June 5, 1934. E. C. MOGFORD ET AL 1,961,446

MEANS FOR TREATING AXLES

Original Filed May 15, 1929 2 Sheets-Sheet 1

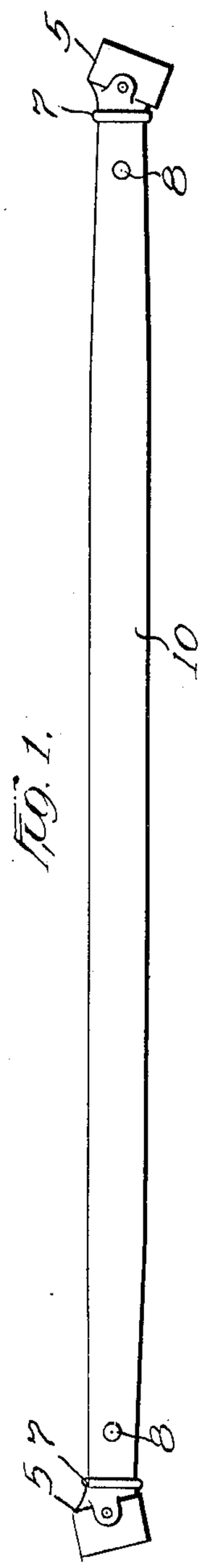


Fig. 1.

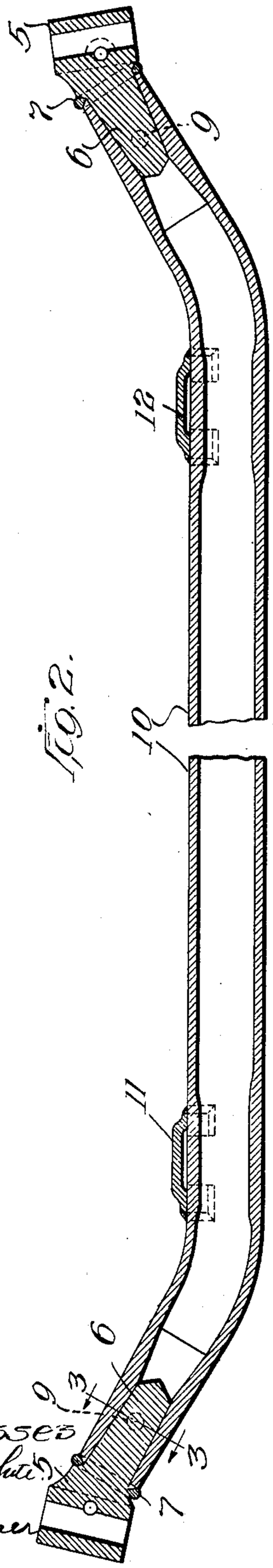


Fig. 2.

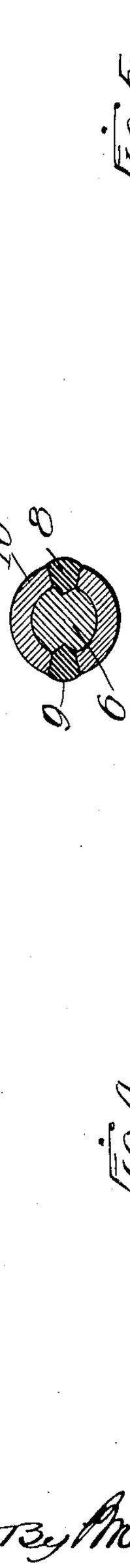


Fig. 3.

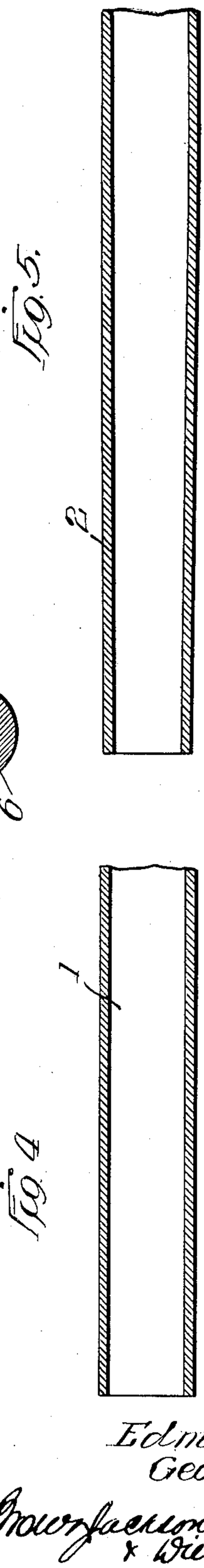


Fig. 5.

Fig. 4

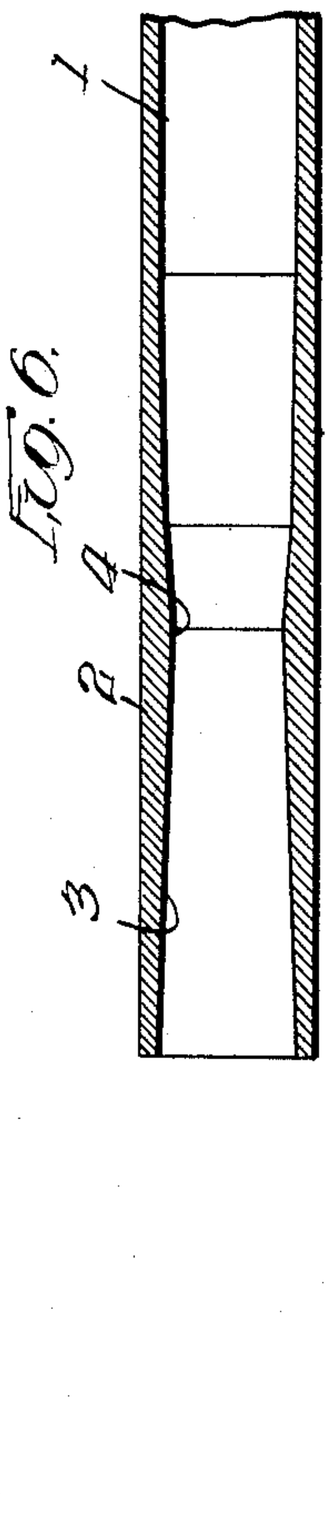


Fig. 6.

Witnesses
Harry R. L. Shute
Robt. Cramer

Inventors
Edmund C. Mogford
George Spatta.

By Brown Jackson Boettcher & Dienner Attys.

June 5, 1934. E. C. MOGFORD ET AL 1,961,446

MEANS FOR TREATING AXLES

Original Filed May 15, 1929 2 Sheets-Sheet 2

Fig. 7.

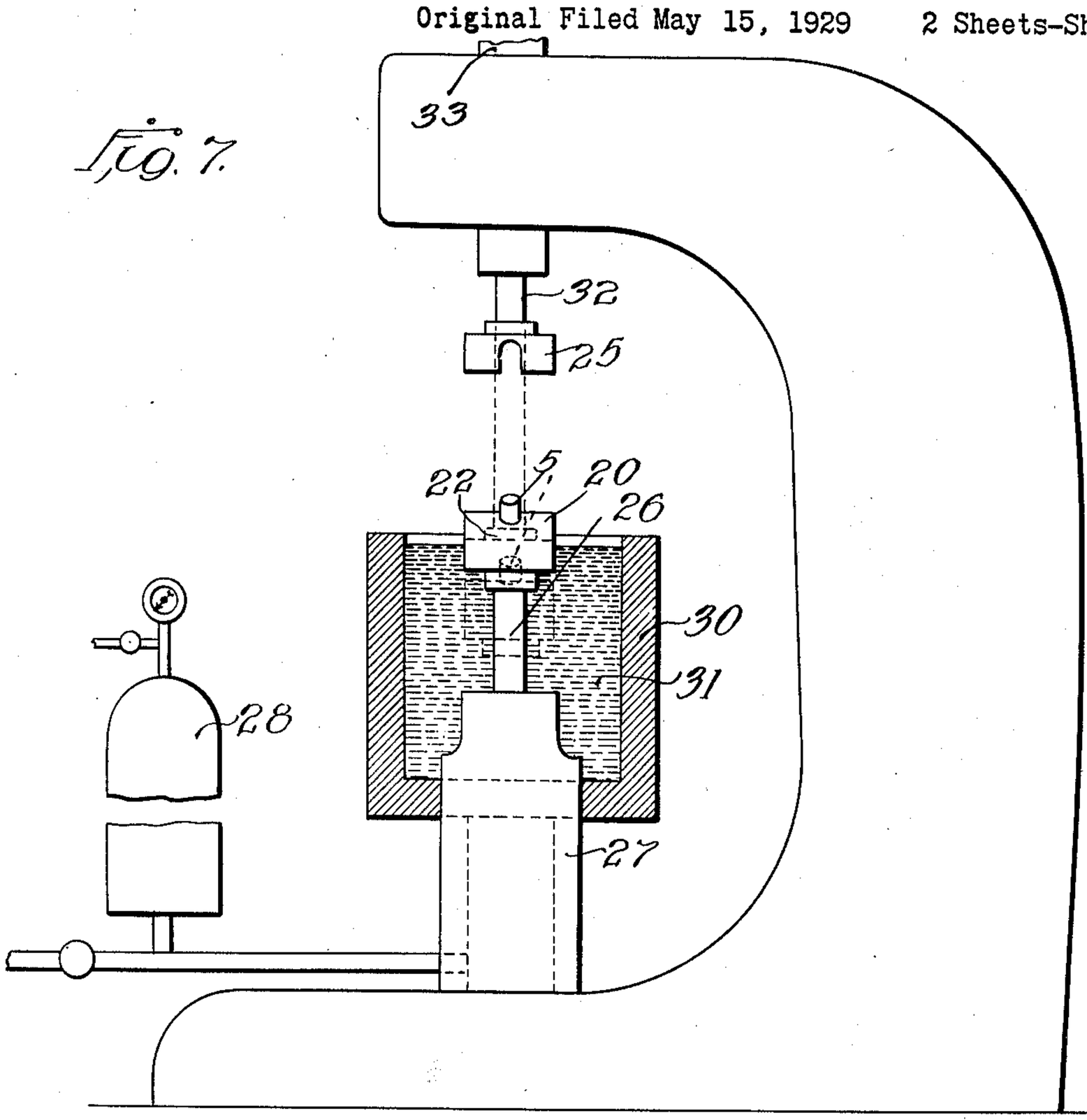
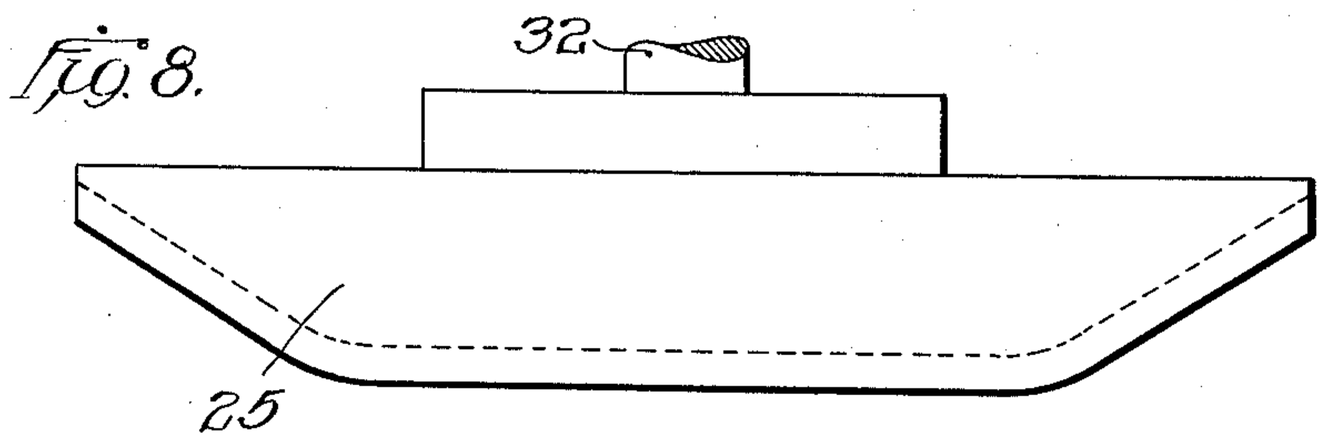
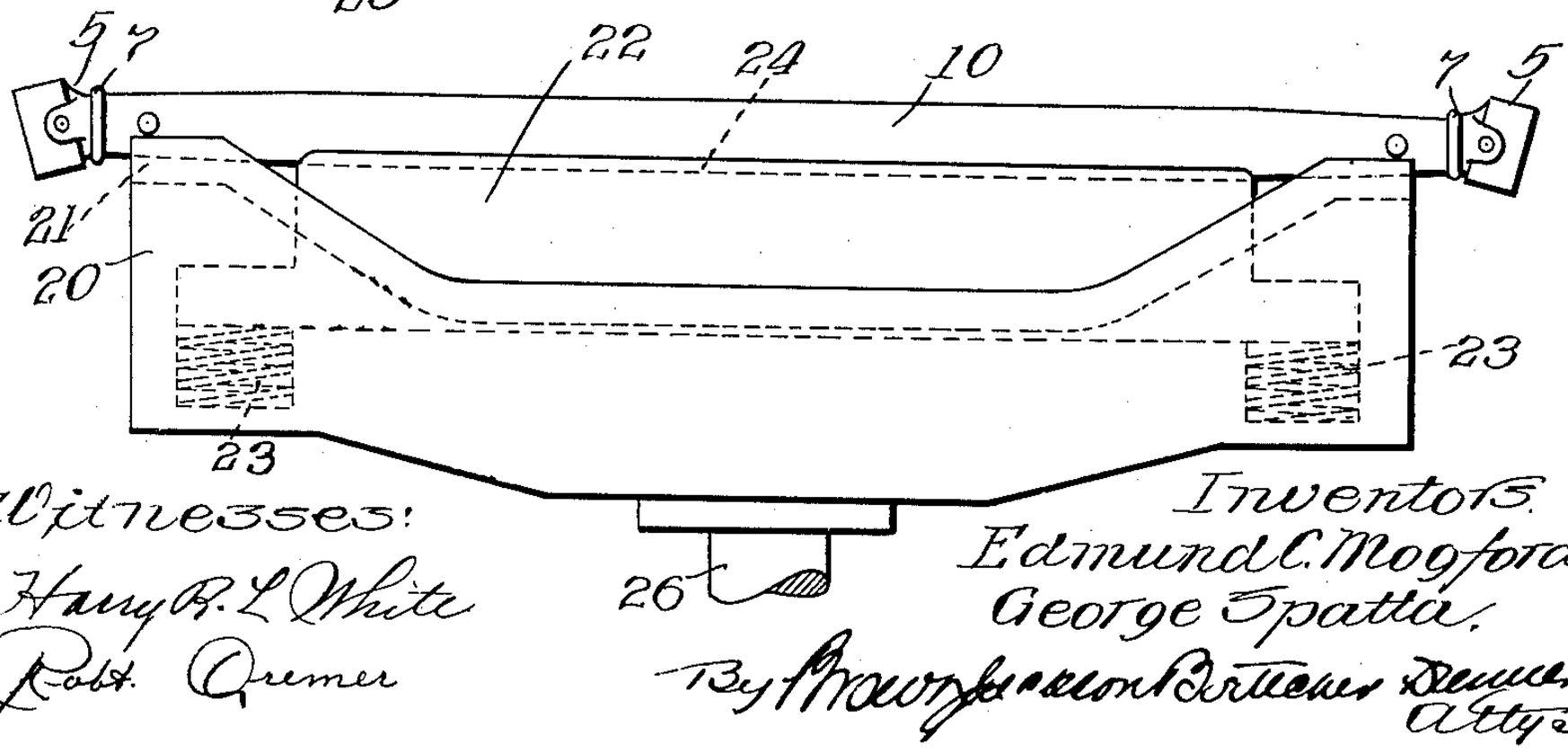


Fig. 8.





Witnesses:
Harry B. L. White
Robt. Cremer

Inventors.
Edmund C. Mogford
George Spatta.
By Brown Jackson Boettcher & Dewey
Attys

Patented June 5, 1934 1,961,446

UNITED STATES PATENT OFFICE

1,961,446

MEANS FOR TREATING AXLES

Edmund C. Mogford and George Spatta, Buchanan, Mich., assignors to Clark Equipment Company, Buchanan, Mich., a corporation of Michigan

Original application May 15, 1929, Serial No. 363,362. Divided and this application November 22, 1929, Serial No. 409,096

4 Claims. (Cl. 266—6)

Our invention relates to tubular front axles for automobiles and the like, and provides more particularly a means for forming and heat-treating such axles.

In our copending application, Serial No. 363,362, filed May 15, 1929, of which our present application is a division, we disclosed a novel tubular front axle for automobiles and the like. In the formation of this axle a blank of seamless steel tubing is formed with tapering ends into which the forged knuckle pieces are forced and fastened to form a front axle of the reversed Elliott type. In the final stage of formation of such an axle the assembled unit is heated and pressed into its final shape in a special forming and quenching die which forms the subject matter of our instant application.

Although the above mentioned copending application discloses an axle of the reversed Elliott type, the forming means employed in the heat treatment of the axle is obviously applicable to the forming of axles of other types and we are not, therefore, to be limited to the formation of this specific kind of axle.

In our present invention we have provided a forming press which grips the axle, forms it into shape, holds it firmly in that shape, and quenches it in a cooling liquid to complete the heat treatment of the unit. During the cooling of the axle it is firmly held by the forming dies in such a manner that there is no possibility of it being warped out of shape by the stresses set up in it during the operation.

Now, in order to acquaint those skilled in the art with the manner of constructing and operating a device embodying our invention, we shall describe it in conjunction with the accompanying drawings in which a specific embodiment of the invention is shown by way of example.

In the drawings:—

Figure 1 is a side view of the upset blank with the knuckle pieces welded in position in the ends thereof;

Figure 2 is a longitudinal cross sectional view of the completed axle;

Figure 3 is a cross sectional view taken through the line 3—3 of Figure 2;

Figure 4 is a longitudinal section through the blank from which the axle is formed;

Figure 5 is a longitudinal section through the blank after it has been tapered;

Figure 6 is a longitudinal section through the blank after it has been upset to increase the wall thickness;

Figure 7 is a side view of a forming and quenching press; and

Figure 8 is a front elevational view of the dies employed in the press of Figure 7 with the axle blank in place.

In our copending application Serial No. 409,094 filed Nov. 22, 1929 now Patent 1,762,409 issued June 10, 1930, we disclose the method of manufacturing the axle disclosed in our copending application, Serial No. 363,362. This method briefly comprises forming tapered ends 2 on the seamless steel tubing blank 1, then upsetting the tapered ends 2 to form an inside tapered surface 3 and to thicken the walls of the end portion 2 of the tube 1, as shown at 4 in Figure 6. The forged knuckle yoke 5 is provided with a tapered shank 6 which is forced into registration with the tapered surface 3 of the axle and welded therein by the ring weld 7 at the end of the tube.

Holes are next drilled through the tube and into the shank 6 of the forging 5 and these holes filled with buttons 8 and 9 which are welded therein to securely hold the shank in the end of the tube.

The assembly thus formed is then ready for the final forming and heat-treating operation to which our instant application particularly relates.

This operation is preferably carried on in the following manner.

The axle is heated preferably throughout its entire length although it may be heated only at the point where it is to be bent, that is, just outside of the place where the spring seat will be later fastened. Then it is placed in the press shown in Figure 7 and laid upon the die 20 which has a groove 21 to receive the axle 10. The lower die 20 has a spring follower plate 22 which is adapted to be held in position by suitable follower spring 23. This follower plate 22 is also provided with a seat 24 for receiving the shaft or body of the axle 10 to hold the same with sufficient rigidity that the upper die member 25 in engaging the body of the axle secures a firm grip upon the same. Then the upper die member 25 forces the axle down to bend it into the shape in which it is shown in Figure 2.

The lower die member 20 is preferably mounted upon a plunger member 26, which plunger member may be connected to a hydraulic piston in cylinder 27 and subjected to a predetermined hydraulic pressure in a connected accumulator 28, subject to air pressure of a predetermined value. This holds the lower die member 20 in elevated position with a predetermined force

which is sufficient in cooperation with the upper die member 25 to form the body of the axle 10 to the desired shape.

A box or chamber 30 surrounds the plunger and this box or chamber contains a bath of quenching liquid 31 which may be water or oil, or the like, the level of which is below the top of the lower die member 20 when the latter is in elevated position.

The upper die member 25 is preferably mounted on a hydraulic plunger 32 having an operating cylinder 33 capable of exerting a pressure in excess of the predetermined pressure, sustaining the lower die member. The operation is as follows:

The lower die member 20 being elevated as shown in Figure 7 and the axle member being placed in the lower die member, hydraulic pressure is admitted to the upper end of the piston connected to the plunger 32 causing the plunger to travel downwardly and carry the upper die member 25 into engagement with the body of the axle 10, depressing the follower plate 22 and forcing the axle to conform to the shape of the die 20. Further pressure overcomes the resistance of the plunger 26 and both dies are then pressed down into the bath 31 with the axle firmly held between them in such position that it is incapable of warping during cooling, and the axle is thereby quenched and at the same time held to the desired shape. The pressure is then released upon the upper side of the piston of plunger 32 and the pressure on the lower side of the plunger 26 causes the same to be raised to its upper limit. Then the pressure applied to the lower side of the piston connected to the plunger 32 causes the die member 25 to be raised to clear the lower die 20 and the contained axle 10. The follower plate 22 and the upper die 25 each have grooves corresponding to the groove 21 in the lower die. When the dies are firmly registered together these grooves form surfaces which substantially completely encircle the axle 10 and extend from end to end of the body portion of the axle. After the forming operation the surfaces of the grooves firmly hold the axle in place against distortion during cooling. This holding action is retained as the upper die forces the lower die downward into the bath 31.

The axle is then removed and thereafter the spring seats 11 and 12 are attached in the manner brought out in our above mentioned copending applications. The arrangement of the die 20, a spring follower plate 22, and the die 25 is such that the axle 10 is straightened, then formed, and immediately the die 22 is lowered into the quenching bath so that the newly formed axle is immediately quenched. The dies 20, 22 and 25 firmly hold the axle during the quenching operation so that it cannot warp and while it is being cooled it is held to the definite shape desired. The axle so formed has proven to be sturdy and capable of withstanding the stresses placed upon it when used in an automobile.

The press in which the dies 20, 22 and 25 are mounted is diagrammatically shown in Figure 7 and we do not intend to be limited to the specific details shown since the die arrangement may be well used in any desired type of press structure.

What we claim is:—

1. A machine for forming and quenching an axle comprising, a tank containing a bath of quenching liquid, a lower die member, a yielding support for holding said die member normally above the level of said liquid, a follower yieldably mounted upon said die member, said follower containing a groove for receiving a heated axle blank, said die and follower together containing surfaces for forming the lower half of a finished axle, an upper die containing complementary surfaces for forming the upper half of a finished axle, means for forcing said upper die into registration with the work supported by said follower, said means forcing the follower into the lower die to form the work by closing said dies together, said dies when closed surrounding the axle from end to end, said means forcing the dies into said liquid.

2. An axle forming machine comprising a lower die for receiving an axle, a bath of quenching liquid, means supporting the die with its axle receiving portion above the top of the liquid, said die being downwardly movable, the force required to move said die downward being in excess of the force required to form the axle, an upper die movable into working relation with the lower die to first form the axle and, upon continued movement, to force the lower die and the axle into the bath of quenching liquid, and a spring pressed member carried by the lower die and bearing against the work and compressed by the upper die for loosening the work from the lower die after that die has returned to its position above the liquid level.

3. An axle forming machine comprising a lower die for receiving an axle, a bath of quenching liquid, means supporting the die with its axle receiving portion above the top of the liquid, said die being downwardly movable, the force required to move said die downward being in excess of the force required to form the axle, an upper die movable into working relation with the lower die to first form the axle and, upon continued movement, to force the lower die and the axle into the bath of quenching liquid, said upper and lower dies having cooperating grooves and together encircling the work throughout the worked length thereof, and firmly holding the work against warping during the quenching action, and a spring pressed member carried by the lower die and bearing against the work and compressed by the upper die for loosening the work from the lower die after that die has returned to its position above the liquid level.

4. A machine for shaping and quenching a metal axle, comprising a lower die for receiving an axle, a bath of quenching liquid, means supporting the die with its axle receiving portion above the top of the liquid, said die being downwardly movable into the liquid, an upper die movable into engagement with the lower die to shape the axle while the axle is maintained out of the liquid and then to force the lower die and the shaped axle into the bath of quenching liquid, said dies having cooperating grooves which encircle the axle along the entire worked portions thereof and constitute the axle shaping portions of the dies, the parts of the dies adjacent the grooves and surrounding the axle being comparatively massive in relation to the mass of worked metal at the axle, said dies being maintained in working relation to the axle during the quenching action.

EDMUND C. MOGFORD.
GEORGE SPATTA.