

April 20, 1943.

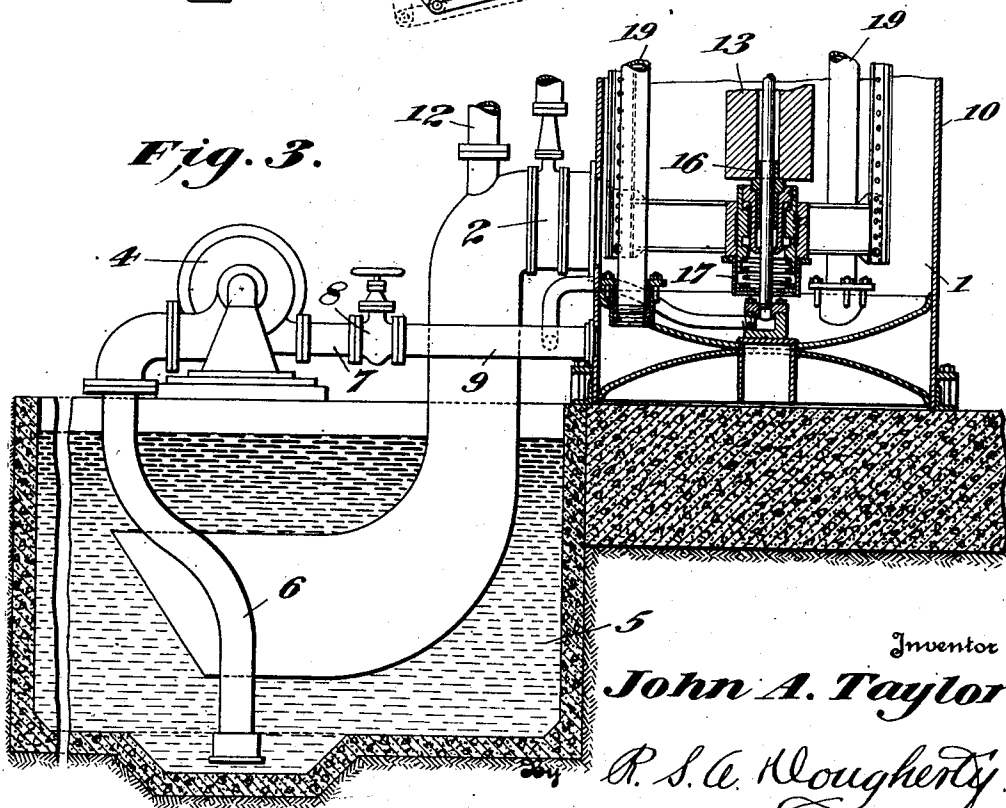
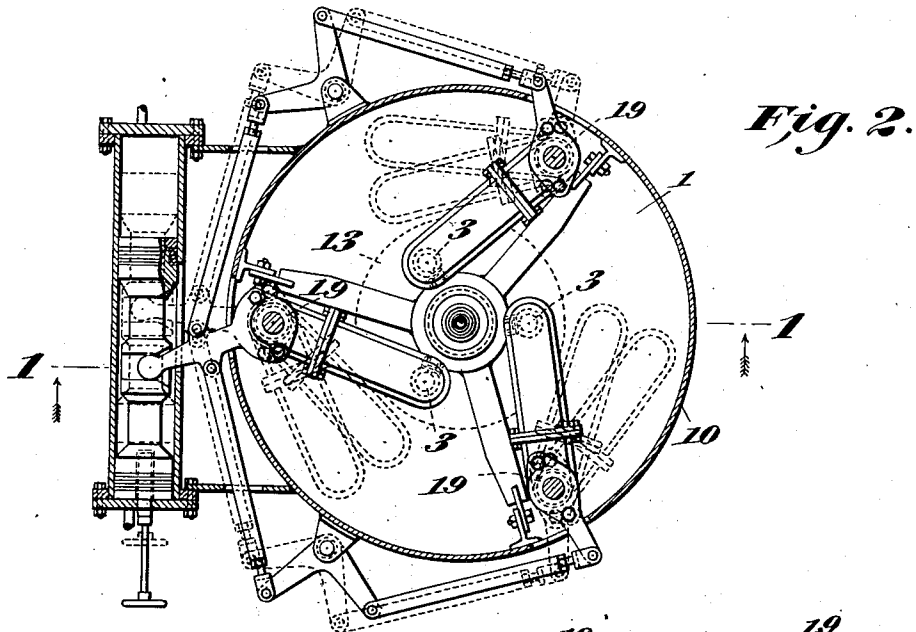
J. A. TAYLOR

2,317,233

METHOD AND APPARATUS FOR HARDENING STEEL ROLLS

Filed Aug. 3, 1940

2 Sheets-Sheet 2



Inventor

John A. Taylor.

R. S. A. Hougherty.

Attorney

April 20, 1943.

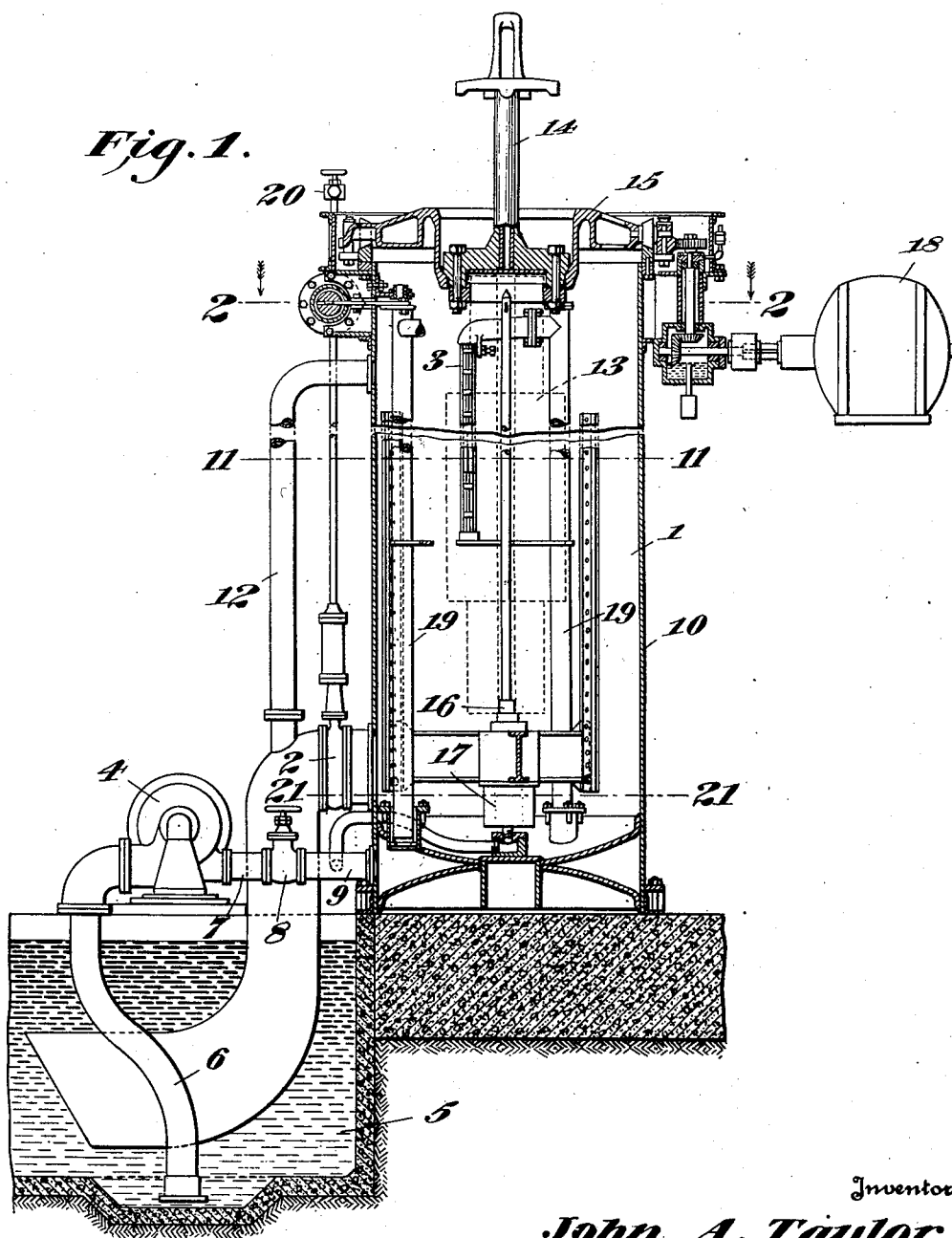
J. A. TAYLOR

2,317,233

METHOD AND APPARATUS FOR HARDENING STEEL ROLLS

Filed Aug. 3, 1940

2 Sheets-Sheet 1



Inventor

John A. Taylor.

By R. S. C. Kougherty.
Attorney

UNITED STATES PATENT OFFICE

2,317,233

METHOD AND APPARATUS FOR HARDENING
STEEL ROLLS

John A. Taylor, Bethlehem, Pa., assignor to Bethlehem Steel Company, a corporation of Pennsylvania

Application August 3, 1940, Serial No. 350,168

9 Claims. (Cl. 148—21)

This invention relates to new and useful improvements in the art of hardening and tempering cylindrical or tubular metal objects, and more specifically it relates to a method and apparatus for the quenching of steel rolling-mill rolls whereby greater depth of hardening and higher and more uniform surface hardness are more readily and efficiently attained.

Spray quenching machines, as heretofore used, have been generally successful in increasing the depth of hardness obtained in steel rolls of the type commonly used in rolling mills, but have had the drawback of producing an uneven surface hardness. This is ascribed to the fact that the sprays prevented steam formation, which is necessary to remove heating scale in the first moments of the quench, and patches of scale remaining on the roll caused soft spots on the surface.

To eliminate this condition, I have found that it is necessary to begin the quenching as a flood quench, the entire hot roll being submerged in water, and in a few seconds, after the scale has been removed, to change to a spray quench.

By this method, steam formed in the flood quench removes the scale and commences the hardening process, and the spray quench then continues the hardening process; resulting not only in the elimination of soft spots from the surface of the finished rolls, but also in a considerable increase in general surface hardness over that which could be obtained by using either a flood quench or a spray quench alone. This hardness increase as actually measured is from three to five points on the scleroscope, and the depth of hardness is correspondingly greater.

Having thus given a general description of the objects and advantages of my invention, I shall now in order to make the same more clear refer to the annexed two sheets of drawings forming a part of this specification and in which like characters of reference indicate like parts.

Figure 1 is a vertical longitudinal section of a hardening apparatus such as is shown and described in United States Letters Patent No. 2,146,793, granted to George J. Buckner, with my improvements shown in connection therewith;

Figure 2 is a transverse section taken on the line 2—2 of Figure 1, and showing the retractable spray pipes; and

Figure 3 is an enlarged detail view of the bottom portion of the apparatus shown in Figure 1.

In operating the quenching machine 1, outlet valve 2 is closed, spray pipes 3 are retracted in the manner described in the above mentioned

patent, and pump 4 pumps water from reservoir 5 through pipes 6 and 7, open valve 8, and pipe 9 into deep cylindrical quenching tank 10. The tank is thereby filled with water to the level 11—11, which in order to allow for the displacement produced by the roll is somewhat below the overflow outlet pipe 12. With the pump running, but with outlet valve 2 closed, the roll 13 which has previously been heated in a furnace slightly above its critical temperature range is rapidly lowered by means of hanger 14 into the tank 10 until totally immersed in the water and suspended from turntable 15 with its lower end supported by tubular center 16 and dash-pot 17. Rotation of the turntable, by means of motor 18 and gearing connections, is immediately begun; the spray pipes 3, fed through supply pipe 19, are brought into position adjacent to the roll surface. By this time, some twenty or thirty seconds, the roll surface is completely freed of scale, whereupon outlet valve 2 is opened by means of the controlling valve 20 and the water is allowed to drain from the tank to the level 21—21. The balance of the quench thereafter is continued by means of the spray pipes 3, in the manner described in the aforementioned United States Letters Patent No. 2,146,793.

The quenching fluid preferably used with my method and apparatus will be water, but I may use other quenching media, or chemical solutions, of the same or different temperatures, singly or in combination, if I so desire.

And although I have shown and described my invention in considerable detail, I do not wish to be limited to the exact and specific details shown and described, but may use such substitutions, modifications or equivalents thereof, as are embraced within the scope of my invention, or as are pointed out in the claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a machine for uniformly hardening without soft spots metallic rolls or the like, comprising a quenching tank, a turntable mounted on the quenching tank having means for suspending and supporting the upper end of a heated roll disposed in a vertical position, yielding means for supporting the lower end of the roll, means for rotating the turntable, means for supplying a quenching fluid to the quenching tank to initially descale and flood quench the roll, means for discharging the flood quenching fluid from the quenching tank after said flood quenching operation, and means for completing the opera-

tion of quenching the heated roll by a continuous sheet spray.

2. A machine for uniformly hardening and preventing soft spots in a heated metal article, comprising a tank, means for supplying a flood quenching fluid to the tank, means for briefly suspending the article in the flood quenching fluid to descale the article, means for discharging the flood quenching fluid from the tank after descaling and flood quenching the article, and means for subjecting the article to a spray to complete the quenching operation.

3. A machine for descaling and uniformly hardening without soft spots heated metal rolls or the like, comprising a deep cylindrical tank, means for supplying a descaling and flood-quenching fluid to the tank, a turntable mounted on the tank, means on the turntable for supporting the upper end of the roll adapted to suspend said roll in the descaling and flood-quenching fluid, means for rotating the turntable, means for removing the descaling and flood-quenching fluid from the tank after descaling and flood-quenching the roll, and means for subjecting the roll to a continuous sheet spray to complete the quenching operation.

4. A machine for removing scale and hardening without soft spots a heated metal roll or the like, comprising a tank for removing scale from the roll by flood quenching the roll, a pump for supplying a quenching fluid to the tank, an outlet valve controlled by an air valve and adapted for rapidly draining the tank after flood quenching the roll has removed the scale, a turntable, a hanger for vertically and centrally suspending the roll from the turntable, a dash-pot for resiliently and rotatably supporting the lower end of the roll, retractable spraying members for applying a continuous sheet spray to the roll, and a manually-operated valve for controlling the volume of the spray quench.

5. A machine for removing scale from a heated metal roll or the like and uniformly hardening the same free of soft spots, comprising a tank for containing a scale removing and quenching fluid, a pump for supplying said fluid to the tank, an outlet pipe for draining excess fluid opening on

the tank above the level of the fluid wherein said roll is immersed, an outlet valve connected to said outlet pipe adapted for rapid drainage of the scale-removing and quenching fluid from the tank after flood quenching the roll, a turntable for suspending and rotating the roll in the scale-removing and quenching fluid, means for rotating the turntable, and means for subjecting the roll to a spray to complete the quenching operation.

6. The method of preventing soft spots due to scale on a heated metal roll or the like, which consists in taking the roll heated slightly above its critical temperature range, briefly subjecting the roll to a steam-producing scale-removing and flood-quenching fluid, withdrawing said steam-producing scale-removing and flood-quenching fluid from the roll surfaces and then completing the quenching operation by applying to the roll a continuous sheet spray.

7. The method of uniformly hardening without soft spots a vertically suspended heated metal roll which consists in taking the roll heated above its upper critical temperature, removing scale therefrom by briefly flood-quenching said roll to evolve steam to remove surface scale while rotating the roll rapidly, quickly removing the flood-quenching fluid from the roll, and thereafter applying to said roll a continuous sheet spray.

8. The method of uniformly hardening without soft spots a metal roll or the like consisting of first heating the roll above the upper critical temperature, then briefly immersing the heated roll in a flood-quench fluid to evolve steam and thereby remove the scale from the surface of the roll, removing the flood-quenching fluid from the roll, and then spray quenching the roll.

9. The method of uniformly hardening without soft spots a metal roll or the like consisting in subjecting the roll heated slightly above its upper critical temperature to a flood-quenching fluid for approximately thirty seconds to produce steam and to remove all patches of scale from the roll, removing the flood quenching fluid from the roll, and then spray quenching the roll until cool.

JOHN A. TAYLOR.