June 3, 1924. 1,496,531

C. A. EWING

METHOD OF AND APPARATUS FOR TREATING STEEL

Filed Dec. 23, 1920 3 Sheets-Sheet 1

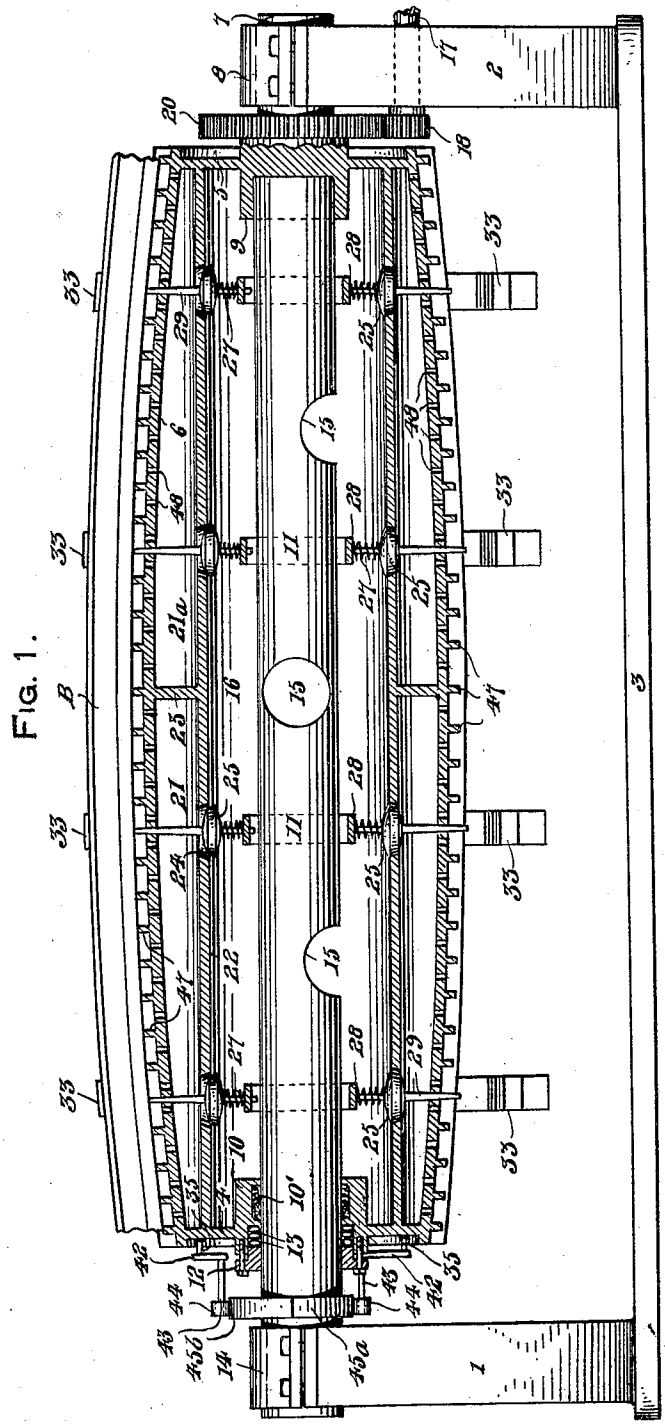


FIG. 1.

Inventor
C. A. Ewing
by
F. A. Bryant.
Attorney

June 3, 1924. 1,496,531

C. A. EWING

METHOD OF AND APPARATUS FOR TREATING STEEL

Filed Dec. 23, 1920 3 Sheets-Sheet 2

FIG. 2.

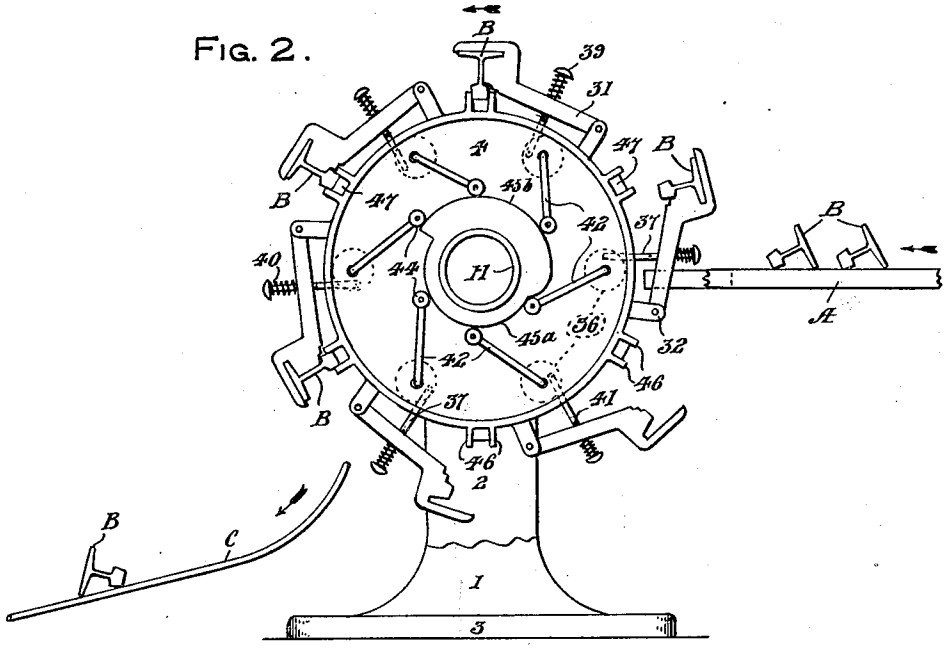
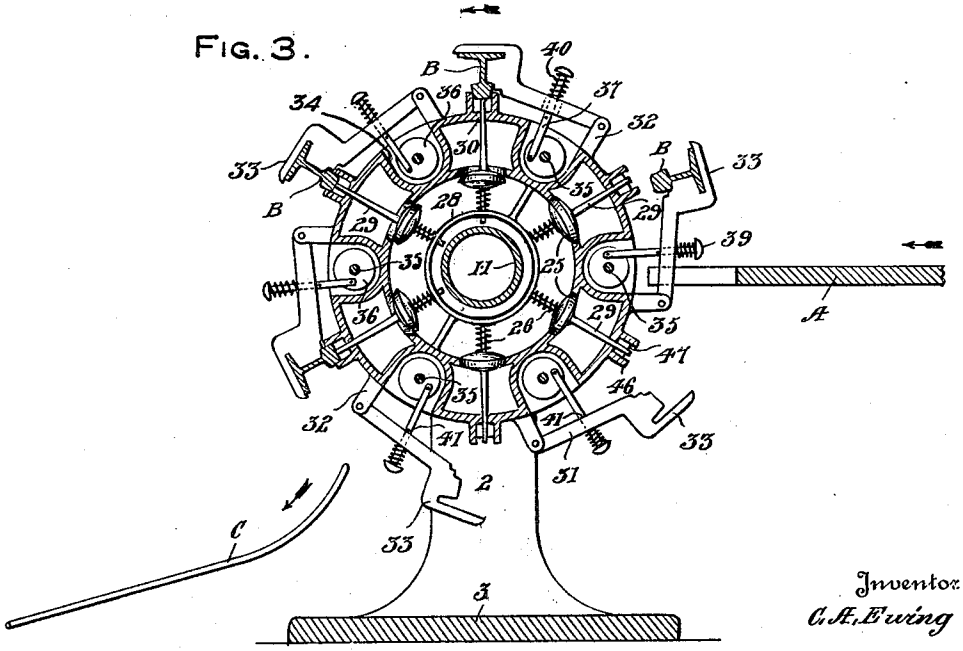


FIG. 3.



Inventor
C. A. Ewing

By T. W. Bryant.
Attorney

June 3, 1924. 1,496,531

C. A. EWING

METHOD OF AND APPARATUS FOR TREATING STEEL

Filed Dec. 23, 1920 3 Sheets-Sheet 3

FIG. 4.

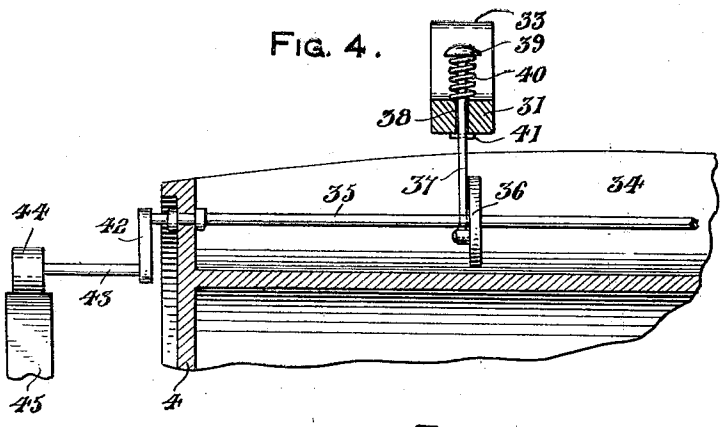


FIG. 5.

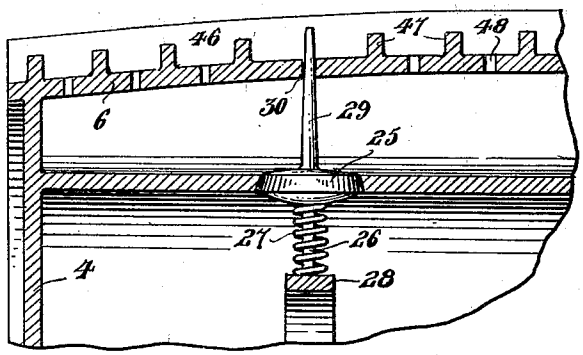


FIG. 6.

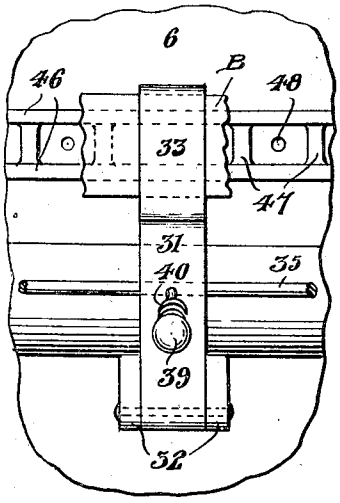
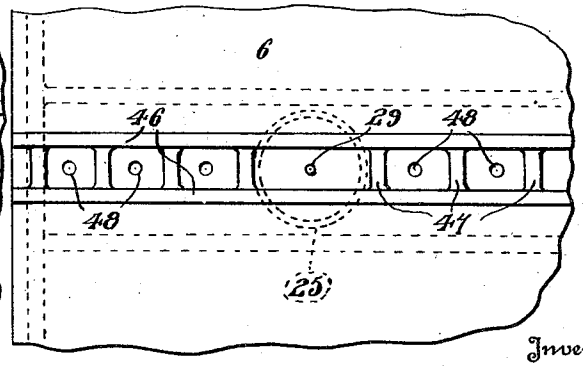


FIG. 7.



Inventor
C. A. Ewing

By T. D. Bryant.

Attorney

Patented June 3, 1924. 1,496,531

UNITED STATES PATENT OFFICE.

CHARLES A. EWING, OF STEELTON, PENNSYLVANIA.

METHOD OF AND APPARATUS FOR TREATING STEEL.

Application filed December 23, 1920. Serial No. 432,759.

To all whom it may concern:

Be it known that I, CHARLES A. EWING, a citizen of the United States of America, residing at Steelton, in the county of Dauphin and State of Pennsylvania, have invented certain new and useful Improvements in Methods of and Apparatus for Treating Steel, of which the following is a specification.

This invention has reference to a new and improved method and apparatus for treating steel, and more especially steel rails for railways and tramways wherein the rails are tempered to produce an unusually hard and tough or sorbitic rail head to the exclusion of all brittleness and faulty microstructure.

One of the objects of the invention embodies an improved method and apparatus for hardening steel rails wherein the hardening medium, which may be air, gas or elastic fluid is caused to move during the treatment of the rail.

Another object of the invention resides in the method of and apparatus for continuously moving the rail during the hardening treatment thereof with the hardening medium also movable to form a continuous uninterrupted treatment of the rails.

The apparatus employed for carrying the method into operation embodies a moving receptacle containing the hardening medium with the rails automatically clamped thereto in a manner to present the head of the rail for direct contact by the hardening medium during the entire period that the rail is clamped to the receptacle.

Another object accomplished by the apparatus has reference to the manner of clamping the rail to the receptacle to provide a substantially confined pocket for the head of the rail to cause an even distribution of the hardening medium, such as air, gas or elastic fluid over the entire head of the rail.

A further object of the apparatus employed is to provide automatically operated releasing valves to permit the hardening medium to flow in contact with the rail immediately upon the clamping of the rail to the support containing the hardening medium with a subsequent automatically closing operation of the valves when the rails are delivered from the support.

A further object of the invention is to provide a machine or device for hardening rails wherein a rotatable receptacle or casing containing the hardening medium is provided with a plurality of automatically operating rail engaging clamps for maintaining the rails secured to the casing during partial rotation thereof.

A still further object of the invention is to provide an apparatus for hardening steel rails wherein a rotatable receptacle containing the hardening medium has rails automatically clamped thereto during a portion of the rotation of the receptacle with a plurality of valves adapted to be opened during the clamping movement of the rails to the casing to permit the flow of hardening medium in the casing direct to the heads of the rails.

With the above general objects in view and others that will become apparent as the nature of the invention is better understood, the same consists in the novel form, combination and arrangement of parts hereinafter more fully described, shown in the accompanying drawings and claimed.

In the drawings, wherein like reference characters designate corresponding parts throughout the several views,

Figure 1 is a longitudinal sectional view of a rail hardening machine constructed in accordance with the present invention, there being illustrated a rotatable casing or receptacle of oval formation with the valves controlling the flow of the hardening medium at the upper side thereof opened and the lower valves closed,

Figure 2 is an end elevational view of the machine showing the operating cam for closing the rail clamping arms and the air pipe,

Figure 3 is a vertical cross sectional view of the machine shown in Fig. 1,

Figure 4 is a detail sectional view showing the cam and rod operating thereby for shifting the rail clamps,

Figure 5 is a detail sectional view showing a portion of the rotatable receptacle

and one of the control valves for the hardening medium, the stem of the valve projecting slightly beyond the rail supporting webs,

Figure 6 is a fragmentary plan view showing one of the rail clamps, and

Figure 7 is a fragmentary plan view of a portion of the receptacle showing the longitudinal pocket receiving the head of the rail with the supporting webs of the rail head and the passage openings in the bottom wall of the pocket.

In the art to which this invention relates, steel rails have been tempered by many methods to produce a hard and tough rail head and the absence of all brittleness and flaws in the structure of the rail, such methods employing the submersion of the heated rails in fluid solutions and also by the application, when the rails are heated above the critical temperature, of air, gas or elastic fluids. In the latter method it has heretofore been customary to provide a stationary air or gas supply pipe line with devices for moving the rail in proximity of the pipe line with the subsequent spreading over the surface of the rail the hardening fluid. Considerable difficulty is encountered in handling the rails and moving the same into position for treatment in this process while a considerable quantity of the hardening medium is lost in view of the spreading thereof.

The present invention aims to overcome all of these difficulties, and embodies a novel method of treating the rails for hardening and a new apparatus for carrying the method into operation. Briefly described, the method expressed in this application provides for the continuous movement of the rail during the hardening process and also a continuous movement of the casing or receptacle containing the tempering medium during the tempering process. It is not intended to limit this invention to any particular direction of movement given the rails and hardening medium during the hardening process, but there is shown in the accompanying drawings for purposes of illustration only, a rotatable receptacle having the hardening medium delivered thereto and confined therein under the control of valve devices. A plurality of rail clamps are carried by the peripheral wall of the receptacle and are operated under the influence of a cam and lever arrangement whereby the rails are received in the clamps and automatically moved home on the receptacle by the cam to be so retained during one-half revolution of the receptacle, the cam operating to permit the release of the clamps at the end of the travel of the rails at which time the rails are delivered from the receptacle. The outer wall of the receptacle is provided with a plurality of spaced longitudinally extending pockets or cavities for receiving and supporting the rail heads. The valve devices, each carry an elongated stem extending radially of the receptacle and into the adjacent pocket to be engaged by the rail head when clamped to the receptacle to open the valve and permit the flow of the hardening medium directly onto the rail head. The pocket is so constructed as to provide a substantial confining area for the hardening medium to insure an even distribution of the hardening medium over the entire rail head. The valve devices being automatically opened by the clamping home of the rails, the same are automatically closed when the rails are released from the receptacle so that a wasteful escape of the hardening medium is eliminated. In the manufacture of steel rails, the same are preformed prior to hardening by passing through suitable roll machines to provide a camber or arcuate bend in the rail with the inner circle of the arc lying in the rail base. In this invention the rails are reversely cambered so that the rail section embodying the greatest area, i. e., the head lies in the inner arc and to compensate for this curvature, the rotatable receptacle for supporting the rails during the hardening thereof has a central bilge tapering toward the opposite ends, although it is not essential in carrying the method expressed in this application into operation to provide the oval receptacle as a receptacle including a cylindrical wall may as well be adapted for the purpose.

It being understood that the invention illustrated in the accompanying drawings shows only one embodiment thereof, such showing comprises in detail the provision of a base supporting frame including end standards 1 and 2 with the connecting foot plate 3. If desired, the rotating receptacle supported in the end standards may be slightly varied in construction to provide for intermediate supports when the receptacle is constructed of unusual length. The receptacle construction is shown more clearly in Figs. 1 and 5 to 7, the same embodying end walls 4 and 5 connected by an oval receptacle wall 6. The end wall 5 carries a stub shaft 7 mounted in a journal bearing 8 in the upper end of the standard 2 with the inner end of the stub shaft extending inwardly of the end wall 5, hollowed to provide a cup bearing 9 for purposes presently to appear. The support for the end wall 4 includes a bearing flange 10 through which a pipe 11 extends with a packing bearing 10′ between the wall flange 10 and the pipe 11. A packing gland 12 surrounding the pipe 11 at the outer side of the wall 4 confines the ball bearings 13 between the packing gland and the flange 10 so that the casing may freely rotate on the

pipe with an air tight connection between the casing flange 10 and the pipe. The outer end of the air pipe is rigidly secured in the bearing 14 at the upper end of the standard 1 while the inner end thereof is loosely received in the cup bearing 9 of the stub shaft 7, this construction being clearly shown in Fig. 1. As illustrated, lateral openings or ports 15 are provided in the side walls of the pipe 11 to permit the free passage of the hardening medium, such as air, gas or elastic fluid into the chamber 16 of the receptacle. The rotation of the receptacle is effected by a power shaft 17 carrying a gear 18 meshing with a relatively large gear 20 upon the stub axle 7 so that the receptacle is rotated at a relatively low rate of speed. While a gearing connection between the power shaft and casing is illustrated, it is understood that other forms of power transmission mechanism may be employed such as pulleys upon the shafts 7 and 17 with a connecting belt.

As shown in Figs. 1 and 5 the receptacle is divided into chambers 16 and 21 and 21[a] by the cylindrical partition wall 22 surrounding the pipe 11 and spaced from the wall 6, the ends of the cylindrical partition wall being integral with or otherwise fixed to the ends walls 4 and 5, a circular partition 23 formed midway the end walls 4 and 5 providing for the separate outer chambers 21 and 21[a].

To confine the hardening medium within the chamber 16 received from the pipe 11 and to regulate the flow thereof to the outer chambers 21 and 21[a] the cylindrical partition 22 is provided with a plurality of spaced valve openings 24 closed by a disk valve 25 carrying a stem 26 upon the inner end thereof surrounded by a coil spring 27 engaging at its inner end an abutment 28 fixed to the wall 22 and through which abutment the stem 26 is adapted to project upon opening movement of the valve as shown in Fig. 1, each valve carrying an outwardly directed stem 29 projecting through a perforation 30 in the receptacle wall 6 as shown in Figs. 1 and 5 for purposes presently to appear. It will be seen, from an inspection of Fig. 1 that the opening of certain valves will cause the fluid in the chamber 16 to pass into either or both of the outer chambers 21 and 21[a].

The rails upon the hot bed are delivered to the machine and are picked up by the clamping arms and delivered to the receptacle to be carried thereby during partial rotation of the receptacle, the clamping arms each including a lever 31 pivotally mounted upon a support 32 carried by the outer face of the receptacle wall 6 with the free swinging end 33 thereof fashioned to receive the base flanges of a rail. As shown in Figs. 2 to 4 the receptacle wall 6 is provided with longitudinally extending peripherally spaced and inwardly directed surface depression walls 34 adjacent the clamp pivots 32 with a longitudinally extending shaft 35 disposed in each depression and journaled in the end walls 4 and 5 of the receptacle. At intervals, disks 36 spaced inwardly of the longitudinally alined clamp arms 31 are fixed to the shaft 35 and are operatively associated with the clamps 31 by radial rods 37, each pivoted to the side face of the adjacent disk 36 and extending through a slot 38 in the clamp arm 31. A head 39 is carried by the outer end of each rod 37 and the rod, between the head and clamp arm is surrounded by a compression coil spring 40 normally forcing the clamp arm 31 toward the wall 6 of the receptacle and limited by the radial lugs 41 on the rod 37 inwardly of the clamp arm. The clamp arms 31 associated with a single shaft 35 are simultaneously operated upon rotation of the shaft, the shaft adjacent the end wall 4 extending outwardly thereof and carrying a lateral arm 42 with a short end rod 43 extending parallel with the shaft 35 and having upon the free end thereof a roller 44 for engagement with a cam 45 fixed to the stationary pipe 11. Upon rotation of the casing within the bearing 8 and upon the pipe 11 at the opposite end of the casing the shafts 35 moving with the casing present the rollers 44 upon the ends thereof for engagement with the cam 45 and as shown in Fig. 2 the cylindrical surface 45[a] of the cam engaged by the rollers 44 will present the clamps in an open condition while continued movement of the roller to engage the cam face 45[b] will cause a rocking movement of the arms 42 and rotation of the shafts 35 and disks 36 fixed to the shaft to move the clamp arms 31 radially inwardly toward the casing to a closed position illustrated at the upper side of Fig. 2.

Assuming that the clamping arms are in the open position at the lower side of Fig. 2 with the casing rotating in the direction of the arrow, the clamping arms move upwardly between the rails of the hot bed A and receive a rail B in the clamp end 33 and upon continued movement the cam surface 45[b] of the cam 45 moves the arms 42 to rotate the shafts 35 to move the arms and rails supported therein toward the receptacle. The head of he rail is positioned adjacent the wall 6 and is received in a longitudinal pocket formed by spaced radial ribs 46 extending between the end walls 4 and 5 of the receptacle and connected by transverse webs 47 between which an opening 48 in the wall 6 is formed. As shown in Figs. 1, 3 and 5, the outer stem 29 of the valve 25 projects into the pocket between the side ribs 46 with the outer ends thereof terminating in a plane slighly outwardly of the upper surfaces of the connecting webs 47 of the

ribs. When the clamps move inwardly toward the receptacle to place the head of the rail B between the ribs 46 for support on the webs 47 the outer ends of the valve stems 29 are engaged by the rails to force the valve stems inwardly and remove the valves 25 from the seats 24 against the face of the valve springs 27. The hardening medium within the chamber 16 passes into the outer chambers 21 and 21[a] for passage through the receptacle wall openings 48 for direct impinging against the head of the rail, the rail comparatively closing the outer open side of the spaced ribs 46. The hardening medium is confined within the pocket formed by the ribs to thoroughly quench the rail head and escape laterally thereof. The rotation of the receptacle may be timed to permit the temperature of the rails to fall below the critical temperature prior to discharge of the rail from the receptacle clamps so that the heat remaining in the rail in being redistributed will not raise the temperature in the rails above the critical temperature. The rails B are retained in clamped relations on the receptacle through a movement of substantially one-half rotation of the receptacle so that when the rollers 44 escape the cam wall 45[b] the weight of the rails will move the clamps outwardly to permit their free discharge on the receiving platform C as shown in Fig. 2.

The resilient mounting of the clamp arms 31 will permit a limited movement thereof when in clamped position relative to the receptacle to provide for partial contraction and expansion of the rails but such movement will not be sufficient to permit the escape of the rails from the clamps until the rollers 44 are free of the cam face 45[b]. Also by the partition wall 23 rails of different lengths may be mounted in series upon the receptacle, and in the case of a relatively short rail the valves 25 controlling communication between the chamber 16 and either of the chambers 21 and 21[a] will alone be operated to permit the flow of hardening fluid from the chamber 16 to either outer chamber.

It is not intended that this invention should be limited by the terms herein employed or the time periods in applying the hardening medium to the rails, it being also understood that working conditions may necessitate various changes in the details of construction without departing from the spirit of the broad invention. When the rails are delivered from the receptacle, the same are slightly cambered and during the cooling of the base flange sections thereof the same are partially straightened by the natural hardening of the base flanges, but it is to be understood that suitable devices may be employed for finishing the rails in exact alinement as may be desired.

The invention broadly includes an apparatus for moving the rails during the hardening process thereof and also moving a receptacle containing the tempering medium. The invention further includes as a novel feature the automatically operating valve devices for opening and closing the supply of hardening medium when the rails are received on the carrier and delivered therefrom, while other advantages will be apparent from the above detail description of the method and apparatus employed to accomplish the results.

What is claimed as new is:—

1. The method of hardening steel rails after rolling while the temperature of the rail is above the critical temperature, consisting in moving the hardening medium during treatment of the rail and maintaining the same relation to the rail when directing the hardening medium thereon.

2. The method of hardening steel rails after rolling while the temperature of the rail is above the critical temperature, consisting in rotating the hardening medium during treatment of the rail.

3. The method of hardening steel rails after rolling while the temperature of the rail is above the critical temperature, consisting in moving the rails during treatment thereof and directing the hardening medium only on the heads of the rails.

4. The method of hardening steel rails after rolling while the temperature of the rails is above the critical temperature, consisting in moving the rails in an arcuate path during treatment thereof and directing the hardening medium only on the heads of the rails.

5. The method of hardening steel rails after rolling while the temperature of the rails is above the critical temperature, consisting in mounting the rails on a moving receptacle, containing a hardening medium, and moving the receptacle and rails during treatment thereof.

6. The method of hardening steel rails after rolling while the temperature of the rails is above the critical temperature, consisting in simultaneously moving a body of hardening medium and the rails.

7. The method of hardening steel rails after rolling while the temperature of the rails is above the critical temperature, consisting in successively delivering the rails to a moving receptacle containing a hardening medium, and supplying the hardening medium directly to the head of the rails while supported on the moving receptacle.

8. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature, including a moving receptacle containing air, gas or elastic fluid and constructed for directing the hardening medium only on the heads thereof.

9. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature, including a rotating receptacle containing air, gas or elastic fluid.

10. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature, including a movable receptacle containing air, gas or elastic fluid, and means associated with the receptacle for supporting rails thereon to be hardened in a manner to cause the hardening medium to be directed only on the heads of the rails.

11. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature, including a rotatable receptacle containing air, gas or elastic fluid, and means associated with the receptacle for supporting rails thereon to be hardened.

12. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature, including a movable receptacle containing air, gas or elastic fluid, means associated with the receptacle for supporting rails thereon to be hardened, and means carried by the receptacle adapted to be operated by the rails to permit the flow of the hardening medium onto the rails.

13. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature, including a movable receptacle containing air, gas or elastic fluid, means associated with the receptacle for supporting rails thereon to be hardened, and means carried by the receptacle adapted to be automatically operated upon the mounting of rails on the receptacle to permit the flow of the hardening medium in the receptacle onto the rails.

14. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature, including a movable receptacle containing air, gas or elastic fluid, and means associated with the receptacle for supporting rails thereon to be hardened in a manner to cause the hardening medium to be directed only upon the heads of the rails.

15. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature, including a rotatable receptacle containing air, gas or elastic fluid, means associated with the receptacle for supporting rails thereon to be hardened, and means carried by the receptacle adapted to be operated by the rails to permit the flow of the hardening medium onto the rails.

16. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature, including a rotatable receptacle containing air, gas or elastic fluid, means associated with the receptacle for supporting rails thereon to be hardened, and means carried by the receptacle adapted to be automatically operated upon the mounting of rails on the receptacle to permit the flow of the hardening medium in the receptacle onto the rails.

17. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature, including a rotatable receptacle containing air, gas or elastic fluid, spaced sets of longitudinally alined rail engaging clamps carried by the receptacle, and means for holding the clamps in closed position during partial rotation of the receptacle.

18. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature, including a rotatable receptacle containing air, gas or elastic fluid, spaced sets of longitudinally alined rail engaging clamps carried by the receptacle, means for holding the clamps in closed position during partial rotation of the receptacle, and means associated with the receptacle adapted to be operated when the clamps move the rails to clamped position to permit the flow of hardening medium in the receptacle onto the rails.

19. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature, including a movable receptacle containing air, gas or elastic fluid, means associated with the receptacle for supporting rails thereon to be hardened in a manner to cause the hardening medium to be directed only upon the heads of the rails, and means for releasing the rail supporting means.

20. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature, including a rotatable receptacle containing air, gas or elastic fluid, means associated with the receptacle for supporting rails thereon to be hardened, and means for releasing the rail supporting means.

21. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature, including a movable receptacle containing air, gas or elastic fluid, means associated with the receptacle for supporting rails thereon to be hardened, means carried by the receptacle adapted to be operated by the rails to permit the flow of the hardening medium onto the rails, and means for releasing the rail supporting means.

22. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature, including a movable receptacle containing air, gas or elastic fluid, means associated with the receptacle for supporting rails thereon to be hardened, means carried by the receptacle adapted to be automatically operated upon the mounting of rails on the receptacle to

permit the flow of the hardening medium in the receptacle onto the rails, and means for releasing the rail supporting means.

23. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature including a rotatable receptacle, rail clamps carried by the receptacle, longitudinally extending peripherally spaced pockets formed on the outer face of the receptacle for the reception of the rail heads, and valve devices carried by the receptacle adapted to be engaged by the rails to permit the flow of hardening medium from the receptacle into the pockets for contact with the rail heads.

24. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature including a rotatable receptacle, rail clamps carried by the receptacle, longitudinally extending peripherally spaced pockets formed on the outer face of the receptacle for the reception of the rail head, valve devices carried by the receptacle adapted to be engaged by the rails to permit the flow of hardening medium from the receptacle into the pockets for contact with the rail heads, and means for moving the clamp arms to closed position and permitting a subsequent release thereof.

25. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature including a rotatable receptacle, rail clamps carried by the receptacle, longitudinally extending peripherally spaced pockets formed on the outer face of the receptacle for the reception of the rail heads, spaced webs within the pockets for supporting the rails, and means for moving the clamp arms to closed position and permitting a subsequent release thereof.

26. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature, including a movable receptacle, longitudinally extending peripherally spaced pockets carried by the receptacle, rail supporting webs within the pockets, and valve devices for controlling communication between the interior of the receptacle and the pockets adapted to be operated upon the reception of a rail in the pocket.

27. Apparatus for hardening tempering steel rails while the temperature of the rails is above the critical temperature, including a movable receptacle, longitudinally extending peripherally spaced pockets carried by the receptacle, rail supporting webs within the pockets, valve devices for controlling communication between the interior of the receptacle and the pockets adapted to be operated upon the reception of a rail in the pocket, and means carried by the receptacle for engaging a rail to position the same in a pocket.

28. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature, including a receptacle, a stub shaft supporting one end of the receptacle, a journal bearing for said shaft, means for rotating said shaft, a pipe for conveying a hardening medium extending into the receptacle from the opposite end thereof, said receptacle being journaled upon said pipe, a rigid bearing for said pipe, means for controlling communication between the interior of the receptacle and the atmosphere, and rail engaging clamps carried by the receptacle.

29. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature, including a receptacle, a stub shaft supporting one end of the receptacle, a journal bearing for said shaft, means for rotating said shaft, a pipe for conveying a hardening medium extending into the receptacle from the opposite end thereof, said receptacle being journaled upon said pipe, a rigid bearing for said pipe, means for controlling communication between the interior of the receptacle and the atmosphere, and rail engaging clamps carried by the receptacle, said means including a plurality of valves each carrying a stem extending outwardly of the casing and adapted to be operated by a rail supported on the casing.

30. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature, including a receptacle, a stub shaft supporting one end of the receptacle, a journal bearing for said shaft, means for rotating said shaft, a pipe for conveying a hardening medium extending into the receptacle from the opposite end thereof, said receptacle being journaled upon said pipe, a rigid bearing for said pipe, means for controlling communication between the interior of the receptacle and the atmosphere, rail engaging clamps carried by the receptacle, said means including a cylindrical partition wall within the casing dividing the casing into inner and outer chambers, said partition having valve seats therein, tensioned valves mounted on said seats and each carrying a stem projecting outwardly of the casing wall and adapted to be operated by a rail mounted on the casing.

31. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature, including a receptacle, a stub shaft supporting one end of the receptacle, a journal bearing for said shaft, means for rotating said shaft, a pipe for conveying a hardening medium extending into the receptacle from the opposite end thereof, said receptacle being journaled upon said pipe, a rigid bearing for said pipe, means for controlling communication between the interior of the receptacle and the

atmosphere, rail engaging clamps carried by the receptacle, said last named means including a cylindrical partition wall within the casing dividing the casing into inner and outer chambers, said partition having valve seats therein, tensioned valves mounted on said seats and each carrying a stem projecting outwardly of the casing wall and adapted to be operated by a rail mounted on the casing, and a central transverse partition dividing the chamber between the cylindrical partition wall and the casing wall into non-communicating lateral chambers.

32. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature, including a receptacle, a stub shaft supporting one end of the receptacle, a journal bearing for said shaft, means for rotating said shaft, a pipe for conveying a hardening medium extending into the receptacle from the opposite end thereof, said receptacle being journaled upon said pipe, a rigid bearing for said pipe, means for controlling communication between the interior of the receptacle and the atmosphere, rail engaging clamps carried by the receptacle, rail receiving pockets extending longitudinally of the receptacle, sail last named means including valve stems extending into said pockets and adapted to be engaged by rails mounted on the receptacle to open the valves and permit the flow of hardening medium within the receptacle onto the rails.

33. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature, including a rotatable receptacle, a cylindrical partition wall within the receptacle, means for supplying tempering medium within the cylindrical partition wall, a transverse partition wall separating the chamber between the partition wall and casing into separate compartments, and means for independently controlling communication between the interior of the cylindrical partition wall and the separate compartments.

34. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature, including means for containing a hardening medium, and pivotally mounted rail supporting devices carried by said means.

35. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature including means for containing a hardening medium, and radially movable rail supporting devices carried by said means for engaging the base flanges and webs of the rails and constructed in a manner to cause the hardening medium only to flow upon the heads of the rails.

36. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature including means for containing a hardening medium, means controlling the discharge of hardening medium therefrom, and rail supporting devices carried by the first named means adapted to move the rails into engagement with the second named means to release the hardening medium and cause same to flow only on the heads of rails.

37. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature including means for containing a hardening medium, means controlling the discharge of hardening medium therefrom embodying parallel rows of spring valves, and rail supporting devices carried by the first named means adapted to move the rails into engagement with said valves to release the hardening medium and cause same only to flow upon the heads of rails.

38. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature including means for containing a hardening medium, means controlling the dicharge of hardening medium therefrom, means for delivering the hardening medium axially of the first named means and constituting a support therefor, and rail supporting devices carried by the first named means adapted to move the rails into engagement with the second named means to release the hardening medium and cause same to flow only on the heads of rails.

39. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature including a drum containing a hardening medium, supports for the opposite ends of the drums, one of the supports being a tubular bearing having lateral ports opening into the drum, means for controlling the discharge of hardening medium from the drum, and rail supporting devices adapted to move the rails into engagement with said means to release the hardening medium from the drum and cause same only to flow upon the heads of rails.

40. Apparatus for hardening steel rails while the temperature of the rails is above the critical temperature including a drum for containing a hardening medium, a tubular axial support for the drum having ports therein for delivering the hardening medium to the drum, longitudinally extending parallel rows of spring valves for controlling the discharge of hardening medium from the drum, and longitudinally extending parallel rows of rail supporting devices adapted to move the rails into engagement with the valves to release the hardening medium from the drum and cause same only to flow upon the heads of rails.

41. Apparatus for hardening steel rails including rail supporting means supplied

with a hardening medium under pressure and constructed to discharge the tempering medium radially thereof, and means for delivering rails to the supporting means.

42. Apparatus for hardening the heads of steel rails including rail supporting means supplied with a hardening medium and constructed to discharge the hardening medium radially thereof, means for delivering rails to the supporting means, and means carried by the supporting means adapted to be engaged by the rails to release the hardening medium and permit radial discharge only on the heads of rails.

In testimony whereof I affix my signature.

CHARLES A. EWING.