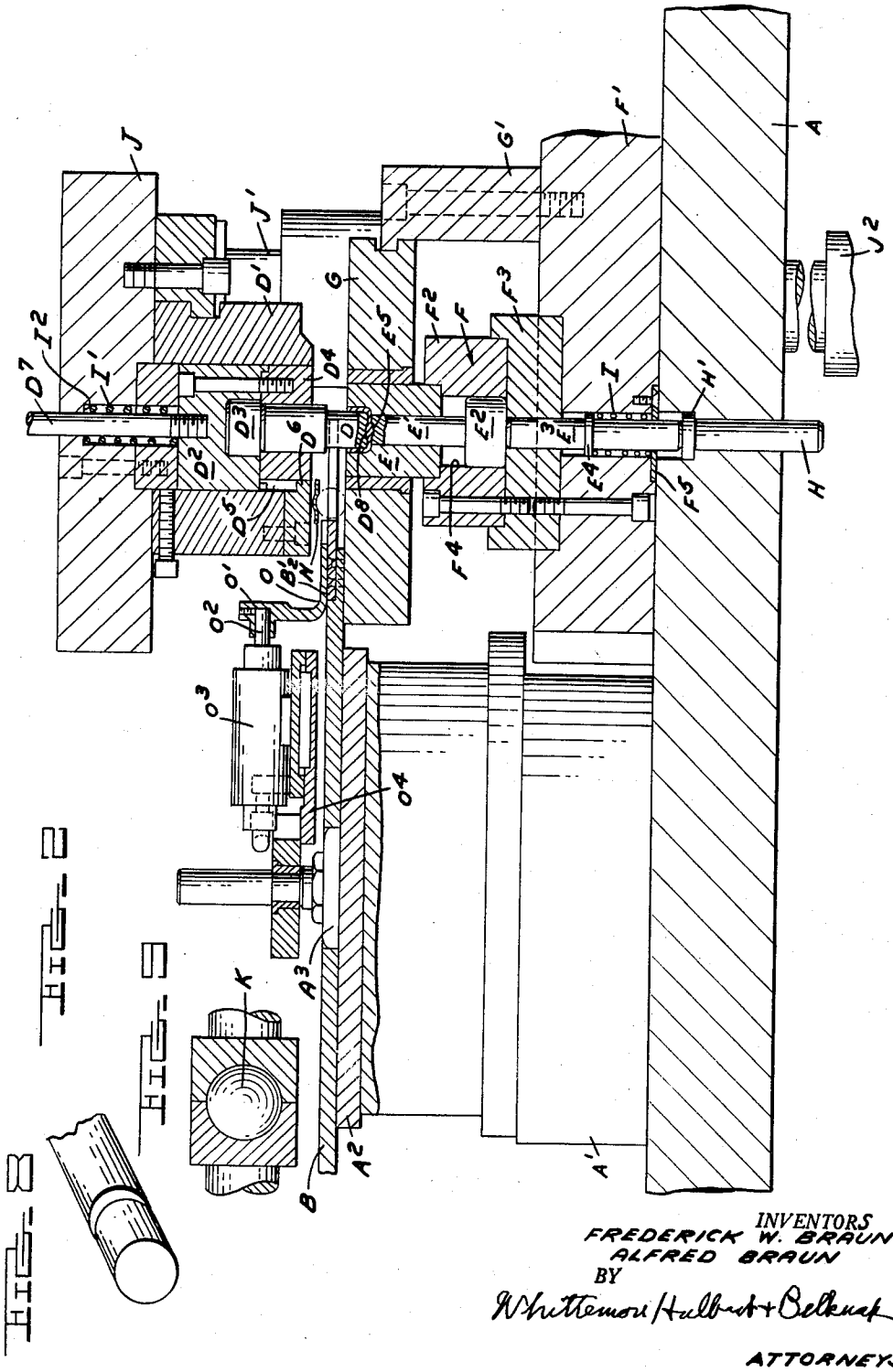

FIG. 2

FIG. 3

FIG. 4

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FIG. 6

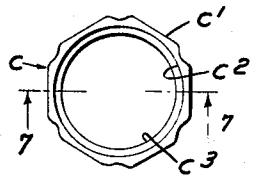


FIG. 7

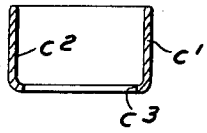


FIG. 3

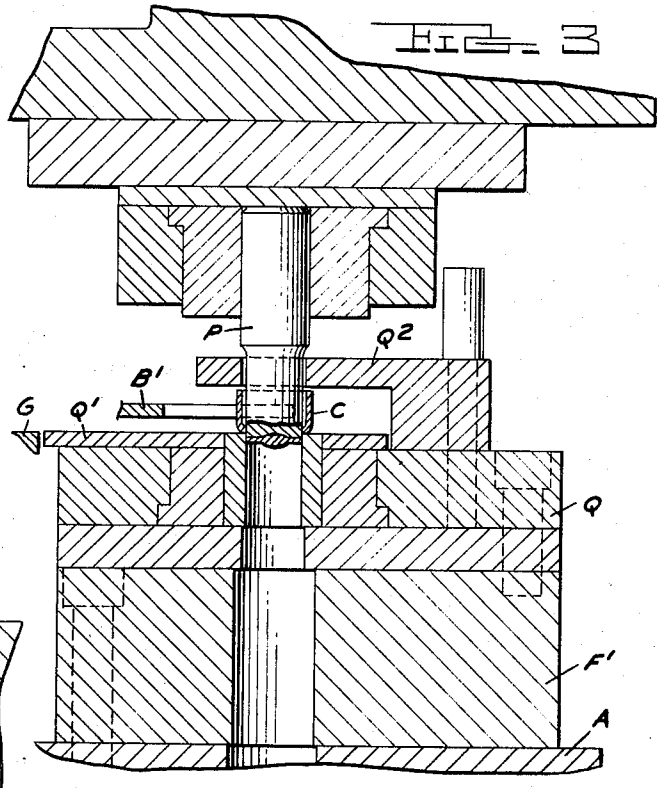


FIG. 5

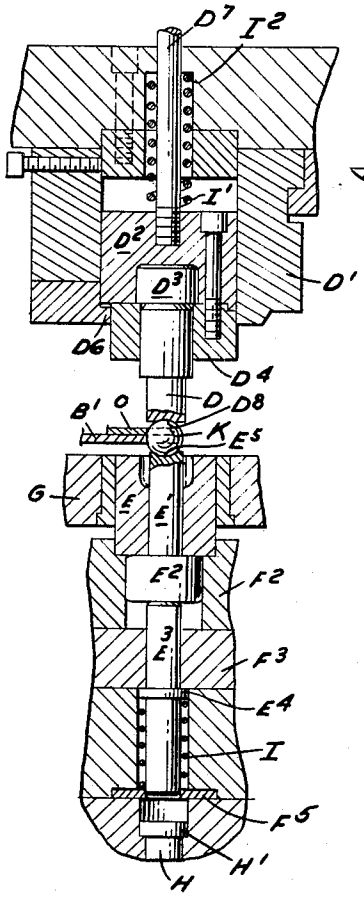
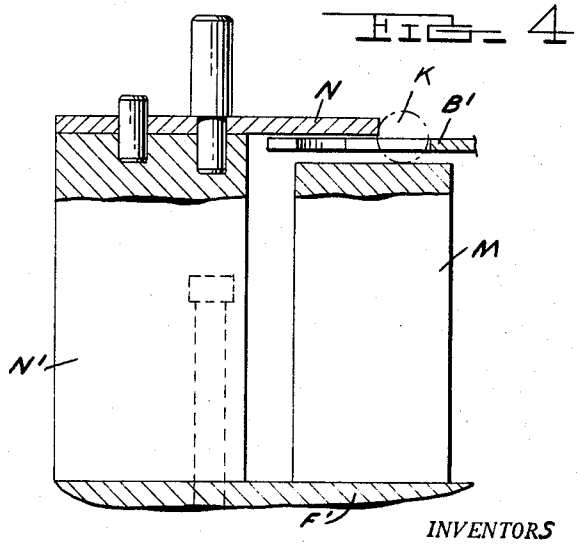


FIG. 4



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APPARATUS HAVING SPRING URGED DIE FORGING MEMBERS FOR MAKING EXTRUDED HOLLOW ARTICLES OF EXTERNAL POLYGONAL FORM

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Application March 2, 1956, Serial No. 569,127

5 Claims. (Cl. 10—76)

The invention relates to the manufacture of articles by die fashioning and more particularly where the metal of the blank is distributed to portions of the die cavity by extrusion.

It is the object of the invention to form said articles by an improved method through which the metal is uniformly distributed within the die cavity. It is a further object to obtain a method, the successive steps of which may be automatically carried out in an organized machine. With these objects in view the invention consists in the method and apparatus as hereinafter set forth.

In the accompanying drawings:

Fig. 1 is a plan view of a portion of the machine.

Fig. 2 is a vertical section on line 2—2, Fig. 1.

Fig. 3 is a vertical section on line 3—3, Fig. 1.

Fig. 4 is a vertical section on line 4—4, Fig. 1.

Fig. 5 is a view similar to a portion of Fig. 2 illustrating the insertion of the blank between resiliently pressed spaced die members.

Fig. 6 is a plan view of the finished product.

Fig. 7 is a cross section on line 7—7 therethrough.

Fig. 8 shows a severed length of stock of the required mass for forming a blank.

Fig. 9 illustrates the pressing of said severed length into spherical form.

Generally described our improved method comprises the die fashioning of articles from spherical blanks. These blanks may be formed by severing successive lengths of the required mass from stock such as rod or wire and in then pressing each into spherical form. Each blank is inserted between male and female die members in which it is held by resilient pressure centralized with the axis of the dies. The diameter of the sphere is less than the internal diameter of the female die so that when pressure is applied to force the dies into engagement with each other the metal of the blank will first flow radially outward uniformly in all directions and will then fill the remaining portions of the die cavity by extrusion. Various articles can be formed by this method but we have specifically illustrated the forming of cap nuts.

The machine in which this method is automatically carried out includes a bolster plate A which is part of a general frame not further shown. Rising from one portion of this plate is a pedestal A′ supporting a circular table A^2 with a central upwardly projecting pivot A^3. A rotary disk carrier B rests on this table and is journaled on the pivot A^3. The outer portion of this carrier is formed by an annular member B′ reduced in thickness and spaced from the table. This portion is formed with a series of radially extending spaced slots B^2 which are successively loaded with the spherical blanks to be conveyed thereby to the forming dies.

The specific article to be formed by the dies is as above stated a cap nut C which has a hexagonal exterior C′ and a cylindrical interior C^2 designed to be threaded, also an annular flange C^3 projecting inwardly at one end. The dies for forming this structure are positioned above the bolster centrally thereof and include the male die

member D, a female die member E, and the central ejector member E′ which forms a complementary portion of the female die during the fashioning operation. The female die is mounted on a pedestal F rising from the bolster and which positions the upper end of said die in the plane of the table A^2. As shown, the positioning means is a circular plate or table G centrally apertured to receive the die and peripherally supported by legs G′. The pedestal F, as specifically shown, is formed of a lower member F′ directly supported on the bolster, an upper member F^2 which is recessed to receive and directly support the die and an intermediate member F^3. The die E is centrally apertured to receive the ejector member E′ which extends downward therefrom. The member F^2 has a central aperture F^4 larger in diameter than the member E′ to receive a head E^2 on the latter. The head E^2 is less in vertical dimension than the aperture F^4 so as to permit the ejector E′ to rise with its upper end in the plane of the table A^2. Below the head E^2 the ejector has a portion E^3 of smaller diameter passing through a corresponding aperture in the member F^3 and through an aperture enlarged in diameter in the member F′. The bolster has an aligned aperture therein, the upper portion of which is of larger diameter than the lower portion. A rod H passes through the small diameter portion of this aperture to beneath the bolster and a head H′ on said rod is in the larger diameter portion. The construction of pedestal just described permits a movement of the member E′ from a position where it forms a bottom of the die cavity in the member E to the position where it is aligned with the table A^2. In its lower position the head E^2 rests upon the member F^3 while its upward movement is limited by the die E. Within the enlarged aperture in the member F′ there is placed a coil spring I which at its upper end bears against a collar E^4 on the portion E^3 and at its lower end bears against a plate F^5. The spring I is under compression so as to resiliently urge the members E′, E^2 and E^3 upward.

The male die member D is carried by a movable plate or head member J which is connected to vertically extending rods J′ passing through apertures in the bolster A and connected at their lower ends by a cross bar J^2. The mounting of said die D includes a member D′ secured to and depending from the plate J and centrally recessed to receive a slidable member D^2. This member D^2 is centrally recessed to receive an enlarged head portion D^3 of said die D which is secured therein by a cap portion D^4. The portion D^4 has a slot D^5 extending longitudinally at one side thereof and a finger D^6 on the member D′ projects into this slot and limits the outward sliding movement of the member D^2. A rod D^7 extending upward from the member D^2 passes through an aperture in the plate J. A portion of this aperture is enlarged in diameter to receive a spring I′ which bears at its upper end on a shoulder I^2 and its lower end against the member D^2.

With the construction as thus far described it will be understood that the spring I and I′, respectively, urge the members E′ and D^2 in opposite direction and towards each other. The upward movement of the member E′ is limited by the head E^2 contacting with the lower end of the die E. Also, the downward movement of the member D^2 is limited by the finger D^6. This will position the opposite faces of the die D and the member E′ so as to be spaced from each other by a dimension slightly less than the diameter of the spherical blank K formed as above described. If this blank is pressed laterally between said members it will cam them slightly further apart and will clamp the blank therebetween by resilient pressure. To centralize the blank one or both of the members D and E′ are centrally recessed in their opposite faces, as indicated by D^8 and E^5.

The rotary disk carrier as above described is provided with spaced radially extending slots B^2 in the portion B' thereof. Indexing mechanism (not shown) will intermittently rotate the carrier step by step, each step being the distance between adjacent slots, one of which will be aligned with the vertical axis of the dies D and E. The slots are successively loaded with the spherical blanks from a chute L which is positioned above the carrier and is in alignment with one of the slots thereof during the intervals of rest. The blanks are deposited at the inner end of each slot and rest upon the upper face of a pedestal M rising from the bolster. The pedestal M extends from the point where the blank is received to the table G which is at the same level and is supported on the latter up to the point where it is in alignment with the dies. A plate N supported on the adjacent pedestal N' rising from the bolster extends over the annular portion B' of the carrier and forms an arcuate guide for the spherical blanks extending from the point of deposit to near the point of registration with the dies. A spring clip N^2 extends from this plate over the blank which is in alignment with the dies and bears thereupon to temporarily hold it in such position. Transfer of the blank to the dies is effected by a finger O which extends radially outward adjacent to the upper face of the carrier B and has an upwardly extending angle arm O' attached to the piston rod O^2 of a cylinder and piston motor O^3 actuated by air or other fluid. The motor O^3 is mounted on a bracket arm O^4 which is attached to the upper end of the pivot portion A^3 of the pedestal A'. Thus the actuation of the piston in an outward direction will contact the spherical blank slightly above the center thereof and move it outward through the slots B^2 and the dies D and E, as above described. The cross bar J^2 is then reciprocated, actuating the blank or head G in a downward direction and carrying the die D and ejector E' downward with it. When the ejector reaches the position which is complementary to the die E the spherical blank will be first radially enlarged and then extruded upward to completely fill the cavity of the die E. This will form a cup shaped member which will be ejected from the die E during the upward movement of the ejector E' under pressure of the spring I or by positive pressure applied to the lower end of the member H. The annular portion B' of the carrier B extends out beyond the axis of the dies and each of the slots B^2 is enlarged near its outer end and is fashioned to the form of the hexagonal exterior C' of the member C. Thus, said member C in its upward movement will be forced into engagement with the carrier to be conveyed thereby during successive steps of its movement. However, the work is not completed as the closed end of the cup shaped member must be cut away leaving only the annular flange C^3. This operation is accomplished by a punch P which is mounted on the plate J to depend therefrom. A pedestal Q on the bolster A is beneath the punch and a plate Q' on this pedestal has its upper face in the plane of the table G. The plate is apertured in alignment with the punch to cooperate therewith in the shearing out of the center of the bottom portion of the cup, leaving only the annular flange. A stripper Q^2 mounted on the pedestal Q to be above the member C is apertured for the punch to pass therethrough so as to strip the work from the punch in the upward movement of the latter. This will complete the formation of the member C which will be further advanced by the carrier B to a suitable point for discharge.

The indexing mechanism for the carrier and the means for reciprocating the cross bar J^2 in timed relation thereto may be of any conventional construction and is not illustrated or further described.

The spherical blanks K are preferably formed of relatively soft low carbon steel which during the process of radial expansion and extrusion will be hardened to some extent thereby improving the character of the product.

What we claim as our invention is:

1. Apparatus for forming members from spherical blanks comprising a frame, axially aligned die members, heads on which said die members are respectively mounted, said heads being mounted for axial reciprocation in said frame with freedom for limited relative movement, resilient means for urging said heads towards each other to the limit of their relative free movement, which in their retracted positions spaces the opposite faces of said die members by slightly less than the diameter of said spherical blank, means for laterally inserting said blank between said members to cam them apart, centering the sphere in their common axis and clamping it by said resilient means, one of said die members having a central recess in its clamping face for centralizing said spherical blank when clamped thereby, a step by step intermittently actuated rotary disk carrier having a series of spaced radial slots therein extending out through the periphery thereof, said disk being located in a plane extending between said dies in the relative retracted positions of said heads, means for successively loading said slots with spherical blanks deposited at the inner ends thereof, and means for moving said blanks radially outward in each slot when in alignment with said dies to cam the latter further apart by the insertion of said blank therebetween, whereby it will be clamped in such position by resilient pressure.

2. The construction as in claim 1 provided with a segmental guide rail for holding each spherical blank at the inner end of the slot during movement thereof with the carrier to near the point of registration with said dies, a resilient clip for holding said blank at said point of registration, and a finger on said radially outward moving means for contacting with the portion of the sphere and pressing it between the resiliently held die members.

3. The construction as in claim 2 in which the peripheral portion of said carrier extends radially outward beyond the axis of said die members, said slots being enlarged at their outer ends for the passage of said male die member therethrough.

4. The construction as in claim 3 in which the enlarged portion of each slot is fashioned to receive the fashioned article when ejected from the female die to be advanced by said carrier in the further movement thereof.

5. The construction as in claim 4 including a punch depending from and operated by the male die carrying head, being located to register with the cup shaped article formed by said dies in one position of advancement thereof and adapted to remove the central portion of the bottom of the cup, leaving only an annular flange.

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