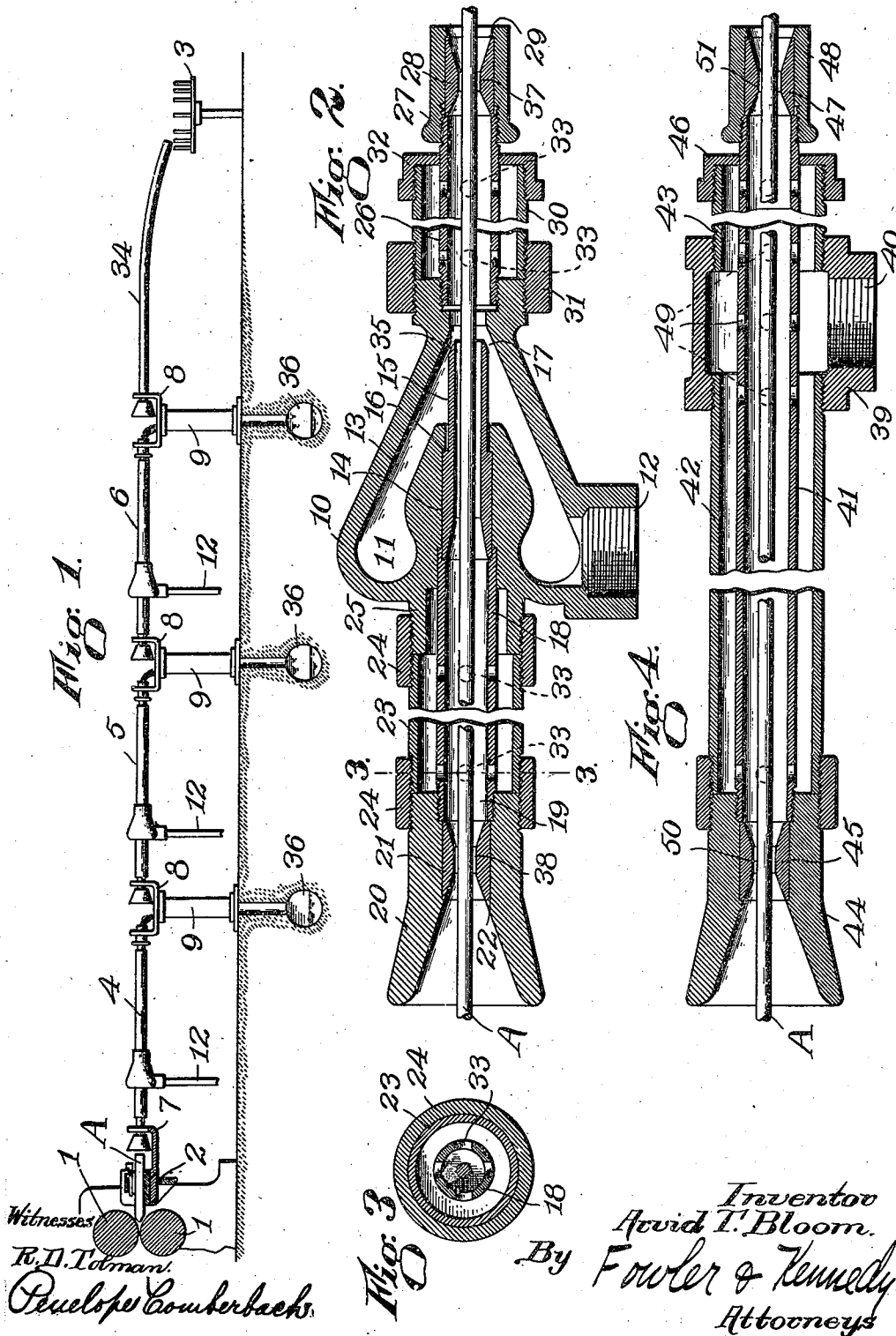


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 APPARATUS FOR COOLING METAL RODS.
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UNITED STATES PATENT OFFICE.

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APPARATUS FOR COOLING METAL RODS.

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Specification of Letters Patent.

Patented Jan. 2, 1917.

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To all whom it may concern.

Be it known that I, ARVID T. BLOOM, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented a new and useful Improvement in Apparatus for Cooling Metal Rods, of which the following, taken in connection with the accompanying drawings, is a specification.

The present invention relates to apparatus for cooling metal rods, and it consists in the provision of means whereby the rods, as delivered from the rolling mill in a red hot state, are passed through a body of water prior to being reeled.

As is well known, the slow cooling of rods delivered from a rolling mill results in the formation of scale thereon. It has been proposed heretofore to pass the red hot rods through a tank, or the like, containing water, or to direct a stream of water upon the rod, with the end in view not only to arrest the formation of scale, but also to cause the scale already formed to drop off, owing to the contraction of the rod due to sudden cooling. It is a well recognized fact that the introduction of water onto a highly heated metallic surface does not result in as considerable or immediate an evaporation of the water as is obtained when water is introduced onto a less heated metallic surface. Instead, there is produced a violent agitation of the water particles, owing to an apparent rapid repulsion thereof from said surface, and consequently the absorption of heat by the water is relatively low. Owing to this phenomenon, and also owing to the fact that the evaporation which does result forms a layer of steam which prevents access to the rod of the major portion of the cooling water, the above referred to methods of cooling have proven unsatisfactory.

The present invention aims to provide apparatus by means of which the cooling water is brought into more intimate contact with the surface of the rod so as to make the desired cooling thereof practicable and thorough; it contemplates the impingement of water against the rod with sufficient force to displace the initially formed layer of steam, and, furthermore, it contemplates the maintenance of sufficient pressure in the body of cooling water to permeate said steam layer and thereby effect the desired cooling.

The invention consists in the construction

and arrangement of parts hereinafter particularly described and claimed and illustrated in the accompanying drawings, in which—

Figure 1 is a diagrammatic view of the apparatus, the same being shown as interposed between a rolling mill and the receiving reel for the rod. Fig. 2 is a longitudinal sectional view through one of the sections of the apparatus. Fig. 3 is a section on line 3—3, Fig. 2, and Fig. 4 is a longitudinal sectional view through one of the sections of a modified form of my invention.

Like reference characters refer to similar parts in the different figures.

In Fig. 1 of the drawings 1, 1 denote the final or finishing rolls of a rolling mill, from which the red hot rod, denoted by the letter A, is continuously delivered. The said rod passes through suitably supported guide bars 2, positioned immediately in front of the rolls 1, 1, and prior to its winding upon a receiving reel 3, in the usual manner, it is cooled, for the purposes hereinbefore set forth, by passage through the apparatus forming the subject matter of the present invention. The cooling apparatus consists of a number of alined similar sections 4, 5 and 6, in the present instance three in number, through which the rod is passed successively on its way to the winding reel. The first section 4 has its rear end supported in a bracket 7 carried by the guide bars 2; its forward end is carried by one arm of a U-shaped bracket 8, supported by a hollow post 9, the other arm of said bracket 8 serving as the support for the rear end of the second section 5. Similar hollow posts 9, provided with U-shaped supporting brackets 8 are provided between each pair of sections for the support of the contiguous ends of the same.

The sections 4, 5 and 6 are identical, so that a description of one of them will suffice for all. Referring to Figs. 2 and 3, a water inlet member 10 has a surrounding annular chamber 11 adapted to be connected to a supply pipe 12. The chamber 11 which has a longitudinal inwardly converging extension 13, surrounds a bore 14 through the center of the member 10. The bore 14 receives a sleeve 15 having a flange in abutting relation to an annular shoulder 16 formed by counterboring said bore, the forward end of the sleeve 15 projecting beyond the end

of the bore into the extension 13 of the annular chamber 11, with its end spaced from the wall of the member 10 to provide an annular passage 17. A pipe 18, introduced into the rear end of the bore 14, holds the sleeve 15 against the shoulder 16. The rear end of pipe 18 is screw threaded into the forward end of a bore 19 formed in a funnel shaped receiving member 20, said pipe serving to retain a sleeve 21, which is provided with a restricted section intermediate its length, against a shoulder 22 formed in the bore 19. A tubular member 23, of greater internal diameter than the pipe 18, surrounds the latter, being secured by couplings 24, 24 to the end of the receiving member 20 and to an annular extension 25 of the member 10. The chamber 13 of the member 10 opens centrally through the forward end thereof into a pipe 26, screw threaded into the end of said member 10, and having threaded upon its outer end a shell 27, within which a sleeve 28, identical with the sleeve 21, is held against a shoulder 29. A tubular member 30, forming an annular chamber around the pipe 26, is secured to the member 10 by a coupling 31, and said annular chamber is closed at its outer end by a collar 32 carried by the pipe 26 and receiving the screw threaded outer end of the tubular member 30. The pipes 18 and 26 have annular series of openings 33 therethrough communicating the interior of said pipes with the annular chambers formed around said pipes by the members 23 and 30 respectively.

The several sections 4, 5 and 6 are supported as hereinbefore described and shown in Fig. 1, with the shell 27 of each spaced from the receiving member 20 of the next succeeding section of the series. The red hot rod A travels successively through the several sections, passing finally into a tubular guide section 34, having a flaring receiving end spaced from the shell 27 of the last section, before being wound upon reel 3. During its passage through each section the rod is in intimate contact with the cooling water, which is introduced to the chamber 11 of each section under considerable pressure. The water impinges against the rod in an annular inwardly directed jet, completely surrounding the same, by reason of its passage through the annular space 17, formed between the inner wall of the member 10 and the parallel beveled edge 35 of the forward end of the sleeve 15. The jet thus formed is of sufficient force to displace any steam which may have formed around the surface of the rod, and, furthermore, the continuous and forcible impingement of the water against the rod in this manner overcomes the tendency of the highly heated surface to repel the water particles, and results in the intimate and constant contact

thereof with said surface. By reason of the forward direction of said jet, the bulk of the water in each section flows forwardly into the pipe 26, passing out through the open end of the shell 27 and falling into the underlying hollow post 9, from which it is led away through a suitable conduit 36. By reason of the gradual convergence of the inner walls of the sleeve 28 to form the restricted passage 37, the velocity of the water is rendered very high at this point, thereby securing an additional forcible and intimate contact of the water with the surface of the rod. After passage through said restricted opening, the force of the jet is rendered inconsequential by reason of the outward divergence of the passage through the sleeve, causing the water to fall naturally into the hollow post 9, instead of being impelled across into the open end of the next section.

The accumulation of water pressure in the forward end of each section as above described, causes a portion of the entering water to flow rearwardly through the sleeve 15 to fill the pipe 18. The restricted passage through the said sleeve brings the water in intimate contact with the rod, and furthermore, the outflow of such water through the end of the receiving member 20 into the underlying hollow post 9 is attended by an increase in velocity due to the passage through the sleeve 21, which, as stated before, is identical with the sleeve 28. The force of the jet thus formed is practically rendered inconsequential, due to the rearward divergence of the inner walls of said sleeve, beyond the restricted passage 38 thereof. The openings 33 in the pipes 18 and 26 permit the cooling water to fill the annular spaces formed between said pipes and the surrounding tubular members 23 and 30 respectively, thereby providing extended surfaces through which a portion of the heat absorbed by said water is conducted away. The tubular members 23 and 30 serve as supports for the pipes 18 and 26, to prevent distortion and insure alinement of the same. It will be noted particularly that in every instance in which high velocity jets are formed in the manner above described, said jets are annular, in surrounding relation to the rod, so that their impingement thereon has no tendency to deflect or bend the rod, and their effect is uniform over the entire surface thereof.

In the modified form shown in Fig. 4, a hollow water inlet member 39, provided with a water connection 40, has passing completely therethrough a pipe or tube 41, which is spaced from the inner walls of said inlet member. Tubular members 42 and 43 extend in opposite directions from the member 39, in surrounding relation to and spaced from the portions of the pipe 41

which project beyond said member 39. The member 42 is coupled at its rear end to a funnel shaped receiving member 44, within which a sleeve 45 is retained by the abutting rear end of the pipe 41, as in the form of the invention first described. The forward end of the member 43 enters a collar 46 carried near the forward end of the pipe 41, which pipe 41 retains a sleeve 47 in a shell 48 carried thereby, as in the first described form of the invention. Water under pressure entering the member 39 fills the annular space surrounding the pipe 41 throughout its entire length, and flows through the openings 49 of said pipe into the interior thereof. As shown, each set of openings 49 is annular, the openings being equally spaced around the circumference of the pipe in sets of four, so that each jet produced by the passage of water through one opening is opposed by a similar jet through an opposite opening, thereby preventing distortion of the rod. The opposing jets through the openings 49 impinge forcibly on the rod, preventing the formation of a protecting layer of steam and insuring intimate contact of the water with the surface of the rod, in a similar manner to the annular jet through the passage 17 in the first described form of the invention. The water thus introduced to the pipe 41 finds exit at both ends thereof through the restricted passages 50 and 51 in the sleeves 45 and 47 respectively. The annular jets of high velocity formed by the passage of the water through these sleeves develop the desired intimate and forcible contact with the surface of the rod as in the first described form of the invention, and their force is ultimately rendered inconsequential before passage of the water into the outlet conduits at each end of the section.

I claim,

1. In an apparatus for cooling a metal rod, means for directing cooling water against said rod in an annular jet surrounding said rod.

2. In an apparatus for cooling a metal rod, a pipe for the passage of said rod, and means for admitting cooling water to said pipe in an annular jet surrounding said rod.

3. In an apparatus for cooling a metal rod, a pipe for the passage of said rod, means for admitting cooling water to said pipe, and means for restricting the outlet of water from said pipe.

4. In an apparatus for cooling a metal rod, a pipe for the passage of said rod, means for admitting water under pressure to said pipe, and a second pipe surrounding

the first mentioned pipe and in communication with the interior thereof.

5. In an apparatus for cooling a metal rod, a plurality of sections, each comprising a pipe for the passage of said rod, means for admitting water under pressure to the pipe of each section, and means for restricting the outlet of water from each pipe.

6. In an apparatus for cooling a metal rod, a pipe for the passage of said rod, and means for admitting cooling water to said pipe, said pipe having a restricted opening near one end to increase the velocity of the water therethrough.

7. In an apparatus for cooling a metal rod, a pipe for the passage of said rod, means for admitting water under pressure to said pipe, and means for forming a high velocity jet within said pipe in surrounding relation to said rod.

8. In an apparatus for cooling a metal rod, a pipe for the passage of said rod, means for admitting water to said pipe, and means for forming a high velocity jet of water in said pipe in surrounding relation to said rod, and means whereby the force of said jet is diminished at the end of said pipe.

9. In an apparatus for cooling a metal rod, a pipe for the passage of said rod, means for admitting water to said pipe, and means for directing said water against said rod in a surrounding jet near each end of said pipe, and means whereby the force of said jets is diminished at the ends of said pipe.

10. In an apparatus for cooling a metal rod, a pipe for the passage of said rod, means for admitting cooling water to said pipe, and means for restricting the outlet of water from said pipe to maintain the water therein under pressure.

11. In an apparatus for cooling a metal rod, a pipe for the passage of said rod, and means for effecting the direct impingement of cooling water on said rod in its passage through said pipe.

12. In an apparatus for cooling a metal rod, a pipe for the passage of said rod, and means for effecting the direct impingement of cooling water on said rod in a surrounding jet in its passage through said pipe.

Dated this 18th day of June 1914.

ARVID T. BLOOM.

Witnesses:

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E. J. JANIBZKY.