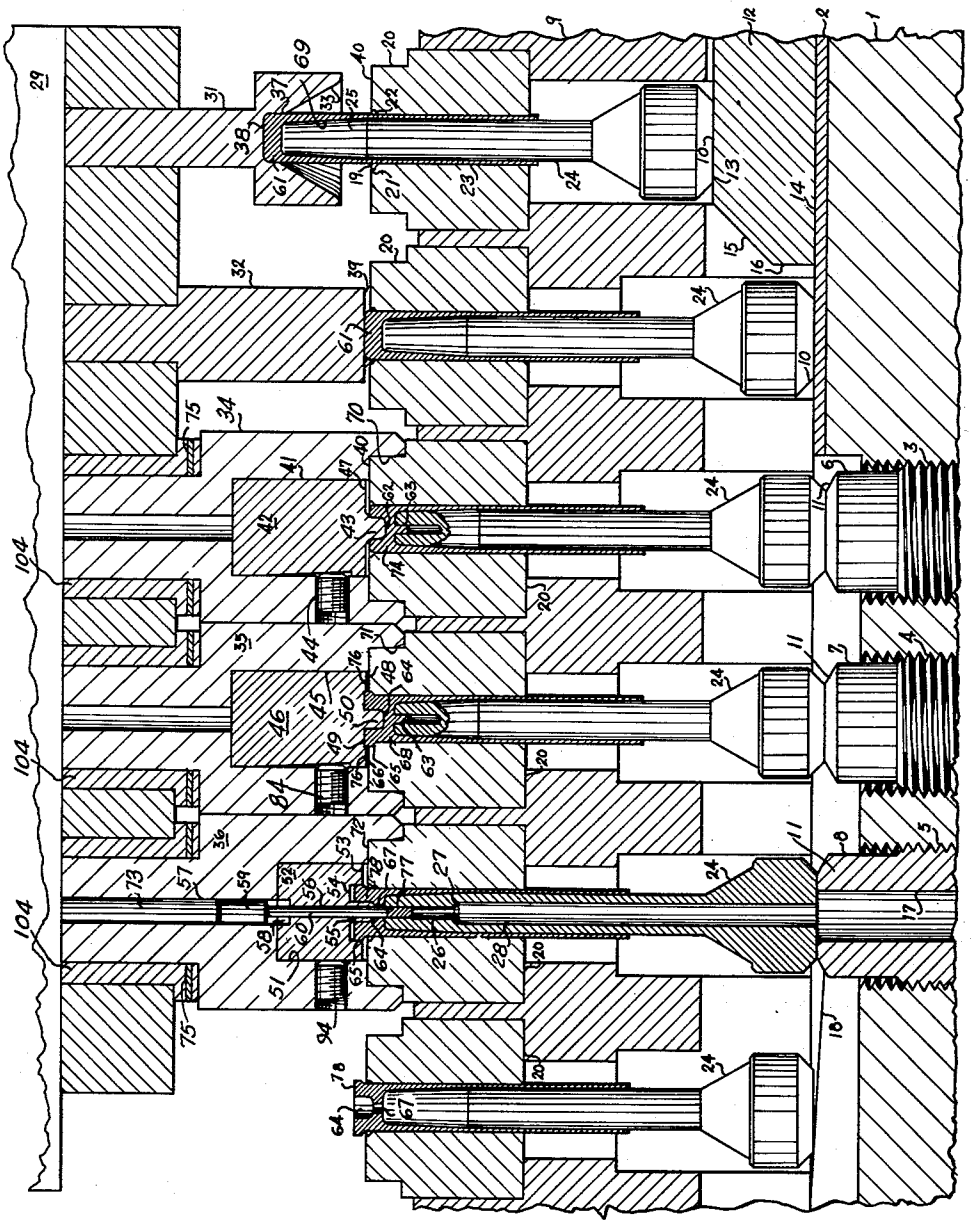
Nov. 6, 1962 A. J. DUFFIELD 3,061,908

METAL FORMING

Filed March 3, 1959



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United States Patent Office

3,061,908
Patented Nov. 6, 1962

3,061,908

METAL FORMING

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Filed Mar. 3, 1959, Ser. No. 796,982
1 Claim. (Cl. 29—13)

This invention relates to the shaping of tubular articles and more particularly, to the heading of cartridge cases.

In the manufacture of ammunition cartridge cases, cupped blanks are initially formed from a suitable metallic blank of brass, aluminum or a harder metal by cupping and drawing operations. Such an operation is specifically detailed in U.S. Patent No. 2,630,916, which produces a cylindrical tube having a relatively thick bottom and a relatively thin side wall. These drawn cup blanks are subsequently subjected to a series of individual operations which form a finished head on the end of the case, and if desired, a tapered neck and mouth portion on the opposite end.

Heretofore, various methods called "heading" have been employed in performing the work upon the closed end of the cartridge case. One method employed in the heading of cartridge cases involves the working of the metal at the closed end of the cupped blank by impact flattening and outwardly displacing the metal in the formation of a radial flange about the head. If required, the operation simultaneously forms a pocket as a seat for a primer. The shaped blank is then subjected to a trimming operation which trims the flange to its ultimate dimensions. The final working of the head includes a separate and individual step of forming a flash hole through the base of the primer pocket.

In another method, a cupped shaped blank, or a flanged blank described above, may be subjected to drilling and reaming operations for the formation of a primer pocket. When a cupped blank has been drilled and reamed, it is further subjected to a trimming operation to form an extractor groove, for the engagement by a feeding means and/or extractor means of a gun, in the wall of the case adjacent the head. The location of the groove must be accurately located and correctly formed, thereby necessitating careful adjustment of the trimming means involved. These operations, of drilling and reaming, must also be repeated in the formation of a flash hole through the base of the primer pocket.

Still another method of forming a metal cartridge case consists of a coining operation in which the metal displaced by the coining punch is forced outwardly to increase the diameter of the head. The deformation of the head of the blank may be removed by trimming, an extractor groove formed as above and the primer pocket and flash hole separately formed by drilling and reaming operations. The coining operation may also be accomplished by placing the blank within a counter-bored die and the metal displaced by the coining punch forces within the counter-bore of the die to form a flange. Due to variations in the amount of metal present in the closed end of the cupped blank, the flange formed in this method will vary in its dimensions. Accordingly, this last said method requires a trimming operation to trim the excess displaced metal in the flange, to the final dimensions required.

Heretofore, the machines employed in the trimming operations were of extremely complex and intricate nature, as for example, the machine disclosed in U.S. Patent No. 2,448,393. These machines usually comprise a rotating turret which carries a plurality of rotating chucks which are indexed to various positions. The articles to be operated upon are fed, rotated to the tool stations and then ejected. These machines require cutting tools which

necessitate frequent resharpening and resetting since the cutting edge must be constant relative to the piece to be worked, due to the wear occurring at their cutting points as soon as a tool is put into operation. In operations which require the use of screw machines in forming the primer pockets or flash holes, the same disadvantages result from the cutting edges of the drills employed in such operations.

It is apparent that heretofore, regardless of the methods used, the forming of cartridge cases required a number of operations and elaborate machinery to form the flange, or groove, the primer pocket and the flash hole. In addition, the use of such elaborate machinery requires maintenance and painstaking readjustments in order to accurately perform and control the various operations of heading the cartridge case.

Accordingly, it is the object of this invention to provide a novel method and apparatus which removes the disadvantages of the prior art.

Another object of this invention is to provide an improved method and apparatus for forming heads on cartridge cases.

Still another object of this invention is to provide an improved method and apparatus for forming the primer socket and flash hole in the heads of cartridge cases.

Still another object is to provide a novel method and apparatus for forming the heads of cartridge cases while simultaneously piercing a flash hole into the head of the cartridge case.

Still another object is to provide a novel means of simultaneously forming a socket and a flange on the heads of cartridge cases.

A still further object is to provide a novel means of trimming the flange at the head of the cartridge case while simultaneously forming a flash hole.

Other objects and advantages will be apparent in the following description and drawing depicting a partial and sectional plane view of a structure which illustrates an embodiment of this invention.

Referring to the drawing, the preferred structure of this invention contains a support **1** having mounted thereon a brass plate **2**, and containing a number of large annular holes **3**, **4** and **5**. Mounted in these annular slots are adjustable and identical screw supports **6**, **7** and **8** which contain an axial annular passageway **17**. These adjustable supports have their top surfaces beveled at **11** to facilitate the travel of the below described supporting pins **24** along their upper surface. Fixed on brass plate **2** is a supporting pin ramp **12** with top surface **13**, and a bottom surface **14** resting on plate **2** on support **1**. The end face **16** and top surface **13** are beveled in a face **15**. Also mounted on support **1** is a ramp **18** of gentle slope rising from adjusting screw **8**.

Mounted on support **1** is a rotatable die block **9** fixed relative to vertical motion. Mounted in die block **9** are a series of identical dies **20** containing a flat face **40** and cylindrical bores **23** conforming to the outer circumference of the side walls of the cupped blank **61**. Dies **20** also contain a counter-bore **19** having vertical side walls **21** which continue into a tapered base **22**. Base **22** merges with cylindrical bore **23**. Mounted in the bore **23** of each die **20** is a supporting pin **24** having base **10** which rests successively on ramp **12**, brass plate **2**, adjusting screws **6**, **7** and **8**, and on ramp **18**.

The outer dimensions of supporting pins **24** conform to the inside dimension of the cupped blank to be processed. As illustrated, supporting pin **24** has a tapered portion **25** which conforms to the inwardly tapering interior portion **69** of blank **61**. Supporting pins **24** contain, through a portion of their length, an axial passageway **26** which merges by means of flaring mouth **27** into a larger passageway **28** in the remainder of the length

of supporting pin 24. Passageway 28 in turn communicates with the large annular passageway 17 in adjusting screws 6, 7 and 8.

Mounted above die block 9 is a vertically reciprocating ram or gate 29 fixed relative to rotation. Mounted on ram 29 are seating punches 31 and 32 and bunter holders 34, 35 and 36. Punches 31 and 32 and holders 34, 35 and 36 are fixed in axial alignment with the various dies and supporting pins described above. Punch 31 contains a pocket 38 consisting of a flaring mouth 33 terminating in vertical side wall 37. The side wall 37 of the pocket 38 conforms to the outer configuration of the closed end of the cupped blank 61. Seating punch 32 contains a flat working face 39.

Bunter holder 34 contains a pocket 41 into which is mounted a bunter 42 fixed in place by set screw 44. Bunter holder 34, in addition, has a counter-bore 70 which encompasses the end face 40 of die 20. Extending from the flat face 47 of bunter 42 is a circular projection 43 in axial alignment with passageway 26 of supporting pin 24. Bunter 42 is fixed in pocket 41 so that the flat face 47 is recessed from the base of counter-bore 70 a fixed distance in order that flat face 47 does not come in contact with the flat working face 40 of die 20 when the base of counter-bore 70 is in contact with the flat working face of die 20.

Bunter holder 35, as holder 34, contains a similar pocket 45 into which is mounted a heading bunter 46 fixed into position by another set screw 84. Holder 35 also contains a counter-bore 71 which encompasses the working face 40 of die 20. Heading bunter 46 contains a counter-bore 49 of the identical diameter as counter-bore 19 in die 20. In addition, heading bunter 46 also contains a circular projection 50, from the center of counter-bore 49, in axial alignment with passageway 26 in supporting pin 24. Bunter 46 is fixed into pocket 45 a fixed distance so that its flat end face 48 is slightly recessed beyond the annular base of counter-bore 71 by a space 66 when the base of counter-bore 71 is in contact with the flat working face 40 of die 20.

In practice, the preferred depths of the recesses formed by counter-bore 49 in bunter 46 and counter-bore 19 in die 20 total up to an amount slightly less, approximately 20 percent, than the thickness of the formed flange on the cartridge. Accordingly, the face 48 of bunter 46 is recessed, from the annular base of counter-bore 71 in holder 35 by space 66 at a distance corresponding to about 20 percent of the thickness of the desired flange. Such an arrangement forms a very thin flash 76 which is easily clipped in the succeeding station, while socket 64 is further pierced.

Bunter holder 36 contains an axial passage 57 which communicates with an enlarged end pocket 51 into which is mounted a clipping bunter 52 held by screw 94. Holder 36 also contains in its working face a counter-bore 72 which, in the position shown, encompasses the working face 40 of die 20. Contained through a portion of passage 57 is a fixed rod 73. Seated in pocket 51 is a bunter 52 containing a counter-bore 58 which communicates with passage 57 of holder 36. Face 53 of bunter 52 contains a counter-bore 54, of the same diameter as that of the flange formed in the preceding station, and a projection 55 protruding from the center of the counter-bore 54. In addition, bunter 52 contains a small annular and axial passageway 56 communicating with counter-bore 58 and extending through projection 55, and in axial alignment with passageway 26 of supporting pin 24. Projection 55 of bunter 52 conforms to the final dimensions of the desired primer socket of the cartridge case. Face 53 of bunter 52 is recessed from the base of the counter-bore 72. Mounted in passage 57 of bunter holder 36 below the lower end of rod 73 is the head or base 59 of a piercing pin assembly. Fixed in the lower end of base 59 is piercing pin 60, completing the assembly, so that the pin protrudes through passage 56 of bunter 52. The length of base 59 is such as to permit a limited axial movement of the piercing pin assembly in passageway 57 and counter-bore 58. When an end of base 59 encounters the end of rod 57 to restrict further movement, a portion of piercing pin 60 protrudes beyond projection 55 of bunter 52 and through the closed end of the blank 68 to make orifice 67.

In practice the various described dies and punches and bunter holders are carried, respectively, on an intermittently rotating base and vertically reciprocating ram of a dial press. The rotating base is fixed relative to vertical movement and the reciprocaitng ram is fixed relative to rotation. During operation the head descends to bring the various tools into engagement with each other. After the various tools have cooperated with each other, the head withdraws to its position of rest and the base indexes to the succeeding station. The tools in the ram are so fixed that after each indexing motion they are in axial alignment with each of the dies and supporting pins fixed in the rotating base. Although 6 dies are illustrated in the drawings their number may be repeated as many times as desired on a rotating base, limited only by the size of the dial press.

In operation a finished drawn cupped blank of aluminum such as that obtained by the method detailed in the aforesaid U.S. Patent No. 2,630,916, is conventionally coated with a thin coat of oil or wax and is inserted mouth end first into the cylindrical bore 23 of die 20 on supporting pin 24, and advanced in alignment with seating punch 31. At this position the base of supporting pin 24 rests on the top surface 13 of ramp 12. Ram 29 descends causing punch pocket 38 to engage the closed end of the blank 61 forcing the blank to be firmly seated on supporting pin 24. Ram 29 withdraws to its position of rest and the base 9 advances the die, the cup blank and supporting pin into alignment with seating punch 32. During the indexing motion the base of supporting pin 24 moves along the top surface 13 and beveled surface 15 of ramp 12 onto the brass plate 2.

At this second station ram 29 descends forcing the face 39 of seating punch 32 against the closed end of blank 61 to insure proper seating of blank 61 on this supporting pin 24 and within bore 23 of die 20 with protrusion of the closed end beyond flat end face 40 to a predetermined dimension. The ram withdraws to its position of rest and the die block 9 advances die 20, supporting pin 24, and blank 61 to a third station in axial alignment with projection 43 of bunter 42. During the indexing motion the base of supporting pin 24 moves on brass plate 2 and from it down onto the top of adjusting screw 6.

At the third station ram 29 descends causing counter-bore 70 of bunter holder 34 to encompass the face 40 of die 20, and to seat the annular base of the counter-bore 70 on face 40 of die 20. This operation forces projection 43 to indent into the top of the closed end of blank 61 forming intermediate socket 62 and forcing a portion of the metal displaced up and outwardly and a portion into passageway 26 of seating pin 24 to form a projection 63. In this position the face 47 of bunter 42 does not come in contact with the face 40 of die 20 since it is in a recessed position relative to the base of counter-bore 70. By proper positioning of adjusting screw 6 the top surface of which is leveled at 11 the top surface of the cupped and partially formed blank 74 is maintained at the desired position relative to projection 43 and face 40 of die 20 for control of the dimensions of socket 62. The ram 29 withdraws to its upper position of rest and then advances die 20, pin 24, and partially formed blank 74 to a fourth station in axial alignment with heading bunter 46. During this indexing motion seating pin 24 is advanced to rest on the top surface of adjusting screw 7 which may be in height to control compaction in the end of the blank.

At the fourth station ram 29 descends causing counter-bore 71 of bunter holder 35 to encompass face 40 of die

20 and causing projection 50 to further size socket 62 to form the socket 64 of ultimate dimensions. In this operation base 48 of bunter 46 is brought very close to, but not in contact with, face 40 of die 20 due to a fixed positioning of face 48 in a slight recess from the base of counter-bore 71. In this operation the socket 64 is made to finished size and metal displaced by bunter 46 and its projection 50 is forced into conformance with the interior surface of counter-bore 49 of bunter 46 and counter-bore 19 of die 20 and into the small open space defined by face 48 of holder 46 and face 40 of die 20. This operation forms a flange 65 with a flash or a thin ring 76 extending radially from and around flange 65 of blank 68. The ram retracts to its position of rest, and the die is advanced to the fifth station.

By proper adjustment of adjusting screw support 7 and proper positioning of bunter 46 by means of spacers such as shims 75 under back-up bushings 104 it is possible to accurately control the thickness of the flange and the flash. As noted above, the total depths of the counter-bores in bunter 46 and die 20 is slightly less than the thickness of the flange. In practice, the difference between the total depth of the counter-bores and the thickness of the flange is approximately 20 percent. In this manner, the flash left is very thin, corresponding to 20 percent of the thickness of the flange, which is easily clipped at the next, fifth, station.

When ram 29 ascends and arrives at its position of rest, at the fifth station the lower end of base 59 of the piercing pin assembly rests on the base of counter-bore 58. When die 20, blank 68 and supporting pin 24 are at this station in alignment with bunter 52, ram 29 descends causing counter-bore 72 to encompass face 40 of die 20 and seats the base of counter-bore 72 on to face 40 of die 20. In its descent ram 29 also causes projection 55 of bunter 52 to seat, without further indentation, into socket 64 and causes rod 73 to actuate pin 60 to pierce the closed end of blank 78 at the base of the socket 64. In this operation, as noted above, the lower end of base 59 initially rests on the base of counter-bore 58 in bunter 52. As the lower end of pin 60 contacts the base of socket 64 it causes the piercing pin assembly to rise within passageway 57 until the upper end of base 59 comes into contact against the lower end of rod 73 where it remains fixed against additional movement. Pin 60 is in axial alignment with passageway 26 of supporting pin 24 and as a result causes slug 77 formed during piercing and inclusive of projection 63 to enter into the passageway 26 of supporting pin 24. In practice slug 77 remains in passageway 26 being forced downward by added slugs formed in additional piercing operations. As additional slugs are forced into passage 26 they cause slug 77 to travel downward in passage 26 until it enters passage 28 whereupon it drops freely, passes through the large annular opening 17 in adjusting screw 8 and into any convenient collection means not show.

During the descent of ram 29 and as base of the counter-bore 72 in bunter holder 36 seats on face 40 of die 20, the face 53 of bunter 52 is not in contact with die 20 since face 53 is recessed relative to the base of counter-bore 72. By means of adjusting screw 8 the head of blank 68 is raised above face 40 of die 20 to a position wherein the lower edge of flange 65 is at or above face 53 of bunter 52. Since the diameter of counter-bore 54 is the same as that of the flanged head of blank 68 and also of finished case 78, the edge of the counter-bore 54 at face 53 clips flash 76 during the seating of the base of counter-bore 72 on face 40 of die 20. Upon completion of the operation at the fifth station the ram withdraws to its position of rest, and die block 9, die 20, finished case 78 and supporting means 24 are indexed to a succeeding station of rest.

This last station contains a cartridge case after the completion of the heading, socketing, and piercing operations. At this position the headed case may be removed by any convenient means. This removal may be accomplished manually or by a conventional stripper of usual construction. The stripper may consist of a plurality of segmented blocks which are drawn together by means of a retaining spring. When so drawn together the stripper blocks form a holder having a central opening equal approximately to the diameter of the outer walls of the cartridge case. The stripper portions have their lower interior edges beveled to facilitate the flanged head of the cartridge case to pass through, as the stripper is driven downwardly to encompass the outer walls of the cartridge case. As the stripper is withdrawn it lifts and removes the cartridge case from bore 23 of die 20 and off of the supporting means 24.

Although the passage of only one cupped blank through the structure has been described, it is obvious that with each indexing motion of die block 9 additional cupped blanks are inserted at the first station. This, as a result, forms a continuous process wherein a finished headed cartridge case is produced with each indexing motion.

Although in the above process a cartridge case having a portion of its inner walls tapering inwardly towards the closed end of said case has been employed, it is obvious that the process is equally applicable to cupped blanks having a uniform side wall. Such a change in the inner configuration of the cupper blank requires a simple modification in the structures required. An example of such a modification is the mere elimination of tapered portion 25 of supporting pin 24 to conform to the inner configuration of the cupped blank. Even though a specifice embodiment has been discussed, it will be obvious that the invention can embrace other applications to small arms and similar seamless metal tubular articles of aluminum, brass or harder metal, as for example, a shot shell head.

As noted above, although the invention has been described with reference to specific embodiments, materials and details, various modifications and changes will be apparent to one skilled in the art. The invention is, therefore, not to be limited by such embodiments, materials or details except as set forth in the appended claim.

What is claimed is:

An apparatus for forming the finished rimmed and socket head of metal cartiridge cases from a cupped blank having excessive bulk in the closed end comprising a station, said station comprising a counter-bored die containing an axial hollow extending through the said counter-bore reciprocateably mounting an internal supporting means for a substantially cylindrical part of the blank at said closed end and for maintaining said blank in said axial hollow and said closed end within the counter-bore of said die, said supporting means having a centered bore, a counter-bored bunter having an indenting projection extending from the center of the counter-bore of said bunter, said die and said supporting means being in axial alignment with and cooperating with the said bunter, means to bring the counter-bores and surfaces of both said die and said bunter in close relationship, without die and bunter contact, with each other until said indenting projection forms a socket in the outer surface of the closed end of said cylindrical part of the blank to form a radial flange of final size about the closed end of said cylindrical part of the blank, and to form a thin ring of excess metal radially about the side of said flange, indexing means to advance the said die and said supporting means to a subsequent station, said subsequent station comprising a second counter-bored bunter, a projection extending from the center of the counter-bore of said second bunter, the face of said second bunter extending beyond the said flange to provide a cutting edge operative when the projection of said second bunter is seated in the said socket, an axial passage-

way in said second bunter extending through the projection of said second bunter, a cylindrical rod mounted for limited axial movement in said passageway, said rod extending beyond the thickness of the closed end of said cylindrical tube when the projection of the said second bunter is seated in said socket, said supporting means and said die being in axial alignment with and cooperating with the said second bunter, and means to seat the projection of said second bunter in the formed socket of said cylindrical tube and to bring the face of said die at said subsequent station in close relationship with the face of said second bunter for simultaneously piercing a central passage through part of the base of said socket by said rod and centered bore and also removing said thin ring by said edge.

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