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METAL BACK-UP RING

3,059,939

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2 Sheets-Sheet 1

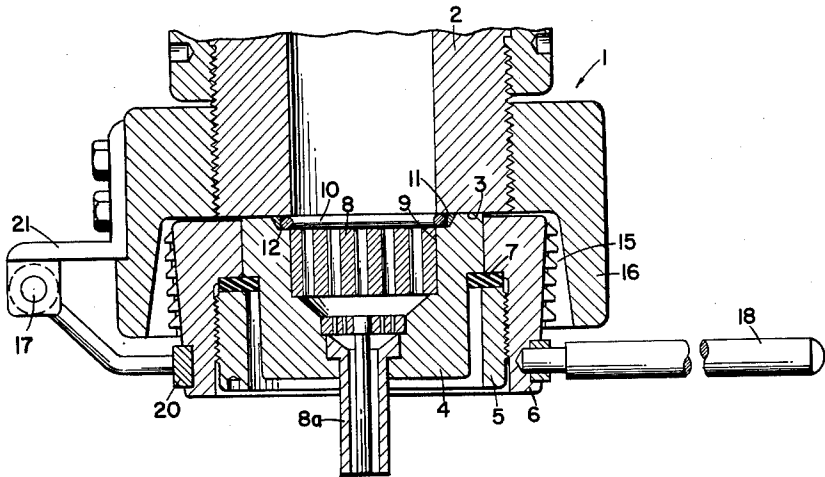


FIG. 1

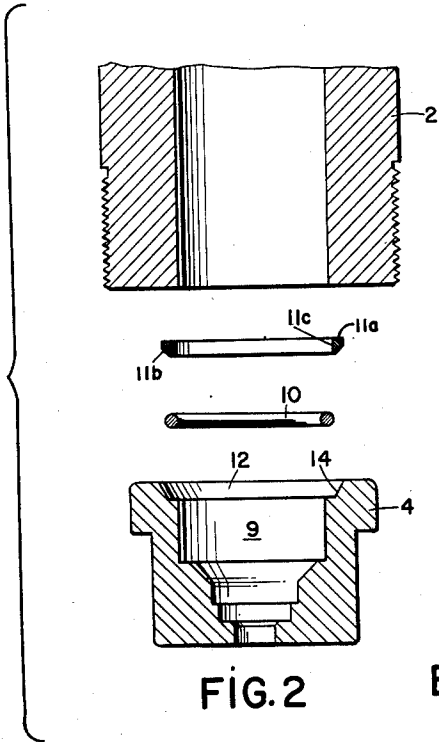


FIG. 2

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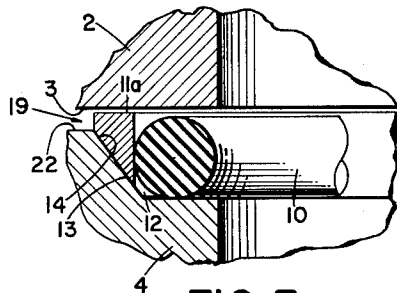


FIG. 3.

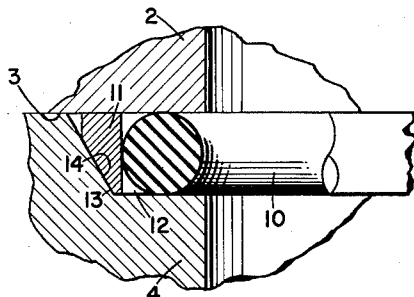


FIG. 4.

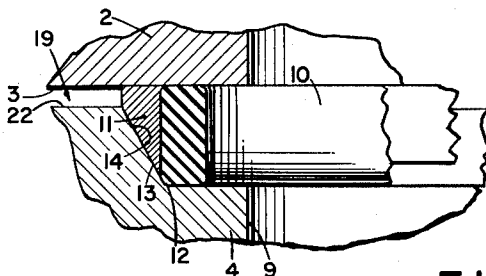


FIG. 5

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1

3,059,939

METAL BACK-UP RING

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1 Claim. (Cl. 277-176)

This application is a continuation-in-part of my co-pending application, Serial Number 442,457, filed July 9, 1954, now abandoned.

This invention relates to a metal back-up ring, and more particularly to back-up or sealing rings for use in powder extrusion presses to prevent extrusion of an O ring and the extruding material between the press face and the die holder and to facilitate press opening after the extrusion process has been completed.

Heretofore, trouble has been experienced in the operation of presses of this type owing to the fact that, during the actual extrusion phase, the conventional type O ring would extrude into the gap formed by separation of the cooperating surface faces of the die holder and the press. Although a metal-to-metal contact is established between the cooperating surface faces of the die holder and press before the commencement of the high pressure extrusion phase, the force acting on the die holder during the high pressure phase causes an elongation of the threads and shear ring supporting the die holder. This elongation, in turn, causes a separation of the die holder face from contact with the press face and forms a gap therebetween of approximately .001 of an inch. The conventional type O ring, also being acted upon by this high pressure, extrudes into the gap in an amount proportional to the size of the gap. In some cases the O ring may completely extrude into the gap and, in other cases, only partially.

In either situation extrusion of the O ring is undesirable; for, when the high pressure force exerted on the die holder is decreased, the return action of the elongated threads and shear ring supporting the die holder causes the die holder to return to its metal-to-metal contact position with the press face thus closing the gap. If the O ring has extruded into the gap, the return of the die holder to contact position with the press squeezes the O ring. With the O ring thus squeezed and binding the press and die holder together, it is extremely difficult to open the press after the extrusion operation. In some instances, it has been necessary to employ wrenches from five to six feet long to open the press.

Furthermore, once the O ring has been unseated, the possible flow of extruding material into the gap may be extremely dangerous, particularly if the extruding material is explosive in nature, i.e., a solid propellant composition. For, upon decrease in extruding pressure, the force exerted by the die holder returning to metal-to-metal contact with the press may be sufficient to detonate the material which had previously flowed into the gap.

With employment of the present invention which provides a one-piece solid and continuous metal back-up ring positioned so as to encircle the O ring, the aforementioned difficulties are overcome. The O ring is prevented from extruding into the gap formed by the separation of the die holder from contact with the press. The extruding material is likewise prevented from flowing into such gap, and, if this material happens to be explosive in nature, the attendant hazard of detonation thereof is avoided. It is also possible to open the press with the torque applied by one hand with an 18 inch wrench.

It is therefore among the objects of this invention to provide a one-piece solid and continuous metal back-up ring that will seal the gap caused by separation of the die holder of extrusion presses from contact with the press during high pressure phases of the extrusion process.

2

It is another object of this invention to provide a one-piece, solid and continuous metal back-up ring encircling a conventional O ring which will prevent extrusion of the O ring into the gap formed by separation of the die holder from contact with the press during the high pressure phases of the extrusion operation.

It is still another object of this invention to provide a one-piece solid and continuous metal back-up ring which will prevent the extruding material from entering the gap formed by separation of the die holder of extrusion presses from contact with the press.

It is still another object of this invention to provide a back-up ring that will facilitate opening of the press after the extrusion operation is completed. A further object is to provide a back-up ring of simple and economical construction yet highly effective in operation.

The specific nature of the invention, as well as other objects and advantages thereof, will clearly appear from a description of a preferred embodiment as shown in the accompanying drawings wherein:

FIGURE 1 is a cross section view illustrating the nozzle end of an extrusion press.

FIGURE 2 is an enlarged exploded view illustrating the component sealing members of this invention.

FIGURE 3 is an enlarged fragmentary detail view illustrating the back-up ring and O ring in position before the die holder and press are in abutting contact.

FIGURE 4 is an enlarged fragmentary detail view illustrating the position of the back-up ring and O ring after abutting contact is effected between the die holder and press.

FIGURE 5 is a view similar to FIGURE 3 but showing the position during the high pressure extrusion phase of the back-up ring and O ring in the gap formed by separation of the die holder from contact with the press face, the gap being exaggerated in size for clarity of illustration.

Referring more particularly to the drawings wherein like reference characters refer to like or corresponding parts throughout the different views, as seen in FIGURE 1, the extruding portion of a powder extrusion press containing the die holder, nozzle, etc. is designated generally at 1. The reference numeral 2 indicates that part of the press containing the material (not shown) to be extruded, and reference numeral 4 indicates a die holder supported by a collar 5 threadably engaged in a matrix 6. A shear ring 7 is interposed between the die holder 4 and the collar 5. An extrusion die 8 is mounted within a large bore 9 formed in the die holder 4 and a nozzle 8a completes the extrusion assembly. The numeral 10 indicates the conventional O ring which rests in a counter bore 12, formed above the large bore 9.

In accordance with the present invention a one-piece solid and continuous metal back-up ring 11 encircles O ring 10 within the counter bore 12. The back-up ring 11 is formed of a solid and continuous piece of metal, steel for example. Back-up ring 11 is substantially a trapezoid in cross section with inner and outer sides parallel, a top edge 11a (FIGURE 3) normal to the parallel sides, and a lower edge 11b making an angle of about 30° to the inner side. The corresponding frusto-conical surface 13 of the back-up ring 11 has surface contact with a complementary frusto-conical surface 14 of counter-bore 12 of the die holder 4. The matrix 6 has interrupted threads which engage with corresponding interrupted threads 15 of a recess in barrel ring 16. The matrix 6 and all parts carried thereby are mounted for swiveling in a ring 20 which, in turn, is hinged as at 17 to a bracket 21 secured to barrel ring or base 16. Thus when matrix 6 is given limited rotation with respect to ring 20 by actuation of handle or lever 18, the interrupted threads are separated so that the matrix 6 may

be hinged downwardly for ready access to die 8, and rings 10 and 11.

Referring particularly to FIGURES 3, 4 and 5, in the operation of the press O ring 10 is encircled by back-up ring 11 and is in engagement with counter-bore 12 of die holder 4. The frusto-conical surface 13 of back-up ring 11 is in contact with the complementary frusto-conical surface 14 of counter-bore 12. Back-up ring 11 is so constructed that, when seated, the top edge 11a (FIGURE 3) thereof is positioned above the upper surface 22 of die holder 4 for reasons to be hereinafter described.

Prior to the actual extrusion phase, die 8 is secured in die holder 4 which is then in hinged down position. Initially locking of interrupted threads 15 of barrel ring 16 and the corresponding threads of matrix 6 is effected by rotation of matrix 6 thru actuation of lever 18. In this position, complete threaded engagement between these cooperating threads is not yet achieved, and press face 3 and die holder face 22 are separated and define a gap 19 as shown in FIGURE 3. Since the top edge 11a of back-up ring 11 is positioned above die holder face 22, contact will be established between press face 3 and the top edge 11a of back-up ring 11 before contact is made between press face 3 and die holder face 22. Further rotation of matrix 6 causes die holder face 22 to engage press face 3 until these faces are tightly abutted. Since the top edge 11a of back-up ring 11 is positioned above the face 22 of die holder 4, gradual depression of back-up ring 11 occurs as press face 3 and die holder face 22 approach each other since ring 11 will now be forced to occupy a slightly smaller space than that occupied by its original size. This position of back-up ring 11 is illustrated in FIGURE 4.

To ready the press for the actual extrusion phase of the operation, the die holder and press faces, 22 and 3 respectively, are moved into the tightly abutting relation shown in FIGURE 4. The back-up ring 11 thus has a force applied to its upper surface or top 11a thereby causing the ring to be compressed into the counter bore or recess 12 as the inclined face 11b of the ring slides downward along the sloping surface 13 of the counter bore. The sloping surface 13 may, therefore, be considered to define a cam or guide surface along which the back-up ring 11 rides.

As illustrated in FIGURE 5, the high pressure developed during the actual extrusion phase causes die holder face 22 to separate from contact with press face 3 forming a gap 19 between these two faces. Back-up ring 11 having been previously compressed, begins to expand due to removal of the force exerted thereon by press 3, the expansion being proportionate to the size of the gap, thereby maintaining metal-to-metal contact between press face 3 and back-up ring 11. Simultaneously the high pressure exerted by the extruding material on resilient O ring 10 in the direction of back-up ring 11 forces O ring 10 against back-up ring 11 as shown in FIGURE 5. As a result, back-up ring 11 moves outwardly and upwardly on the frusto-conical surface 14 of counter-bore 12.

Thus by this initial expansion of compressed back-up ring 11 and the outward and upward movement thereof along the surface 14, a continuous tight metal-to-metal contact is maintained between the back-up ring 11 and the press face 3 and forms a good seal at the same time affords a full and complete back-up surface for the O ring 10 preventing any extrusion of the powder between the press face 3 and the upper surface 22 of die holder 4 by preventing any deformation of the O ring into the space 19 which would otherwise tend to break the seal between the die holder 4 and press portion 2.

From the foregoing it will be apparent that this invention provides a means for continuously sealing any space occurring between the two elements 2 and 4 of the extrusion press machine. The separation between the elements occurs due to the pressure of the extruding ma-

terial passing therethrough during machine operation. One of the elements, die holder 4, is provided with the annular recess or counter bore 12 having its outer face or surface 14 inclined upwardly and outwardly for complementary surface contact with the inclined face 11b of the back-up ring 11, compressible slightly within the elastic limits of the material from which it is made, seatable in the recess 12. The planar upper surface 11a of the back-up ring is adapted for abutting engagement with the planar surface 3 at the discharge end of the element 2. The O ring is disposed in the recess 12 so that it is in physical contact with the face 11c, of the back-up ring, remote from the sloping or inclined face 11b. During machine operation, the pressure of the material being extruded through the elements 2 and 4 will cause the machine elements 2 and 4 to separate. Ring 11 will now expand to fill the gap and the metal-to-metal contact between faces 3 and 11a will be maintained. Further, the machine operation will also cause resilient deformation of the O ring 10 (FIGURE 5) to thereby develop therein a resilient force which will be exerted against face 11c of the back-up ring 11 whereby the latter will be caused to ride along the recess face 14 and assist in maintaining a tight abutting relation between the complementary surfaces of the back-up ring and the extrusion press machine element 2 throughout the entire operation of the machine.

By employment of the present invention which provides a one-piece, solid and continuous metal back-up ring, extrusion of the O ring and extruding material is completely eliminated.

When the extrusion phase is completed, the high pressures developed are decreased and the die holder 4 returns to its metal-to-metal contact with the press closing gap 19 and again compressing back-up ring 11. Die holder matrix 6 can then be easily rotated until separation of the interacting threads of matrix 6 and the press occurs, whereupon matrix 6 may be hinged downwardly for access to die 8. During rotation of matrix 6 compressed back-up ring 11 again expands as the gap 19 between die holder face 22 and press face 3 progressively widens.

It is therefore apparent from the foregoing that a new and useful sealing means has been provided to prevent extrusion of the O ring and the extruded material between the press face and the die holder.

While a preferred form of the invention has been shown and described, various modifications and substitution of equivalents will occur to those skilled in the art after a study of the foregoing disclosure. Hence, the disclosure should be taken in an illustrative rather than a limiting sense, and it is my desire and intention to reserve all modifications within the scope of the subjoined claim.

I claim:

Means for providing a continuous seal between two abutting extruding machine elements through which explosive extruding material passes and which move toward and away from each other during machine operation due to the pressure of the extruding material passing there-through, one of said elements having an annular recess therein opening through the side thereof abutting the other of said elements, said recess having its outer face inclined upwardly and outwardly, a one piece solid and continuous metal back-up ring seated in said recess and having an outer sloping face for complementary surface contact with said outer recess face, an inner cylindrical face, and an upper planar surface adapted for abutting engagement with a complementary planar surface of the other of said elements, an O ring of resilient material disposed within said recess and in contact with the cylindrical face of said back-up ring, said O ring having a diameter in cross section equal to the axial depth of said recess, the pressure of the material being extruded through said elements thereby applies a radially compressive force on said O ring to cause a resilient deformation of said O ring

5

developing therein a resilient force which is exerted against said back-up ring, the force exerted on said back-up ring causes said back-up ring to ride up said recess face to maintain a continuous, tight, abutting relation between the complemental planar surfaces of said back-up ring and said other element when the two abutting elements separate, whereby the maintaining of a continuous, tight, abutting relation between the complemental planar surfaces of the back-up ring and said other element precludes any possibility of particles of extruded material from lodging behind said O ring during separation of the machine elements.

6

References Cited in the file of this patent

UNITED STATES PATENTS

2,253,073	Hayes	Aug. 19, 1941
2,345,515	Tweedale	Mar. 28, 1944
2,420,104	Smith	May 6, 1947
2,462,586	Whittingham	Feb. 22, 1949
2,499,398	Lyon	Mar. 7, 1950
2,543,679	Van Riper	Feb. 27, 1951
2,735,701	Ecker et al.	Feb. 21, 1956
2,770,836	Hankey	Nov. 20, 1956