Jan. 2, 1923. 1,440,527.

L. H. BRINKMAN.

DRAWING MONEL AND OTHER HARD METALS.

FILED JUNE 14, 1918.

Fig. 2.

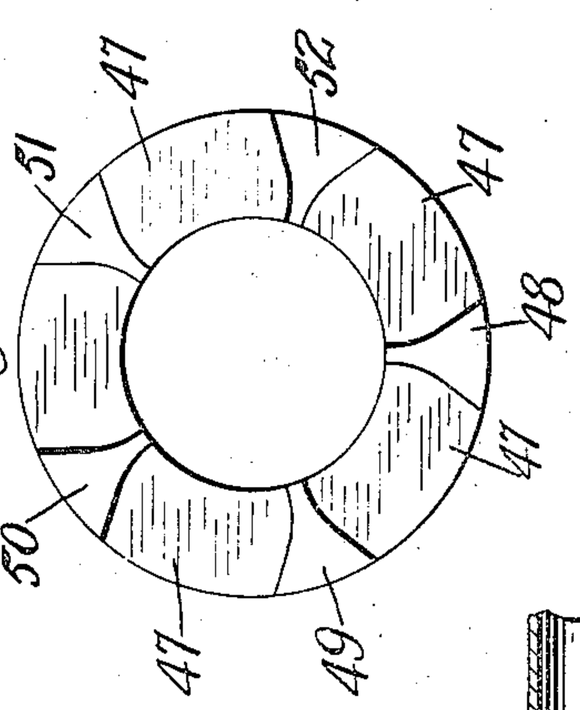

Fig. 1.

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UNITED STATES PATENT OFFICE.

LOUIS H. BRINKMAN, OF GLENRIDGE, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO GENERAL SEAMLESS TUBE COMPANY, OF BLOOMFIELD, NEW JERSEY, A CORPORATION OF DELAWARE.

DRAWING MONEL AND OTHER HARD METALS.

Application filed June 14, 1918. Serial No. 239,945.

To all whom it may concern:

Be it known that I, LOUIS H. BRINKMAN, a citizen of the United States, residing at Glenridge, Essex County, and State of New Jersey, have invented new and useful Improvements in Drawing Monel and Other Hard Metals, of which the following is a specification.

This invention relates to the use of dies wherein balls are the members operating upon the work.

Hitherto in drawing hot tubes, it has been usual to have a water cooled mandrel inside the tube with its head under the balls. This mandrel is generally extended within the tube to be drawn, through the furnace for heating the tube, and water cooling is provided to such an extent as to prevent the mandrel from injury by the heat of the furnace and hot tube. The metals of the tube drawn have been of such a nature that their heat at drawing might be comparatively low, so that no difficulty was encountered in maintaining the metal at drawing heat as it passed through the die and the water cooling of the mandrel could be carried out with reference to the preservation of the mandrel rather than to the maintenance of the proper drawing condition of the metal in the die. When the same procedure was followed, however, with hard metals, such as Monel metal, it was found that the metal could not be drawn and after consideration and experimentation it was found necessary in the case of these hard metals, to regulate the heat of the mandrel according to the requirements of the metal being drawn and to bring about the preservation of the mandrel consistent with these conditions. Monel metal was found to require under most conditions a temperature of the mandrel head under the balls of about 1000° Fahrenheit. Other of the hard metals do not require such a high temperature and possibly the Monel metal might be drawn at a somewhat lower temperature of the mandrel or might require a higher temperature according to the desired condition of the metal at drawing, but this and other hard metals require a mandrel temperature of not less than 500° Fahrenheit, which is above that accomplished by the old procedure above referred to.

It is the main object of the present invention to provide a method for drawing hard metals.

A further object of the invention is to provide improved apparatus for drawing metals of the character indicated.

Other and ancillary objects of the invention will appear hereinafter.

In the accompanying drawings, which illustrate the invention—

Figure 1 is a longitudinal section of a die and operating mechanism showing also a portion of a furnace with a mandrel in position and a tube being drawn;

Fig. 2 is a view on an enlarged scale of the ball spacer seen from the right in Fig. 1.

Referring to the drawings, the die mechanism comprises a succession of balls 29 surrounding the tube 7 to be operated upon. Surrounding the balls is a race ring 30 having an inclined interior surface 31 so that by shifting it longitudinally the balls may be forced inwardly or permitted to move outwardly to vary the diameter of the die. The ring 30 is secured against rotation in a recess in one end of the member 34 which is rotatably mounted in the supporting frame 4. The ring 30 may, however, be adjusted longitudinally by turning it, it being screw threaded to the member 34 and held in any adjusted position by any suitable means as a set screw. The other end of the member 34 is provided with a collar or nut 35 bearing against the support 4 and so preventing movement of the member 34 and its carried parts to the left (see Figure 1) while the longitudinal movement of this member in the other direction is limited by the shoulder 36 coming against the frame 4. Shims 37′ may be interposed between the shoulder 36 and the frame 4 for purposes of adjustment. The member 34 is driven by means of a gear 38′ fixed to it and meshing with a gear 39′ on the shaft 40 which is an extension of the shaft of the motor 2 for driving the die mechanism. It will be observed that the member 34 is rotatably mounted on a bushing 41 on the frame 4. The frame

4 comprises an end head 43 for one end of the appáratus, which has a central screw threaded opening 44 within which is secured a member 45 which may be located in any desired position of longitudinal adjustment by means of a jam nut 45′. At its inner end the member 45 has rotatably mounted upon it the ball retaining and spacing ring 46, this spacing ring is mounted to rotate freely in the member 45 and as will be seen more clearly from Fig. 2, comprises a number of compartments 47 adapted to receive the balls 29, the ribs or partitions 48, 49, 50, 51, and 52, between these compartments, serving to space the balls uniformly about the circumference of the die, the bottoms of the compartments being flat. It will be observed that the compartments for the balls extend below the centers of the balls and the inner ends of the partitions are curved so as to extend beneath the balls so that they will be held from falling out of the die when the work is removed. The compartments, however, are of such shape as to permit adjustment of the diameter of the die by radial adjustment of the balls. This retaining ring serves to prevent displacement of the balls, but does not sustain any considerable pressure during the drawing operation as the tendency of the work is to force the balls in the opposite direction.

Rotatably mounted within the member 34 is a sleeve 54 having fixed to it at one end a gear 55 which engages with a gear 56 on the shaft 40. At the other end the sleeve has fixed to it the cheek plate 57 against which the die balls 29 bear. The surface of the cheek plate 57 against which the die balls bear, is smooth, that is, has no ribs or projections which interfere with the circumferential rolling of the balls. The spacing of the retainer 46 and the cheek plate 57 between which the die balls are located, may be adjusted by turning the member 45 on its screw threads. To aid in keeping the die balls cool, a circumferential groove 59 in the member 45, and which is closed on one side by the frame casing 43, is supplied with a cooling fluid such as water from any suitable source by means of a pipe 60. This circumferential groove communicates by passages 61, of which there may be any suitable number distributed circumferentially about the work, with the inner face of the member 45. From this face the fluid is projected through the space between the retainer 46 and the ring 31 upon the die balls. The fluid thus introduced to the balls is thrown outwardly by the centrifugal action of the balls and moving die parts and passes out from the ball cavity by means of the passage 62 to the exterior casing whence it may be drained off in any suitable manner. The gears 38′ and 39′ are made of such ratio and the speed of the motor is such that the race ring 31 is driven at the desired rate of speed which would ordinarily be a high speed, to effect the desired results. A furnace 5 may be arranged as in my Patent No. 1,203,306, granted October 31st, 1916, to heat the tube prior to its entrance into the die and also suitable means for drawing the tube through the die, such as a bench and draw head as shown in my prior patent referred to, is provided. The gearing of the die mechanism is such that the cheek plate 57 rotates at a number of revolutions per minute, which is somewhat greater than one-half of the number of revolutions per minute of the ring 31. As the ring 31 rotates, the balls tend to be rolled thereby in a path circumferentially of the work and the center of a ball moves in its circumferential path at a speed substantially one-half that of the ring 31. As the surface of the plate 57 is substantially radial at the points where it engages the balls, this plate would have no turning effect on the balls if run at a number of revolutions per minute which is one-half those of the ring 31. Under such circumstances, the plate 57 would simply rotate along side the balls at the same speed at which they were driven about the work by the ring 31. By varying the speed of the plate 57 so that its revolutions are either above or below one-half those of the ring 31, a turning force is exerted upon the balls which tends to rotate them about an axis substantially at right angles to that about which they tend to be rotated by the ring 31, the latter axis being substantially parallel to the axis of the work. There is thus imparted to the balls a rolling movement having a component extending longitudinally of the tube. This causes the wear to be distributed over the surfaces of the balls. Where the plate 57 is rotated in the same direction as the ring 31 at a speed somewhat greater than one-half of the ring speed, the longitudinal component is in such direction that the balls continually tend to climb upon the shoulder of the work against which they bear and aid the drawing of the work through the die. The movement of the balls is dependent upon the relative speeds of the plate 57 and the ring 31, the balls being rotated in one direction if the speed of the plate is greater than one-half that of the ring, and in the opposite direction if the speed of the plate is less than one-half that of the ring. In view of the foregoing, it will be seen that by driving the plate 57 in the same direction as the ring 31, and at somewhat greater than one-half its speed, the balls will be given a rolling motion with a small longitudinal component so that the distribution of wear and the drawing of the tube through the die will be facilitated as before referred to.

A mandrel 64 in the form of a hollow tube may be constructed and arranged similar to that described in my prior patent mentioned above. In the present case the mandrel has an enlarged head 65 and through the hollow mandrel is passed a small tube 66 extending to the tail end of the mandrel and through the same to the head. This tube is connected to a suitable source of cooling fluid from which water will be discharged into the tube from whence it will flow to the head and out again through the hollow mandrel. This flow of water will prevent the mandrel from becoming over heated by the furnace and the hot tube. The mandrel head in the present instance, however, differs from that of my patent above referred to in that while the latter is hollow so as to permit the cooling fluid to be carried into the head beneath the balls, in the present case the mandrel head is formed to have a solid portion 67 beneath the balls, and the cooling fluid enters only a small cavity at the rear of the head. In drawing hard metals, for instance Monel metal, the composition of which is substantially copper 26½ parts, iron 1½ parts and nickel 72 parts, the temperature of the mandrel head should be allowed to rise to approximately 1000° Fahrenheit for best results—although this metal may be drawn at a somewhat lower temperature of mandrel or, under some circumstances, at a somewhat higher temperature, and other hard metals may be drawn at lower mandrel temperatures. In order that the high temperature of mandrel head may be attained without danger of injury to the mandrel head itself, the head is made of high speed steel, which is hardened at 2200° Fahrenheit so that it can readily withstand the temperatures up to the 1000° for Monel metal, as referred to above, and higher. Also the water, while made sufficient in amount to cool the tube portion of the mandrel which extends through the furnace, is so regulated and applied to the head of the mandrel that the temperature will, under the influence of the hot tube be allowed to rise to the desired temperature. The Monel metal itself being drawn, should usually have a temperature of approximately 1800° Fahrenheit.

In the operation, therefore, of the apparatus, the tube after being heated up sufficiently in the furnace so that it will be delivered at a temperature of about 1800° Fahrenheit, is drawn through the die by the apparatus as before referred to, and sufficient water to keep the mandrel tube cool is allowed to enter through the tube 66. It will be seen, however, that this water is only allowed to come in contact with sufficient of the mandrel head to carry away sufficient heat so that the temperature of the head will be approximately 1000° Fahrenheit.

Certain features shown but not claimed herein are claimed in the copending applications Serial Numbers 188,709 and 235,099 filed August 27th, 1917 and May 17th, 1918, respectively.

While the invention has been illustrated in what is considered its best application, it may be carried out by other apparatus than that shown, and without adherence to the precise details recited, without departing from its spirit; it is not, therefore, limited to practice with the apparatus shown in the drawings, nor to the precise details recited, the invention being pointed out in the appended claims as required by the patent statutes.

What I claim is—

1. The method of drawing tubes, which consists in heating the tube, passing it under circumferentially rolling balls at proper drawing temperature and supporting the interior of the tube under the balls by a mandrel heated to a temperature of not less than 500° Fahrenheit.

2. The method of drawing Monel metal tubes, which consists in heating the work, passing the work under circumferentially rolling balls at proper drawing temperature and supporting the interior of the tube under the balls by a mandrel heated to a temperature suitable to maintain the desired drawing temperature of the Monel metal.

3. The method of drawing Monel metal tubes, which consists in heating the work, passing the work under circumferentially rolling balls at proper drawing temperature, and supporting the interior of the tube under the balls by a mandrel heated to a temperature of approximately 1000° Fahrenheit.

4. The method of drawing Monel metal tubes, which consists in heating the tube, passing the work under circumferentially rolling balls at proper drawing temperature, supporting the interior of the tube under the balls by a mandrel head, the remainder of the mandrel extending through the heated tube, before it reaches the balls, supplying cooling fluid to the mandrel within the heated tube to maintain desired temperature of the mandrel outside the head, the application of the cooling fluid to the said head being restricted to permit the said head to rise to the desired temperature for drawing the Monel metal.

5. In metal tube drawing apparatus, the combination with a die comprising balls for acting on the work and a rotatable support therefor, of a hollow mandrel extending within the heated tube and having a head, the portion of said head beneath the said balls being solid, and means for supplying a cooling fluid to the interior of said mandrel.

6. The method of drawing tubes which consists in heating the tube passing it through a die at proper drawing temperature and supporting the interior of the tube within the die by a mandrel heated to a temperature of not less than 500° Fahrenheit.

7. The method of drawing Monel metal tubes which consists in heating the work, passing the work through a die at proper drawing temperature and supporting the interior of the tube within the die by a mandrel heated to a temperature suitable to maintain the desired drawing temperature of the Monel metal.

8. The method of drawing Monel metal tubes which consists in heating the work, passing the work through a die at proper drawing temperature and supporting the interior of the tube within the die by a mandrel heated to a temperature of approximately 1000° Fahrenheit.

9. The method of drawing Monel metal tubes which consists in heating the tube, passing the work through a die at proper drawing temperature supporting the interior of the tube within the die by a mandrel head, the remainder of the mandrel extending through the heated tube before it reaches the die, supplying cooling fluid to the mandrel within the heated tube to maintain the desired temperature of the mandrel outside the head, the application of the cooling fluid to the said head being restricted to permit the said head to rise to the desired temperature for drawing the Monel metal.

In testimony whereof I have signed this specification this 11th day of June 1918.

LOUIS H. BRINKMAN.