April 8, 1930. J. E. BATIE 1,753,680

APPARATUS FOR EXPANDING CUP SHAPED MEMBERS

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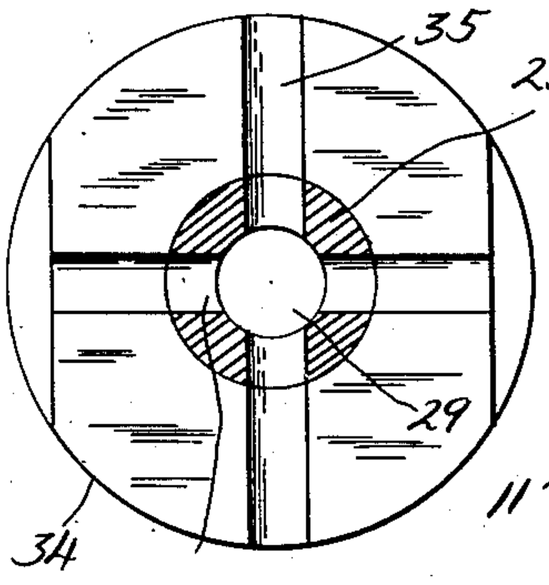


Fig. 3.

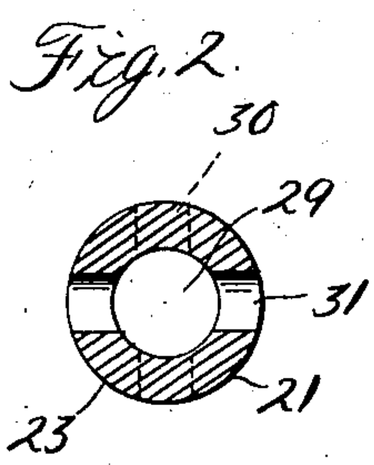


Fig. 2.

Fig. 1.

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APPARATUS FOR EXPANDING CUP-SHAPED MEMBERS

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The invention relates to apparatus for expanding cup-shaped members and refers more particularly to apparatus of the hydraulic type. One of the objects of the invention is to so construct the apparatus that the liquid for expanding the cup-shaped member is automatically admitted to the cup-shaped member during the operation of the apparatus. Another object is to construct the apparatus so that it will automatically force the liquid into the cup-shaped member to expand the latter. A further object is to so construct the apparatus that the means for automatically conducting the liquid to the cup-shaped member, the means for forcing the liquid into the cup-shaped member and the means for automatically controlling the pressure of the liquid form a unit. With these as well as other objects in view, the invention resides in the novel features of construction and combinations and arrangements of parts as more fully hereinafter set forth.

In the drawings:—

Figure 1 is a median section through an apparatus embodying my invention;

Figures 2 and 3 are cross sections respectively on the lines 2—2 and 3—3 of Figure 1.

The apparatus herewith shown operates upon a sheet metal cup-shaped member forming part of the hub shell of a vehicle wire wheel. 1 is the stationary die shoe, 2 the die holder vertically slidable in the shoe and 3 a rubber bumper located below the shoe and yieldably carrying the holder through the rods 4 which extend through the shoe. The die is formed of the sectional die blocks 5 slidably mounted in the holder 2 and forming when in their lowermost positions a continuous ring having an inner contour corresponding to the desired completed outer contour of the cup-shaped member. The cup-shaped member when inserted into the die has the imperforate bottom 6 which is lowermost, the main cylindrical portion 7 connecting into the bottom, the beveled or flared annular shoulder 8 connecting into the main cylindrical portion and the enlarged cylindrical portion 9 connecting into the annular shoulder, the annular shoulder being near the edge of the cup-shaped member. The enlarged cylindrical portion, the annular shoulder and the part of the cylindrical portion adjacent the annular shoulder fit corresponding bearing faces upon the die blocks 5 when in their lowermost positions, but the remaining part of the cup-shaped member must be refashioned.

For cooperating with the die formed by the die blocks 5, I have provided the holder 10 mounted upon the ram 11 of a vertical press. This holder is hollow having the axial recess 12. 13 is a plunger vertically slidable within the recess 12 and comprising the body 14 and the cup-shaped packing 15 secured to the upper end of the body by the plate 16 and slidably engageable with the wall of the recess in the holder. The plunger also comprises the forming member 17 which is threaded upon the reduced lower end 18 of the body and has the reduced cylindrical lower end portion 19 extending below the reduced lower end 18 and the beveled annular shoulder 20 connecting into the upper end of the reduced lower end 19. The reduced lower end 19 is engageable with the part of the cylindrical portion 7 of the cup-shaped member adjacent its annular shoulder 8 and the annular shoulder 20 is engageable with the annular shoulder of the cup-shaped member and adapted to form therewith a liquid seal.

For admitting liquid such as water to the portion of the cup-shaped member to be fashioned, I have provided the valve 21 which is carried by the plunger 13 and has the head 22 and the stem 23. The body 14 of the plunger is formed with an axial opening having the enlarged cylindrical upper portion 24 and the reduced cylindrical lower portion 25. The plate 16 is also provided with the axial opening 26 registering with the enlarged upper portion 24. The part of the body 14 between the portions of different diameters of the opening has the annular seat 27 which is engageable by a corresponding face 28 upon the lower part of the valve head 22. The reduced cylindrical portion 25 of the opening is elongated to provide an extended bearing for the valve stem 23 so that rocking of the valve and consequent impairment of its seat-

ing is avoided. The valve stem has the axial bore 29, the transverse openings 30 and 31 at its upper end and below the valve head 22 and the transverse openings 33 near its lower end, the former openings being the inlet openings and the latter the outlet openings. 34 is a block threaded upon the lower end of the valve stem and of a size to pass through the cylindrical portion 7 of the cup-shaped member and engage the bottom 6. The top of this block and also the bottom of the forming member 17 are formed with cooperating radial grooves 35 and 36, respectively forming passageways therebetween for water passing out through the outlet openings 33, this being essential to provide for the introduction of the water into the cup-shaped member inasmuch as the block is against the bottom of the cup-shaped member and practically seals escape of water from the lower end of the valve stem.

In operation, the apparatus as thus far described functions in the following manner. Assuming the cup-shaped member and the die blocks to be in position and the plunger 13 in its lowermost position, at which time it is held from disengagement from the holder 10 by the annular plate 37, the valve to be seated and the chamber in the holder formed by the recess 12 above the plunger to be filled with water, the ram 11 is lowered toward the die and the block 34 first comes into contact with the bottom 6 of the cup-shaped member to unseat the valve, after which water is admitted into the cup-shaped member and displaces the air therein. The annular shoulder 20 of the plunger is then brought into sealing contact with the annular shoulder 8 of the cup-shaped member and upon continued downward movement of the ram the holder 10 moves relative to the plunger and forces the water into the cup-shaped member to expand the same against the die blocks 5.

For the purpose of automatically admitting water to the chamber formed within the holder 10 and also for the purpose of automatically controlling the pressure of the water exerted upon the cup-shaped member during the downward movement of the holder 10 relative to the plunger 13, I have provided the fitting 38 which is mounted upon the holder 10 and communicates with the upper end of the recess 12 through the passageway 39 formed in the holder. This fitting 38 is provided with the longitudinal passageway 40 and the transverse passageways 41 and 42 connecting into the passageway 40. The passageway 41 is flexibly connected to a suitable source of water supply while the passageway 42 is flexibly connected to a suitable drain. 43 is a check valve in the nature of a ball for automatically preventing backward flow of the water from the passageway 40 to the passageway 41, and 44 is a pressure valve yieldably preventing passage of the water from the passageway 40 to the passageway 42. This latter valve is yieldably held to its seat by the coil spring 45, the pressure of which may be suitably adjusted as by means of the plate 46 abutting the spring and the nuts 47 abutting the plate and threaded upon the studs 48.

It will now be seen that the pressure of the water exerted during the downward movement of the ram upon the cup-shaped member by reason of the movement of the holder 10 relative to the plunger 13 is controlled by the valve 44 so that excess pressure is avoided. It will also be seen that upon the upward movement of the ram water is automatically admitted into the chamber formed in the holder to make the apparatus ready for the next operation.

What I claim as my invention is:

1. In an apparatus for expanding cup-shaped members, the combination with a die for receiving a cup-shaped member, of a holder movable toward said die, a plunger carried by and movable relative to said holder and engageable with the cup-shaped member, means dependent upon the movement of said plunger for controlling the passage of liquid into the cup-shaped member and the movement of said holder relative to said plunger, said holder operating to force the liquid into the cup-shaped member to expand the same against said die, and means operable when a predetermined pressure of the liquid exerted upon the cup-shaped member has been reached to automatically relieve this pressure.

2. In an apparatus for expanding cup-shaped members, the combination with a die for receiving a cup-shaped member having an annular shoulder near its edge, of a member movable toward said die and engageable with the annular shoulder of said cup-shaped member, and means carried by said member and engageable with the bottom of said cup-shaped member prior to sealing engagement between said member and the annular shoulder of said cup-shaped member for controlling the passage of liquid into said cup-shaped member to expand the same.

3. In an apparatus for expanding cup-shaped members, the combination with a die for receiving a cup-shaped member, of a hollow holder movable toward said die, a plunger slidable within said holder and engageable with the cup-shaped member, a valve carried by said plunger for controlling the passage of liquid from said holder into the cup-shaped member, and means upon said holder for automatically relieving the pressure of the liquid therewithin.

4. In an apparatus for expanding cup-shaped members, the combination with a die for receiving a cup-shaped member, of a hollow holder movable toward and away from said die, a plunger slidable within said hold-

er and engageable with the cup-shaped member, a valve carried by said plunger for controlling the passage of liquid from said holder into the cup-shaped member upon movement of said holder toward said die, means upon said holder for automatically controlling the pressure of the liquid exerted upon the cup-shaped member during the movement of said holder toward said die, and means upon said holder for automatically supplying liquid to said holder upon movement thereof away from said die.

5. In an apparatus for expanding cup-shaped members, the combination with a die for receiving a cup-shaped member, of a holder movable toward said die, a plunger slidable within said holder and engageable with the cup-shaped member, said plunger having an axial opening therethrough providing an elongated bearing surface, and a valve carried by said plunger for controlling the passage of liquid into the cup-shaped member, said valve having a hollow stem engaging the elongated bearing surface of said plunger and being provided with inlet and outlet openings adapted to be positioned beyond the ends of the elongated bearing surface of said plunger.

6. In an apparatus for expanding cup-shaped members, the combination with a die for receiving a cup-shaped member having an annular shoulder near its edge, of a hollow holder movable toward said die, a plunger slidable within said holder and engageable with the annular shoulder of said cup-shaped member, a valve carried by said plunger for controlling the passage of liquid from said holder into the cup-shaped member upon movement of said holder toward said die, and a block secured to said valve and engageable with the bottom of the cup-shaped member to open said valve.

7. In an apparatus for expanding cup-shaped members, the combination with a die for receiving a cup-shaped member having an annular shoulder near its edge, of a hollow holder movable toward said die, a plunger slidable within said holder and engageable with the annular shoulder of said cup-shaped member, said plunger being provided with an axial opening, a valve for controlling the passage of liquid from said holder to the cup-shaped member, said valve having a hollow shank engaging the opening in said plunger and transverse openings adapted to be positioned beyond the ends of the opening in said plunger, and a block upon said valve stem and engageable with the bottom of the cup-shaped member for moving said valve to open position, and means located beyond the end of said plunger engageable with the bottom of said cup-shaped member for placing the outlet opening in said valve stem in communication with the interior of the cup-shaped member.

8. In an apparatus for expanding cup-shaped members, the combination with a die for receiving a cup-shaped member, of a member movable toward said die, means for automatically admitting liquid to the cup-shaped member upon movement of said member toward said die, and means for automatically relieving the pressure of the liquid exerted upon the cup-shaped member when the same has exceeded a predetermined amount.

9. In an apparatus for expanding cup-shaped members, the combination with a die for receiving a cup-shaped member, of a ram movable toward said die, and means carried by said ram for automatically admitting liquid to the cup-shaped member for automatically forcing the liquid into the cup-shaped member and for automatically relieving the pressure of the liquid when the same exceeds a predetermined amount.

10. In an apparatus for expanding cup-shaped members, the combination with a die for receiving a cup-shaped member, of a member movable toward said die, a valve carried by said member for admitting liquid to the cup-shaped member, and means operable upon movement of said member toward the die for positively moving said valve to open position.

11. In an apparatus for expanding cup-shaped members, the combination with a die for receiving a cup-shaped member, of a ram movable towards said die, and a valve carried by said ram for controlling the flow of fluid to the cup-shaped member, said valve being positively actuated upon movement of the ram toward the die to admit fluid to the cup-shaped member.

12. In an apparatus for expanding cup-shaped members, the combination with a die for receiving a cup-shaped member, of a holder movable towards said die and adapted to contain a supply of fluid under pressure, and means carried by the holder for admitting fluid to the cup-shaped member, said means including a valve normally maintained in closed position by the pressure of the liquid in said holder.

13. In an apparatus for expanding cup-shaped elements, the combination with a die for receiving a cup-shaped element, of means for discharging a fluid under pressure into the cup-shaped element, said means including, relatively movable members and a valve associated with one of said members and positively moved to open position upon relative movement of said members for admitting fluid under pressure into said cup-shaped element.

14. In an apparatus for expanding cup-shaped members, the combination with a die for holding a cup-shaped member, of a member movable toward said die and adapted to contain a supply of fluid, said member having an outlet opening therein for the passage

of fluid into the cup-shaped member, and valve means having a portion normally closing communication through said opening and having another portion operable upon movement of the member aforesaid toward the die for moving the said first mentioned portion out of sealing engagement with the opening permitting the fluid in said member to flow into the cup-shaped member.

In testimony whereof I affix my signature.

JOSEPH E BATIE.