April 6, 1937. H. S. GEORGE 2,075,982

METHOD OF AND APPARATUS FOR HEAT TREATING RAILS

Filed Sept. 6, 1933 5 Sheets-Sheet 1

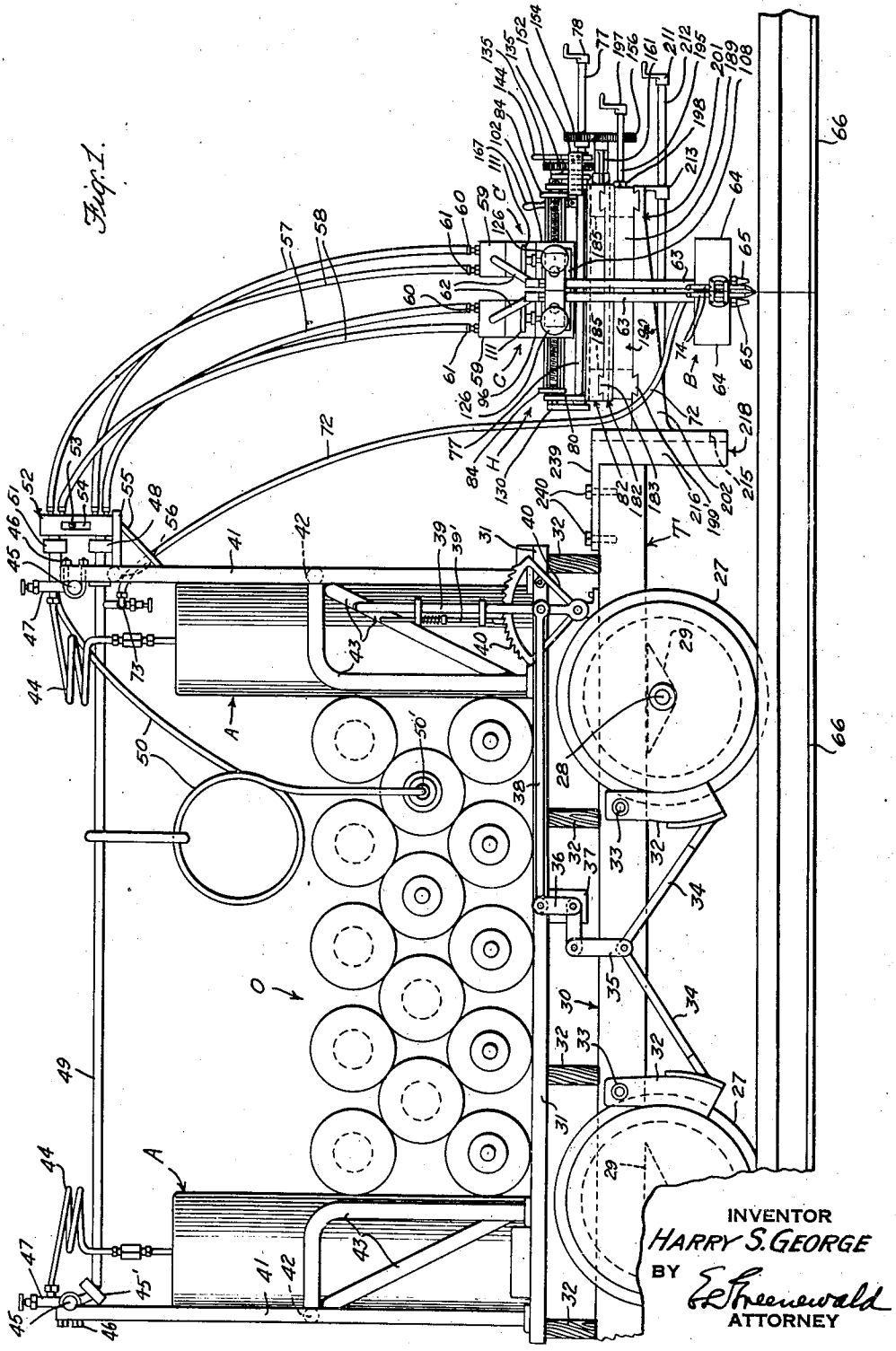


Fig. 1.

INVENTOR
HARRY S. GEORGE
BY E. E. Greenewald
ATTORNEY

April 6, 1937. H. S. GEORGE 2,075,982

METHOD OF AND APPARATUS FOR HEAT TREATING RAILS

Filed Sept. 6, 1933 5 Sheets-Sheet 2

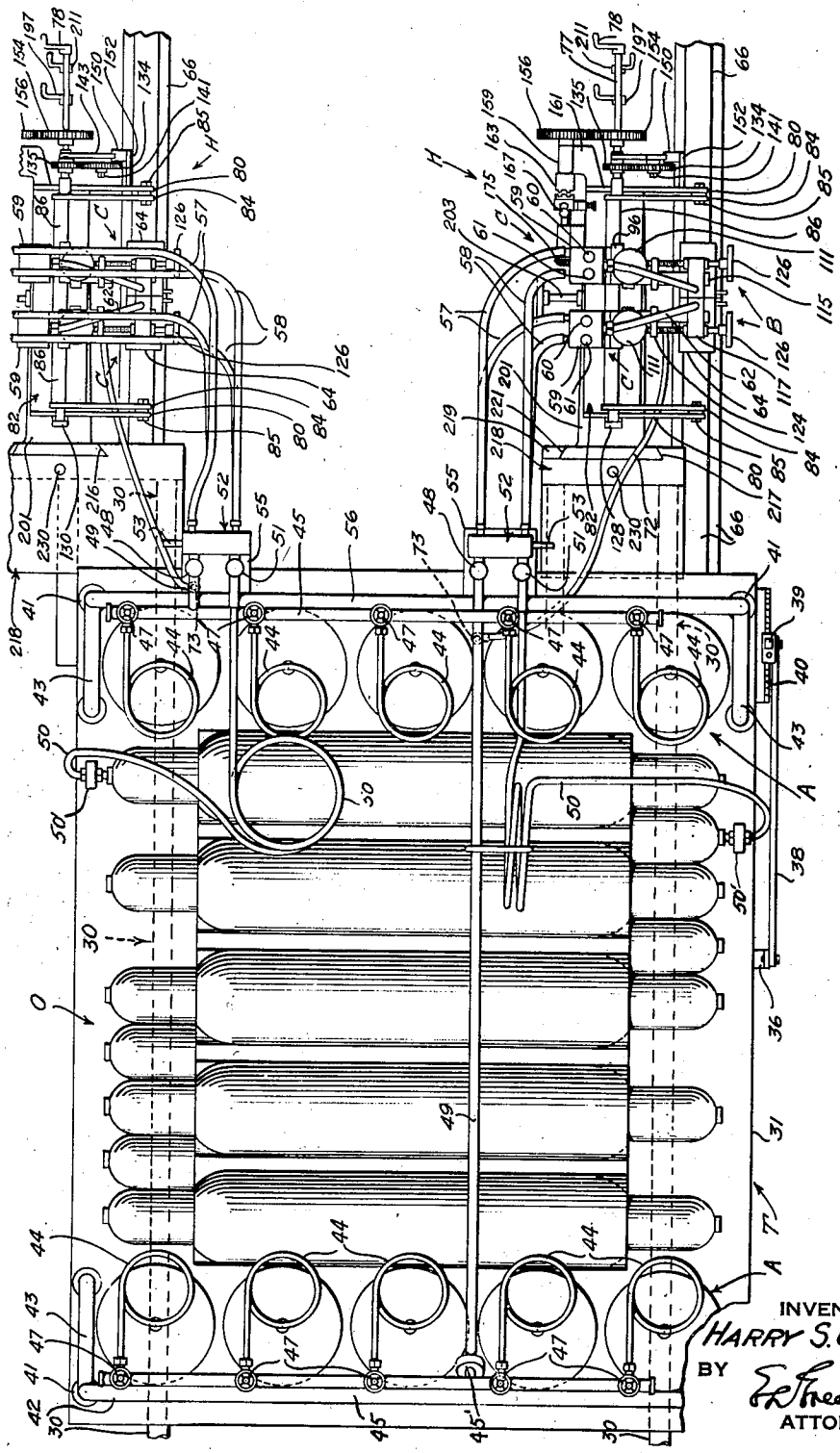


Fig. 2.

INVENTOR
HARRY S. GEORGE
BY E. R. Greenewald
ATTORNEY

April 6, 1937. H. S. GEORGE 2,075,982

METHOD OF AND APPARATUS FOR HEAT TREATING RAILS

Filed Sept. 6, 1933 5 Sheets-Sheet 3

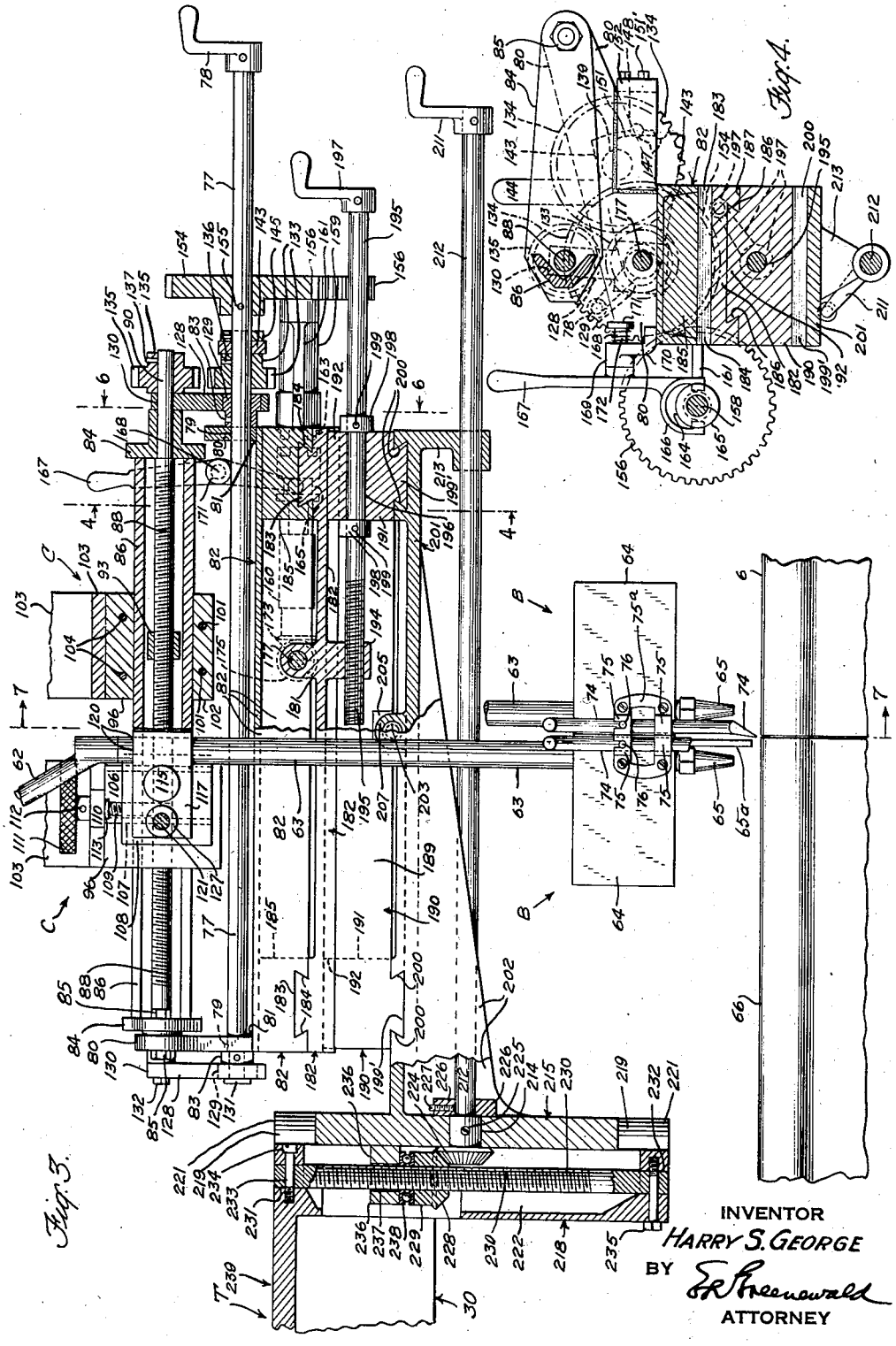


Fig. 3.

Fig. 4.

INVENTOR
HARRY S. GEORGE
BY
ATTORNEY

April 6, 1937. H. S. GEORGE 2,075,982

METHOD OF AND APPARATUS FOR HEAT TREATING RAILS

Filed Sept. 6, 1933 5 Sheets-Sheet 4

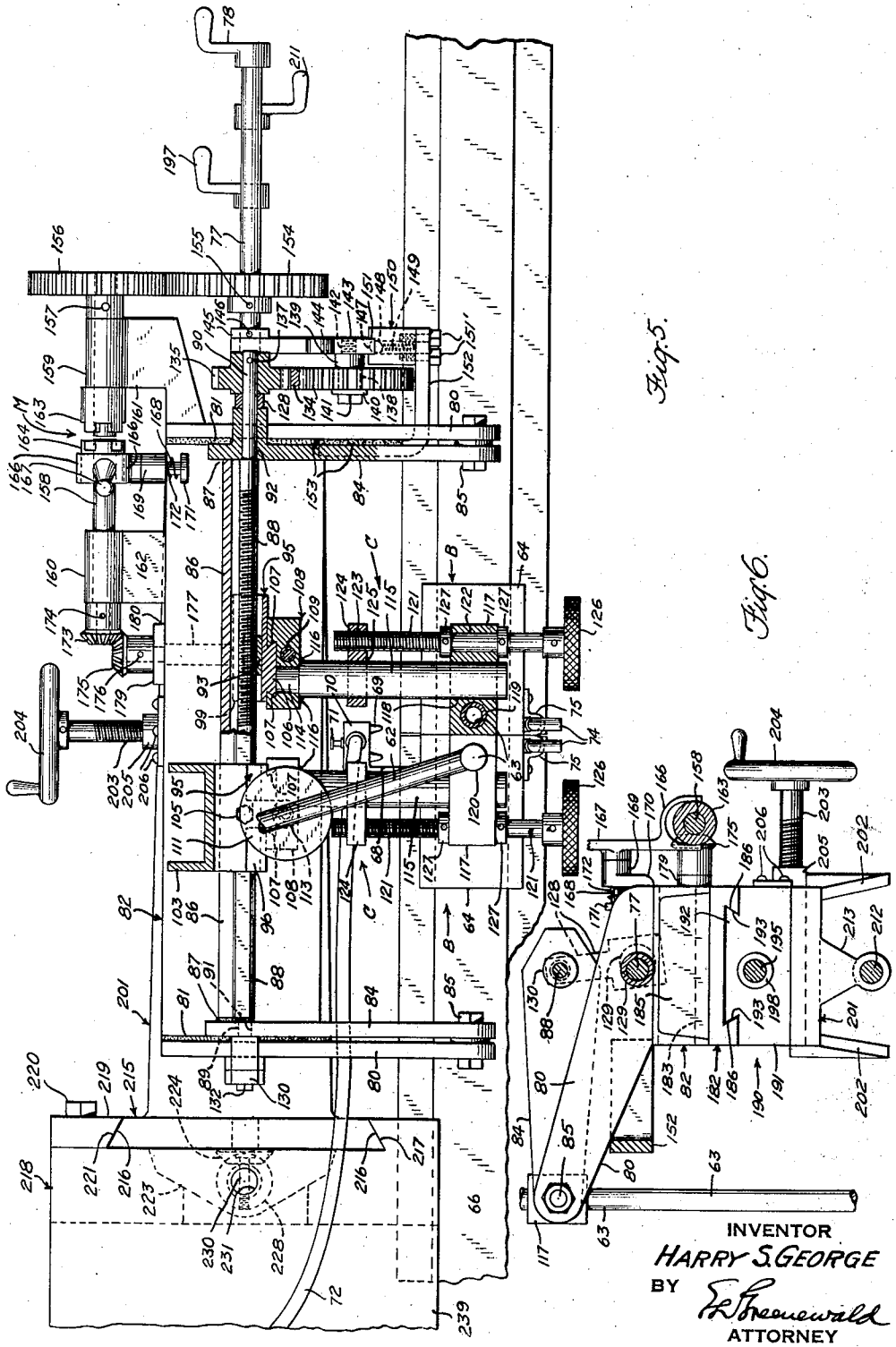


Fig. 5.

Fig. 6.

INVENTOR
HARRY S. GEORGE
BY
ATTORNEY

April 6, 1937. H. S. GEORGE 2,075,982

METHOD OF AND APPARATUS FOR HEAT TREATING RAILS

Filed Sept. 6, 1933 5 Sheets-Sheet 5

Fig. 7.

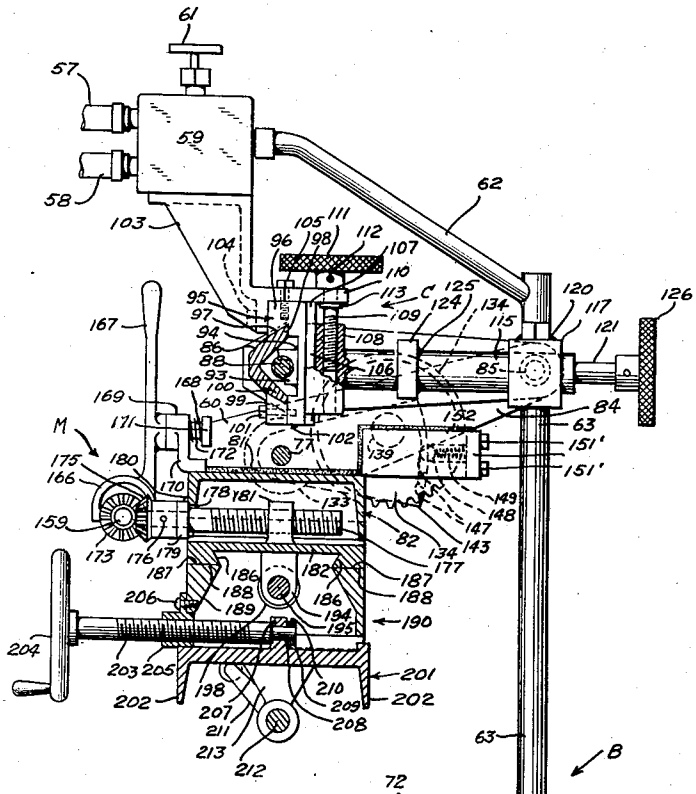
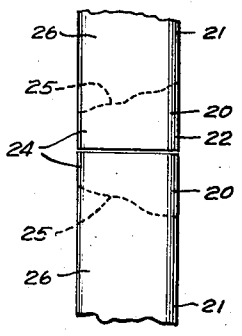


Fig. 8.



INVENTOR
HARRY S. GEORGE
BY
ATTORNEY

Patented Apr. 6, 1937 2,075,982

UNITED STATES PATENT OFFICE

2,075,982

METHOD OF AND APPARATUS FOR HEAT TREATING RAILS

Harry S. George, Massapequa, N. Y., assignor, by mesne assignments, to Union Carbide and Carbon Corporation, a corporation of New York

Application September 6, 1933, Serial No. 688,335

19 Claims. (Cl. 148—21.5)

This invention relates to a method of and apparatus for heat treating the running or tread surfaces of rails.

In recent years considerable study has been given to the problem of increasing the life of rails by eliminating rail batter on the tread surfaces thereof, and this problem is not only confined to tracks but it has also assumed importance in switch-points, frogs, and crossings. This is particularly true at the ends of rails where rolling traffic passes over a rail joint. The tread surfaces at the ends of rails at joints in track become battered to a lower level than other portions of the tread surfaces of rails, because at the ends of rails there is no support against end flow of rail metal at the tread surfaces thereof; hence, the rate at which tread surfaces of rails become battered is greatest at rail ends. This lowering of the running or tread surfaces of rails at rail joints increases the effect of the pressure of rolling traffic by converting it into a downward blow as the wheels pass over rail joints. This action still further increases the rate at which the tread surfaces at the ends of rails become battered over that of the rest of the rails. For this reason rails, particularly the ends thereof, are heat-treated or hardened to retard the rate of batter and prolong their life so as to reduce operating costs in track maintenance.

Heretofore, the only methods of heat treatment which have proved practicable employ an external quenching medium, such as water or an air blast. In most cases the treatment has included a tempering operation. Although it is possible to attain the desired results with such methods when great care is employed, the methods are very difficult because of the necessity of guarding against cracks or the setting up of internal stresses which, when combined with repeated stresses from service, often result in the eventual cracking of the corners of tread surfaces at the ends of rails. This is especially true when a secondary tempering operation is employed, because of the extra hazard entailed in the drastic application of heat to steel in a hardened state.

It has also generally been the practice to harden tread surfaces of rails, especially at their ends, by heat treating a rectangular area. This practice is objectionable, because of the abrupt transition between the hardened heat treated tread surface area and unhardened tread surface area adjacent thereto.

In order to facilitate an understanding of this invention in which an improved method and apparatus for carrying out the same are provided for heat treating the tread surfaces of rails, it seems expedient at the outset to consider the manner in which rolling traffic tends to cause deformation of rail tread surfaces. As the wheels of rolling stock move over a track, the tires of the wheels bear on a strip of tread extending from about the middle of the rail head toward the outside edge thereof but not reaching the outside edge. After months of service this strip tends to broaden toward the inside edge of the rail head, finally reaching it as the rail wears down and the contour of the rail head takes on the shape of the tire. This is especially true where rails are substantially vertical or canted not more than 1 in 40. The above is also true to a lesser extent where rails are canted as much as 1 in 20, and in such cases in straight track a longer time is required for tires to bear on the inside edges of the tread surfaces.

From the above considerations, I have found that the objections of having the transition zones extending at right angles to the lengths of rails, as obtained by prior heat treating practices, can be avoided by terminating the heat treated tread surface areas approximately diagonally across rail heads. This diagonal boundary at a transition zone preferbly is produced so that the area heat treated is longest at the edge of the rail head where the tendency of the rail metal to wear and flow is greatest. Thus, in straight track where the rails are substantially vertical or only slightly canted, the diagonal boundary is produced so that the heat treated area extends a longer distance along the inner edge than the outer edge of a rail head. Conversely, where rails are canted a considerable amount and where track maintenance is such that the greatest wear occurs from the middle to the outside edges of rail heads, the diagonal boundary is produced so that the heat treated area extends a longer distance along the outer edge than the inner edge of a rail head.

An object of my invention, therefore, is to heat treat tread surface areas at the ends of rails so that the length of a heat treated area longitudinally of a rail is longest at the edge of the rail head where the tendency of the rail metal to wear and flow is greatest.

Another object of my invention is to heat treat tread surface areas at the ends of rails in such a manner that rolling traffic will not pass abruptly from a hardened to an unhardened portion of a tread surface area or vice versa.

A further object of my invention is to provide an improved method of heat treating and hard-

ening tread surface areas at the ends of rails with a single application of heat and without employing any external quenching medium.

A further object of my invention is to provide an improved method of heat treating end areas of rail tread surfaces in which a source of high-temperature heat having a substantially constant rate of heat output is applied to the areas for a predetermined length of time.

A further object of my invention is to provide an improved apparatus which is flexible in operation for effectively carrying out the above objects.

A further object of my invention is to provide an improved apparatus, which can be mounted on a wheeled truck adapted to move on rails, for heat treating tread surface areas on one or both lines of rails in a section of track with the minimum amount of effort and in the least length of time.

A further object of my invention is to provide an improved apparatus for heat treating simultaneously the tread surface areas at the ends of abutting rails at a rail joint.

A further object of my invention is to provide an improved apparatus having a longitudinal, vertical, and transverse adjusting means for readily heat treating tread surface areas in accordance with the principles of this invention.

The above and further objects and novel features of my invention will become apparent in the following description and drawings, in which

Fig. 1 is a side elevational view of apparatus embodying my invention disposed over the abutting ends of a pair of rails for heat treating areas on the tread surfaces thereof, the apparatus being mounted on a wheeled truck arranged to carry gas cylinders.

Fig. 2 is a plan view of the apparatus and truck shown in Fig. 1;

Fig. 3 is an enlarged side elevational view, partly in section, of part of the apparatus shown in Figs. 1 and 2;

Fig. 4 is a sectional view taken on line **4**—**4** of Fig. 3;

Fig. 5 is a plan view, partly in section, of the apparatus shown in Fig. 3;

Fig. 6 is an end view taken on line **6**—**6** of Fig. 3;

Fig. 7 is a sectional view taken on line **7**—**7** of Fig. 3 with the blowpipes disposed above the tread surface of the rail to be heat treated; and

Fig. 8 is a plan view of a rail joint diagrammatically showing trapezoidal-shaped heat treated areas on the tread surfaces of abutting rails.

Referring to Fig. 8 of the drawings, I have illustrated one application of the principles of my invention in which trapezoidal-shaped hardened tread surface areas **20** are produced at the ends of abutting rails **21** which form a joint in a straight track where track maintenance is such that the tendency of the rail metal to wear and flow is greater on the inside edges **22** than at the outside edges **24** of the rail heads. In this instance the trapezoidal-shaped heat treated areas are preferably produced so that the inner edges **22** of the rail heads are heat treated a longer distance longitudinally of the rails than the outer edges **24** thereof. In some cases these hardened tread surface areas are substantially of triangular shape, but in Fig. 8 they are shown as being of trapezoidal shape, as distinguished from the usual hardened tread surface areas of rectangular shape. Rails having hardened areas of this general character form the subject matter of copending application Serial No. 688,334.

By terminating the heat treated tread surface areas **20** approximately diagonally, as indicated by the dotted lines **25**, the transition zones between the hardened areas **20** and unhardened areas **26** adjacent thereto extend a considerable distance along the longitudinal direction of the heads of the rails **21**. In this manner the rolling traffic will not pass abruptly from a heat treated tread surface area to an untreated area or vice versa.

It is desirable, at least for economic reasons, to heat treat a minimum area of the tread surfaces at the end of rails. I have found that a trapezoidal or triangular or similar shaped heat treated area is particularly desirable because, for a given and sufficient depth of heat treatment in the tread surface of a rail, it is the smallest area which will give sufficient length longitudinally of the rail in such a manner that the tread surface areas are effectively utilized to prevent wearing and flowing of the rail metal.

Although hardened tread surface areas may be produced in many different ways, the trapezoidal-shaped heat treated area particularly lends itself to my preferred method in which a heat treated tread surface area is allowed to cool naturally without employing any external quenching medium, such as water or an air blast. It is to be understood that the expression "natural cooling" signifies the combined cooling effect of convection and radiation of heat from the rail to the surrounding air plus the cooling effect of the underlying and adjacent mass of rail which is relatively cool. I have found that the latter effect is much greater than the cooling effect of air where a relatively small tread surface area of an ordinary rail is heated.

In order to produce a substantially uniform and satisfactory condition of hardness of tread surface areas with natural cooling, it is desirable to control both the temperature to which a tread surface area is heated and the depth of penetration of heat. This can be accomplished by employing a source of high temperature heat having a substantially constant rate of heat output, and by applying such source of heat to tread surface areas for a predetermined length of time. This insures the heating of tread surface areas to an elevated temperature before too much heat has penetrated into the mass of the rail, and also avoids the use of a source of heat of such intensity that only a superficial or skin hardening is effected. The elevated temperature is sufficiently high so that, when the heated tread surface metal cools rapidly, it will acquire a high degree of hardness; and throughout the specification and claims this elevated temperature is termed "an elevated hardening temperature".

In accordance with the principles of this invention, I provide an improved apparatus H for uniformly heat treating areas of tread surfaces of rails, as described above, in the minimum length of time. In this embodiment of my invention gas flames are employed as the source of high temperature heat, but it is to be understood that other sources of high temperature heat may be employed. The apparatus H is mounted on a suitable support, and I prefer to mount the same on the end of a wheeled truck T which may be moved along the rails by manual force, by attaching a motor car thereto, or by providing suitable self-propelling means.

The truck T includes wheels **27** secured in the usual manner to a pair of spaced axles **28**, and journal boxes **29** for supporting a frame **30** of

the truck on the axles 28. A floor 31 is mounted an spaced transverse members 32 which are secured in any suitable manner to the frame 30.

The braking mechanism for stopping the truck T comprises brake shoes 32 pivotally secured at 33 to the frame 30. The brake shoes are pivotally attached to the lower ends of members 34, the upper ends of which are pivotally attached to a link 35. The link 35 is pivotally connected to one arm of a bell crank 36 which is secured to a bracket 37 extending downward from the floor 31. The other arm of the bell crank 36 is pivotally connected to one end of a member 38, the opposite end of which is connected to a brake arm 39 pivotally secured to an arcuate shaped member 40 mounted on the frame 30 and floor 31. The arm 39 is provided with a control rod 39' having a pawl at the lower end thereof which is adapted to engage with the notched teeth on the member 40 to maintain the brake shoes 32 in or out of a braking position.

Gas cylinders are carried on the truck T for supplying gas to the blowpipes B. The gas employed is preferably a mixture of acetylene and oxygen supplied by acetylene cylinders A and oxygen cylinders O. The acetylene cylinders A are arranged in a vertical position at each end of the floor 31, and longitudinal movement thereof is prevented by transverse members 42 which extend behind the cylinders A and are attached at their ends to vertical members 41 fixed to each corner of the floor 31. Side brackets 43 secured to the floor 31 and vertical members 41, respectively, prevent lateral movement of the acetylene cylinders.

The oxygen cylinders O are arranged crosswise on the floor 31 in the space between the two banks of acetylene cylinders A at each end of the truck T. For conveniently supplying oxygen to both apparatus H mounted at the front end of the truck T and above the tread surfaces of the two lines of rails, one-half of the cylinders O are arranged to face one side of the truck T, and the other half of the cylinders O are arranged to face the opposite side of the truck, as shown in Figs. 1 and 2.

The mixture of oxygen and acetylene gases may be supplied to the blowpipes B in any suitable manner, and as shown the banks of acetylene cylinders A at each end of the truck T are connected through coiled conduits 44 to manifolds 45 which are arranged transversely of the truck T at each end thereof and clamped at their ends at 46 to the upper ends of vertical members 41. Manifolding each bank of acetylene cylinders A in this manner insures an adequate supply of acetylene gas for the heat treating apparatus H. The flow of acetylene gas from each cylinder A is controlled by a valve 47 connected between the manifold 45 and each conduit 44.

In order to maintain the acetylene gas at a substantially constant pressure, the gas is delivered from the manifolds 45 to pressure regulating valves 48. As shown in Figs. 1 and 2, the manifold 45 at the forward end of the truck T is connected directly to its pressure regulating valve 48, and the manifold 45 at the rear end of the truck T is connected to one side of a regulator 45', the opposite side of which is connected by a conduit 49 to the forward end of the truck where it is connected to the other pressure regulating valve 48. The regulator 45' is provided at the connection of the conduit 49 to the manifold 45 so that the conduit 49 will not be subjected to the full acetylene pressure in the manifold 45. In a like manner, oxygen gas is supplied through flexible conduits 50 to pressure regulating valves 51 arranged adjacent the valves 48, respectively. Regulator valves 50' are provided at the connection of the flexible conduits 50 to the oxygen cylinders O, so that the flexible conduits will not be subjected to the full pressure of the oxygen cylinders. The flexible conduits 50 and regulators 50' may be changed from one oxygen cylinder O to another as required.

Since it is desirable to control the flow of acetylene and oxygen gas without disturbing the valve adjustments on the blowpipes B after they have once been made, cut-out valves 52 are provided. These cut-out valves 52 are connected to the outlets of the acetylene and oxygen pressure regulating valves 48 and 51, and have a single lever 53 extending through an opening 54 for simultaneously controlling the flow of oxygen and acetylene gas to each apparatus H. The cut-out valves 52 and pressure regulating valves 48 and 51 connected thereto are mounted on brackets 55 which are supported by a transverse member 56 that is secured at its ends to the vertical members 41 at the forward end of the truck T.

The acetylene gas and oxygen gas are delivered from the cut-out valves 52 through flexible conduits 57 and 58, respectively, to the mixing chambers 59 of the blowpipes B, and valves having handles 60 and 61 are provided for controlling the mixture of oxygen and acetylene gases in each of the chambers 59. As shown more clearly in Fig. 7, the mixture of acetylene and oxygen gas is delivered from the mixing chambers 59 through conduits 62 and vertical pipes 63 connected thereto to manifold blocks 64 which are connected to the pipes 63 at their lower ends. Each manifold block 64 is provided with three transversely aligned nozzles or tips 65 for directing the flames produced at the orifices thereof on the tread surfaces of rails 66.

To prevent any backfiring which may occur as a result of pre-ignition of the gases before issuing from the orifices of the nozzles 65, suitable means is provided to prevent each individual nozzle from being subjected to the intense heat produced by all of the flames. Although the nozzles may be maintained cool by employing water jackets or the like through which water is circulated, such an arrangement requires additional equipment to be carried by the truck T. I prefer to employ a metallic baffle which cooperates with the nozzles and tends to diminish the circulation of the flames and surrounding heated air about the nozzles, the baffle preferably being of a metal or alloy possessing high heat conductivity and capable of dissipating heat sufficiently rapidly so that it will not melt. I have found a copper block of substantial mass suitable for this purpose and, as shown in Fig. 3, such a copper block 65a may be secured to the underside of a manifold block 64 and depend therefrom in a vertical plane substantially parallel to and between the transversely aligned nozzles 65 when the blocks 64 are abutting each other. Although the block 65a is shown in a transverse position in Fig. 3 it is to be understood that in other instances it may be desirable to arrange a baffle in a longitudinal position for each block so as to divide the nozzles into separate groups.

For igniting the gas at the nozzles 65, pilot burners may be employed. Each pilot burner may comprise a small nozzle 67 secured to a bracket 68 extending outward from one side of the manifold block 64. The nozzle 67 is bent at

69 so as to direct a flame adjacent the orifices of the nozzles 65, and may be provided with a partially open valve 70 having a push button 71 for opening the valve further when it is desired to increase the size of the continuously burning pilot flame to ignite the gas at the nozzles 65. The nozzle 67 may be supplied with acetylene gas through a flexible conduit 72 connected through a valve 73 to the acetylene conduit 49, as shown in Fig. 1. Although only a single pilot burner is shown, it is to be understood that each blowpipe B may be provided with a pilot burner in a like manner. The two pointers 74 of each apparatus H are arranged adjacent each other, and can be moved vertically within guide rings 75 formed integrally with a plate 75a which is secured to the side wall of the manifold block 74 opposite the pilot nozzle 67. The pointers have projections 76 which are received in recesses in the upper guide rings 75 to limit further downward movement of the pointers 74 when their tips are adjacent the tread surfaces of the rails 66. When the two blowpipes of an apparatus H are contacting each other, their respective pointers 74 form a single pointer for aligning the apparatus at a rail joint or any other point on the tread surface of a rail where it is desired to use both blowpipes B of the apparatus simultaneously. Before a heat treating operation is started the pointers 74 are raised, and are maintained in such a position by the normal friction between the pointers and the guide rings 75 so as to remove the tips of the pointers from the flames at the nozzles 65 of the blowpipes B.

In accordance with this invention, in order to provide trapezoidal, triangular or similar shaped heat-treated areas at the abutting ends of rails, as shown in Fig. 8, the two blowpipes B of each apparatus H are moved longitudinally of the rails 66 from the joint therebetween toward the centers of the respective rails, and simultaneously with such longitudinal movement a transverse movement is imparted to the blowpipes B. In this instance the transverse movement is preferably towards the inside edges of the rail heads so that the length of the area heat treated will be longer on the inside edges than on the outside edges of the rail heads. The blowpipes B are also continuously oscillated transversely of the rail head during the heat treating operation to insure uniform heating without any local over-heating at any point in the area heat treated.

In the present embodiment of my invention the oscillation and longitudinal and transverse movements of the blowpipes B are simultaneously produced by a single drive shaft 77 having a handle 78 at one end thereof. As shown in Fig. 3, the drive shaft 77 is journaled at openings 79 in spaced brackets 80 welded at 81 to the ends of an inverted U-shaped frame 82. Collars 83 are fixedly secured to the shaft 77 and bear against the outer walls of the brackets 80 to prevent longitudinal movement of the shaft 77. Between the spaced brackets 80, which extend upwardly and to one side of the U-shaped member 82 and above the drive shaft 77, as shown in Fig. 6, the blowpipe carriages C and driving mechanism therefor are pivotally mounted.

Referring to Fig. 5, the pivotally mounted structure for the carriages C comprises two spaced arms 84 arranged adjacent and inside the spaced brackets 80. The arms 84 are pivotally connected at one end thereof at 85 to the outer ends of the brackets 80, and the opposite ends of the arms 84 are connected by a longitudinal V-shaped member 86 welded at 87 at each end thereof to the arms 84.

A lead screw 88 for moving the blowpipe carriages C longitudinally of the rails 66 extends within the horizontally positioned V-shaped member 86, as shown in Figs. 5 and 7, and the reduced ends 89 and 90 thereof extend through and are journaled in openings 91 and 92 of the pivotally mounted arms 84. In order to move the blowpipe carriages C in opposite directions so as to heat treat the tread surfaces of abutting rail ends simultaneously, one-half of the lead screw 88 is provided with left hand threads, and the other half thereof is provided with right hand threads, as shown in Fig. 3.

Referring to Figs. 5 and 7, the two blowpipe carriages C are actuated by left hand and right hand threaded half-nuts 93 which engage the respectively threaded halves of the lead screw 88. The half nut 93 is welded at 94 to the bottom of a U-shaped guide block 95. The upper wall 96 of the guide block 95 has in its inside face an undercut bearing groove 97 which is adapted to slide along the end 98 of the upwardly extending wall of the V-shaped member 86. The guide block 95 is maintained in sliding contact with the V-shaped member 86 by a removable bearing block 99. The block 99 is held in place against the end 100 of the downwardly extending wall of the V-shaped member 86 by a cap screw 101 passing therethrough and secured to the lower wall 102 of the guide block 95. By this arrangement the removable bearing block 99 and lower wall 102 form an undercut bearing groove which slides along the end 100 of the downwardly extending wall of the V-shaped member 86. The mixing chamber 59 of each blowpipe B is mounted on a bracket 103 which is secured by cap screws 104 and 105 to the upper portion of the guide block 94.

On the side of the U-shaped guide block 95 opposite the half nut 93, there is a vertical projection 106 having undercut bearing grooves 107 to receive a vertical blowpipe supporting plate 108, as shown in Fig. 5.

Referring to Fig. 7, the plate 108 is supported and movable vertically by means including a stud 109 which fits into a threaded vertical opening at the top of the plate 108. The upper end of the stud 109 extends through an opening in the projection 110 of the bracket 103, and is provided with a flange 113 which bears against the bottom of the projection 110. Turning a handknob 111 fixedly secured to the stud 109 by a set screw 112 raises or lowers the plate 108 as desired.

Referring to Fig. 5, the guide plate 108 is provided with an opening to receive the reduced end 114 of a horizontal blowpipe guide tube 115 that is welded at 116 to the guide plate 108. A block member 117 having a central opening 118 is adapted to slide along the guide tube 115, and at one side thereof is provided with a vertical opening 119 through which the vertical pipe 63 of the blowpipe B extends. As shown in Fig. 7, the pipe 63 is welded at 120 to the top of the block member 117.

Referring again to Fig. 5, each blowpipe B is independently adjustable transversely of the rails 66 by a threaded stud 121 which extends through a horizontal opening 122 in the block member 117 and which is received in a threaded opening 123 in a plate 124. The plate 124 fits over the guide tube 115 and is welded thereto at 125. Each blowpipe B and its block member 117

can be moved toward or away from the plate 124 by a handknob 126 secured to the stud 121, and longitudinal movement of the stud is prevented by collars 127 fixedly secured thereto and bearing against opposite sides of the block member 117.

It will thus be seen that the blowpipes B are adjustable vertically and transversely of the rails 66 independently of each other; that the blowpipe carriages C are slidable along the V-shaped member 86 and actuated by the lead screw 88; and that the V-shaped member 86 and lead screw 88 are mounted and journaled respectively on the arms 84 which are pivotally connected at 85 to one end of the spaced brackets 80.

During a heat treating operation it is desirable to oscillate the blowpipes B transversely of the rail heads in order to heat uniformly the areas on the tread surfaces thereof. This oscillatory movement is imparted to the blowpipes B by rocking the blowpipe carriages C and lead screw 88 about the pivotal connections 85 of the arms 84. In order to insure such an oscillatory movement at all times during rotation of the drive shaft 77, vertical connecting arms 128 are provided to connect the drive shaft 77 to the lead screw 88, as shown in Figs. 3 and 6. The lower ends of these arms are eccentrically mounted at 129 on the drive shaft 77 adjacent to the collars 83 which bear against the outer walls of the brackets 80. The upper ends of the arms 128 have central openings and are mounted at 130 on the lead screw 88. Referring to Fig. 3, the arm 128 nearest the truck T is retained in position by cap screws 131 and 132 which are received in threaded openings at the ends of drive shaft 77 and lead screw 88, respectively.

In commencing a heat treating operation, it is sometimes desirable to impart only an oscillatory movement to the nozzles 65 before moving them over rail tread surfaces. For this reason, the driving mechanism for moving the blowpipe carriages C longitudinally of the rails in opposite directions may be rendered operative or inoperative as desired, independently of the oscillatory movement imparted to the blowpipes B by the drive shaft 77.

Referring to Figs. 3, 4, and 5, the driving mechanism for actuating the blowpipe carriages C on the lead screw 88 may comprise a gear 133 mounted on the drive shaft 77 which is adapted to drive, through an idler gear 134, a gear 135 mounted on the end of the lead screw 88. The gears 133 and 135 are fixedly secured by set screws 136 and 137 to the drive shaft 77 and lead screw 88, respectively. As shown in Fig. 5, the idler gear 134 is loosely mounted at the reduced portion 138 of a stub shaft 139, and is retained thereon by a washer 140 and cap screw 141 passing into an internally threaded opening at the reduced end of the stub shaft 139. The opposite end of the stub shaft 139 is threadedly secured at 142 in an opening near the periphery of an arcuate shaped arm 143 which is provided with a vertical handle 144, as shown in Fig. 4. The arm 143 is loosely mounted on the drive shaft 77, and is retained in position thereon between the hub of the gear 133 and a collar 145 secured by a set screw 146 to the shaft 77. The stub shaft 139 is so positioned on the arm 143 that, when the arm 143 is moved to a "down" position by the handle 144, the idler gear 134 only engages the lower gear 133 on the shaft 77; and, when the arm 143 is moved to an "up" position by the handle 144, the idler gear 134 engages both the gears 133 and 135 on the drive shaft 77 and lead screw 88, respectively. In order to maintain the arm 143 in either its "up" or "down" position so that the gear 134 will maintain its engagement with either both or one of the gears 133 and 135, the peripheral edge thereof is provided with two spaced depressions 147 for partially receiving a ball bearing 148 which is urged against the peripheral edge of the arm 143 by a helical spring 149, as shown in Fig. 5. The spring 149 is fixed in a recess in a block 150 having a U-shaped groove 151 for receiving and guiding the outer peripheral portion of the arm 143. The block 150 is secured by cap screws 151' to one arm of a right angle bracket 152, the other arm of which is welded at 153 to the inside wall of the bracket 80. Thus, when the drive shaft 77 is rotated by the handle 78, the blowpipe carriages C can be moved longitudinally of the rails 66 by moving the handle 144 of the arm 143 upward, so that the idler gear 134 on the stub shaft 139 will engage both the gears 133 and 135 on the drive shaft 77 and lead screw 88.

In order to produce heat treated areas on the tread surfaces of the rails 66 which vary in width in a longitudinal direction of the rails at the boundaries between such areas and untreated tread surface areas adjacent thereto, blowpipes B are moved transversely of the rails simultaneously with their longitudinal movement along the rails. Referring to Fig. 5, the drive for the transverse movement of the blowpipes B comprises a gear 154 that is secured by a set screw 155 to the drive shaft 77 and engages a gear 156 secured by a set screw 157 to one end of a shaft 158. The shaft 158 is split in two sections, and these sections are journaled in bearings 159 and 160 carried by brackets 161 and 162 which are secured to the right hand bracket 80 and U-shaped member 82, respectively. A clutch M for engaging and disengaging the two sections of the shaft 185 for starting and stopping the transverse movement of the blowpipes B comprises a pair of cooperating toothed elements 163 and 164, the toothed element 163 being fixedly secured to one section of the shaft 158, and the toothed element 164 being shiftable and keyed on the other section of the shaft 158. As shown in dotted lines in Fig. 3, the shiftable element 164 is provided with a grooved collar 165 to receive the ends of a fork 166 which is formed at one end of a handle 167. The handle 167 is provided with a stub shaft 168 that is journaled in a bearing 169 carried by a bracket 170 which is secured to the U-shaped member 82, as shown in Figs. 5, 6, and 7. Between the end of the bearing 169 and the flanged end 171 of the stub shaft 168, a compressed helical spring 172 is coiled about the shaft 168 to provide sufficient friction to maintain the handle 167 of the clutch M in either an engaged or disengaged position.

A bevel gear 173 secured by a set screw 174 to the end of one section of the shaft 158 engages a bevel gear 175 which is secured by a set screw 176 to the end of a threaded shaft 177 that extends through an opening 178 in the side wall of the U-shaped member 82. The shaft 177 is journaled at the opening 178 by an annular member 179 which is welded at 180 to the side wall of the U-shaped member 82. Within the U-shaped member 82, as shown in Fig. 7, the shaft 177 passes through an internally threaded nut 181 which extends upward and which is formed in-

tegrally with a longitudinal plate 182 upon which the U-shaped member 82 rests. Referring particularly to Figs. 3 and 4, each end of the plate 182 is provided with an upwardly extending transverse projection 183 having under cut bearing grooves 184 for receiving similar shaped transverse recesses in the side walls of the inverted U-shaped channel member 82 and blocks 185, which snugly fit and are secured in the hollow ends of the member 82. It will thus be seen that, as the threaded shaft 177 is rotated, it will move through the internally threaded nut 181. This will carry the entire oscillating and longitudinal feeding mechanism of the blowpipe carriages C and the blowpipes B, which are all mounted on the member 82, transversely of the rails by the transverse movement of the member 82 on the plate 182.

Two adjustments comprising the vertical adjustment attained by turning the handknob 111, and the transverse adjustment attained by turning the handknobs 126, have already been described. These two adjustments are limited in movement and are preferably employed after the blowpipes B have been approximately located above the tread surfaces of the rails at the point where the heat treating operation is to take place. In order to increase the flexibility of the apparatus H, longitudinal and additional transverse and vertical adjusting mechanisms are provided so that the apparatus can readily be positioned for a heat treating operation after the truck T has been moved near a rail joint or other point where it is desired to heat treat the tread surface areas of rails.

Referring to Figs. 3, 4, and 7, the apparatus H is adjustable longitudinally of the rails 66 by providing the plate 182 with downwardly extending and inwardly tapering side walls 186 having flat horizontal ends 187. The flat ends 187 rest on and are adapted to slide along the flat horizontal upper ends 188 of the inwardly tapered side walls 189 of a rectangular shaped hollow block 190. The end walls 191 of the block 190 are considerably thicker than the side walls 189, and are provided with upwardly extending projections 192, as shown in Fig. 6, having longitudinal undercut bearing grooves 193 on each side thereof for receiving the inwardly tapering side walls 186 of the plate 182. Thus, the plate 182 rests and is slidable on the side and end walls 189 and 191 of the block 190, and is guided in a longitudinal direction by the projections 192 at the thickened end walls 191.

As shown in Figs. 3 and 7, the plate 182 is moved longitudinally along the block 190 by mechanism comprising an internally threaded nut 194 that is integral with the plate 182 and extends downwardly therefrom, opposite the upwardly extending and internally threaded nut 181, into the hollow of the rectangular shaped block 190. The nut 194 is adapted to receive the threaded end of a shaft 195 which extends through an opening 196 in the right hand end wall 191, and is provided with a handle 197. Collars 198 bearing against the opposite sides of the end wall 191, secured by set screws 199 on the shaft 195, prevent longitudinal movement of the shaft 195 as it is rotated to slide the plate 182 on the block 190.

In order to adjust the blowpipes B transversely of the heads of the rails 66, in addition to the limited transverse adjustment obtained by the handknobs 126 described above, the bottom surfaces of end walls 191 of the block 190 are provided with downwardly extending projections 199', as shown in Fig. 3. The projections 199' have transverse undercut bearing grooves 200 which receive similar shaped recesses formed at the ends of a main supporting bracket 201 having side ribs or flanges 202. Referring to Fig. 7, a threaded lead screw 203 having a handwheel 204 at one end thereof is employed to move the hollow block 190 and apparatus mounted thereon transversely of the rail heads on the bracket 201. The lead screw 203 passes into the hollow of the block 190 through an internally threaded nut 205 which is secured by a cap screw 206 at an opening in the side wall 189 of the block 190. An upwardly extending lug 207 which is integral with the bracket 201 is provided with an opening to receive the reduced end 208 of the lead screw 203, and a collar 209 bearing against the lug 207 is secured by a set screw 210 to the end of the lead screw 203 to prevent longitudinal movement thereof when it is rotated by the handwheel 204 to move the nut 205 and block 190 transversely of the bracket 201.

Referring to Figs. 3 and 5, the mechanism for moving the entire apparatus H vertically with respect to the tread surfaces of the rails 66 comprises a handle 211 mounted on the end of a shaft 212 that extends through an opening in the downwardly extending projection 213 at the end of the bracket 201, and through an opening 214 in a vertical plate 215 formed integral with the bracket 201 and its ribs 202. The side edges 216 of the plate 215 are beveled, and one of the edges 216 slidably fits into an undercut vertical bearing groove 217 in a supporting block 218. As shown in Fig. 5, the plate 215 is maintained in vertical alignment on the block 218 by a beveled strip 219 secured to the block 218 by cap screws 220 and forming an undercut bearing groove 221 for the opposite edge 216 of the plate 215.

Integral with the block 218 is a horizontal ledge 239 which is secured by threaded bolts 240 to the forward end of the truck frame 30, as shown in Fig. 1. Referring to Figs. 3 and 5, a large recess 222 of the cross sectional shape indicated by the dotted line 223 is formed in the block 218, the opening of the recess 222 being covered by the plate 215 which is vertically movable in the undercut bearing grooves 216 and 221 on each side of the recess.

The mechanism for moving the plate 215 vertically includes a beveled gear 224 disposed in the recess 222, the hub of which is secured by a set screw 225 to the end of the shaft 211 at the opening 214 in the plate 215. Longitudinal movement of the shaft 211 is prevented by the flat face of the gear 224 bearing against one side of the plate 215, and by a collar 226 bearing against the opposite side of the plate 215 and secured by a set screw 227 to the shaft 212.

The gear 224 engages a beveled gear 228 having a hub 229 that is internally threaded and adapted to move along a threaded lead screw 230 which extends vertically in the recess 222 and through openings 231 and 232 in the top and bottom of the supporting block 218. A countersunk cap screw 233, the head 234 of which fits flush against the inside face of the plate 215, passes through a hole at the bottom of the block 218 and an opening at the lower end of the lead screw 230 to prevent rotation and longitudinal movement of the lead screw 230.

The plate 215 is provided with a projection 236 that is integral therewith, the projection 236 having an opening 237 through which the lead screw

230 passes. Between the projection 236 and the hub 229 of the gear 228 a roller thrust bearing 238 is mounted on the lead screw 230, so that the gear 228 can be moved along the lead screw 230 with as little friction as possible between its hub 229 and the projection 236. Downward movement of the plate 215 is thus prevented by the projection 236, which rests on the thrust bearing 238 which in turn rests on hub 229 of the gear 228. When the gear 228 is moved downward on the lead screw 230 by driving the gear 224 on the shaft 212, the force of gravity will cause the thrust bearing 238, projection 236 and plate 215 to move downward as a single unit with the gear 228. When the gear 228 is moved upward on the lead screw 230, it will move the thrust bearing 238, projection 236 and plate 215 upward with it, the driving gear 224 always being maintained in engagement with the gear 228.

The method of operating the heat treating apparatus just described is substantially as follows: It will be assumed that the proper number of valves 47 are open between the acetylene cylinders A and manifolds 45 at each end of the truck T so that an adequate supply of acetylene will be delivered to the blowpipes B; that the acetylene and oxygen pressure regulating valves 46 and 47 are adjusted to deliver oxygen and acetylene at predetermined pressures; that the levers 53 of the cut-out valves 52 are in a closed position; that the handknobs 61 and 62 of the oxygen and acetylene valves in the mixing chambers 59 of the blowpipes B have been adjusted to produce flames having a proper rate of heat output at the nozzles 65, the flames preferably being neutral or having a slight excess of acetylene; that the valve 75 is open to deliver acetylene through the conduit 72 to the pilot burner or nozzle 67, which has been ignited; and that the two blowpipe carriages C of each apparatus H mounted at the front of the truck T have been moved together so that the pointers 74 are abutting each other.

With the above assumed conditions, the truck T is moved along a section of track, and by means of the brake arm 39 the truck T is stopped approximately at the joint of abutting rails. The pointers 74 are moved downward with the projections 76 resting in the recesses in the top guide rings 75. If any longitudinal movement of the blowpipes B is necessary to fix the pointers 74 at the extreme ends of two abutting rails, the handle 197 of the shaft 195 is turned in the proper direction. This will move the internally threaded nut 194, which is integral with the plate 182, along the threaded end of the shaft 195. The plate 182, on which the mechanism and apparatus including the blowpipes B is mounted, will slide along the top of the hollow rectangular block 190.

If any transverse movement of the blowpipes B is necessary to center the nozzles 65 between the edges of the heads of rails 66, lead screw 203 is turned in the proper direction by means of the handwheel 204. Since longitudinal movement of the lead screw 203 is prevented, the nut 205, which is secured to the wall of the block member 190, will move along the lead screw 230. This will move the hollow block member 190 and apparatus and mechanism mounted thereon transversely of the rail heads to position properly the nozzles 65.

Vertical adjustment of the blowpipes B with respect to the tread surfaces of the rails may be obtained by turning the handle 211 of the shaft 212 to actuate the gear 238 along the lead screw 230. This will move the projection 236 of the plate 215, and raise or lower the plate between the undercut bearing grooves 217 and 221 of the block 218 and beveled strip 219.

The above described longitudinal, transverse and vertical adjustments move both blowpipes B simultaneously. If further individual vertical or transverse adjustment of a single blowpipe B is required, without interfering with the position of the other blowpipe B, the handknobs 111 and 126 may be used. After the blowpipes B have been properly positioned at the rail joint, the pointers 74 are raised.

With the above described initial adjustments made, the tread surface areas at the ends of abutting rails 66 are heat treated with the apparatus H in the following manner: It is assumed that the clutch handle 167 is in a disengaged position, and that the handle 144 has been moved downward so that the idler gear 134 is out of engagement with the gear 135 on the lead screw 88.

The handle 78 of the drive shaft 77 is turned continuously so that only an oscillatory movement is imparted to the nozzles 65 at the beginning of the heat treating operation. This oscillatory movement is imparted to the blowpipes B and blowpipe carriages C from the drive shaft 77 to lead screw 88 through the connecting arms 128, which are eccentrically mounted on the drive shaft 77. The eccentric movement of the arms 128 causes the lead screw 88, blowpipes B and blowpipe carriages C, which are all mounted on the V-shaped member 86 and arms 84, to rock about the pivotal connection of the arms 84 on the spaced brackets 80 at 85.

The button 71 of the pilot valve 70 is then pressed to increase the size of the pilot flame. While the nozzles 65 are oscillating and the pilot flame is operative to ignite the gas at the nozzles 65, the lever 53 of the cut-out valve 52 is moved to its open position and oxygen and acetylene gas will be delivered from the cylinders A and O to the nozzles 65 through the conduits 57 and 58, mixing chambers 59, conduits 62, pipes 63, and manifold blocks 64. With the various valve adjustments already made, as described above, the blowpipes B will produce at their nozzles 65 flames having a substantially constant rate of heat output, the acetylene and oxygen regulating valves 48 and 51 maintaining the pressure of the gases delivered to the blowpipes B substantially constant. In order to prevent overheating of the extreme ends and corners of the tread surfaces of the rails 66, the blowpipes B are arranged at points near the extreme ends of the rail heads. In this manner the gase flames are not directly applied to the extreme end edges and corners of the rail tread surfaces. The conduction of heat to the corners of the rails from the heated portions adjacent thereto is sufficient to raise the corners to the same elevated hardening temperature as the other portions of the heat treated areas.

After this oscillatory movement of the nozzles 65 has been maintained for a length of time sufficient to raise the tread surfaces to an elevated hardening temperature, such as 1600° F. for example, the blowpipes B are moved longitudinally of the rails and back from the ends of the rail heads, and at the same time a transverse movement is imparted to the blowpipes B. The longitudinal movement of the blowpipes B is obtained by raising the handle 143 so that the idler gear 134 will engage both the gears 133 and 135 on the drive shaft 77 and lead screw 88, and

the transverse movement thereof is obtained by moving the handle 167 of the clutch M so that the shiftable element 163 on one section of the shaft 158 will engage the fixed element 164 on the other section of the shaft 158.

In addition to the oscillatory movement of the blowpipes B, the rotation of the drive shaft 77 now will drive the lead screw 88 through the gears 133, 134, and 135. Since one-half of the lead screw 88 is provided with left hand threads and the other half thereof is provided with right hand threads, the respective half nuts 93 engaging the two halves of the lead screw 88 will simultaneously move the blowpipe carriages C in opposite directions from the joint between the abutting rails 66.

The drive for the transverse movement of the blowpipes B is completed from the shaft 77 through gears 154 and 156, clutch elements 163 and 164 on the two sections of the shaft 158, and bevel gears 173 and 175. This will cause the threaded shaft 177 to feed through the internally threaded nut 181 which is integral with the plate 182, and to move the U-shaped member 82 on the plate 182 transversely of the rails 66. After the nozzles 65 have moved off the inside edges of the heads of rails 66, the cut-out valve 52 is closed, and rotation of the drive shaft 77 is stopped.

After a heat treating operation is completed, the brake arm 39 is released, and the truck T moved to the next joint in the two lines of rails. The two blowpipe carriages C of the apparatus H are moved together again by reversing the direction of rotation of the drive shafts 77, and the heat treating operation repeated at the next joint or any other point in the section of track.

In order to produce a substantially uniform and satisfactory condition of hardness of tread surface areas by natural cooling, a source of high temperature heat having a substantially constant rate of heat output is preferably employed. By standardizing on certain size flames and timing the application of the flames on a tread surface area, a simple method of control is obtained. In this manner the underlying mass of rails will remain relatively cool and exert a quenching effect by withdrawing heat from a heated tread surface to cool and uniformly harden it naturally. Such a procedure insures the heating of tread surface areas before too much heat has penetrated into the mass of rails, and also avoids the use of sources of heat of such intensity that only a superficial or skin hardening is effected. When heat treating with oxyacetylene flames, strictly neutral flames or flames having a slight feather of excess acetylene may be used.

For a given size of rail and size of area to be heat treated, the pressure of the gas and length of time of applying the heat to obtain the required depth of heat treating, such as ⅛ inch, for example, can readily be determined by trial. The tread surface areas are quickly and uniformly raised above the critical range to a temperature of about 1600° F., and natural cooling by the relatively cool underlying mass of rails effectively hardens the heat treated areas.

Ordinary rails usually contain from approximately .55 to .80 per cent carbon and a similar amount of manganese, and it has been found that they readily respond to heat treatment when cooled naturally from a hardening elevated temperature. Rail tread surface areas of the composition just mentioned have been satisfactorily hardened in accordance with the method described above.

It will thus be seen that an improved method of heat treating rails has been provided. By making the hardened areas of approximately trapezoidal or triangular shape, there is the further economy in the amount of heat required, as compared with producing hardened areas of rectangular shape, to obtain the same effective length of hardening along rails.

While I have shown a particular embodiment of my invention, it will be obvious to those skilled in the art that modifications may be made, and that certain features may be used independently of others in heat treating tread surfaces of rails either with gas flames or the electric arc, without departing from the spirit and scope of my invention.

I claim:

1. The method of heat treating an area on the tread surface of a rail wherein a high temperature heat is applied to the tread surface so as to heat such an area substantially uniformly to an elevated hardening temperature and to considerable depth; which comprises moving the source of heat longitudinally of the rail; and, during at least a portion of the longitudinal movement of the source of heat, moving the same transversely of the rail until the high temperature heat is no longer applied to the tread surface, such combined movements of the source of heat constituting a diagonal movement so as to produce a hardened area which varies in width longitudinally of the rail at the boundary between such area and the untreated portion of the rail tread surface adjacent thereto.

2. The method of heat treating an area on the tread surface of a rail head wherein the heat treated area varies in width longitudinally of the rail head at the boundary between such heat treated area and untreated portion of the tread surface adjacent thereto; which includes applying a high temperature heat to the tread surface so as to heat the same substantially uniformly to an elevated hardening temperature and to a considerable depth; and simultaneously moving the high temperature heat longitudinally and transversely of the rail head, at least a portion of such combined movements constituting a diagonal movement completely across the tread surface so as to produce a hardened area which is substantially trapezoidal in shape.

3. A method of heat treating tread surface areas at the ends of abutting rails; which comprises applying a source of high temperature heat near the extreme end of each rail head to the tread surfaces thereof so as to heat them substantially uniformly to an elevated hardening temperature and to a considerable depth; simultaneously moving the sources of heat longitudinally of the rails in opposite directions from the extreme ends thereof; and, during the longitudinal movement of the sources of heat, moving the same transversely of the rails until the high temperature heat is no longer applied to the tread surfaces, such combined movements of the sources of heat constituting diagonal movements completely across the tread surface of each rail so as to produce similarly shaped heat treated areas which vary in width longitudinally of the rails at the boundaries between such heat treated areas and untreated areas of the tread surfaces adjacent thereto, whereby run offs will be provided on the tread surfaces of the abutting rails which will prevent rolling stock from passing

abruptly from such heat treated areas to the adjacent untreated portions or vice versa.

4. The method of heat treating an area on the tread surface of a rail wherein at least a portion of the boundary between such heat treated area and untreated area on the tread surface adjacent extends approximately diagonally across the rail head; which comprises applying one or more high temperature flames to the tread surface and oscillating the flame or flames transversely of the rail head so as to heat the same to a substantially uniform elevated hardening temperature and to a considerable depth; moving the oscillating flame or flames longitudinally of the rail; and, during the longitudinal movement of the oscillating flame or flames, moving the same transversely of the rail until the flame or flames are no longer applied to the tread surface, such combined movements of the flame or flames constituting a diagonal movement so as to provide a substantially trapezoidal shaped heat treated area which will prevent rolling stock from passing abruptly from a treated to an untreated portion of the tread surface or vice versa.

5. The method of heat treating an area on the tread surface of a rail wherein the heat treated area varies in width longitudinally of the rails at the boundary between such heat treated area and untreated area on the tread surface adjacent thereto; which comprises applying a source of high temperature heat to the tread surface so as to heat the same to a substantially uniform elevated hardening temperature and to a considerable depth; moving the source of heat longitudinally of the rail; and, during the longitudinal movement of the source of heat, moving the same transversely of the rail until the high temperature heat is no longer applied to the tread surface, at least a portion of such combined movements of the source of heat constituting a diagonal movement completely across the tread surface so as to produce a runoff which will prevent rolling stock from passing abruptly from a treated to an adjacent untreated portion of the tread surface or vice versa; the source of heat being applied quickly to the heat treated area whereby the underlying mass of the rail comprising the bottom of the head, the web and flange thereof will remain relatively cool so as to exert a quenching effect on the heated tread surface by withdrawing heat therefrom to cool and harden the same naturally after the heat has been applied thereto.

6. A method of heat treating tread surface areas at the ends of abutting rails, which comprises applying a source of high temperature heat near the end of each rail head to the tread surfaces thereof so as to heat them substantially uniformly to an elevated hardening temperature; and moving the sources of heat from the starting point near the end of each rail diagonally across the rails in opposite directions from the extreme ends thereof so as to produce similarly shaped heat treated areas which vary in width at the boundaries between such heat treated areas and the tread surfaces adjacent thereto.

7. Apparatus for hardening by heat treatment the tread surface areas of abutting rails at a rail joint, comprising the combination of supporting means adapted to rest upon at least one rail of a track, said supporting means being stationary during a heat treating operation; two sources of heat mounted for movement on said supporting means and adapted to be disposed above the tread surfaces of adjoining rails; means for adjusting at least one of said sources of heat longitudinally of the rails, and with respect to the rail joint and the supporting means, so as to position both of said sources of heat properly for starting a heat treating operation; and means for reciprocating said sources of heat transversely over the tread surfaces of the rails while said supporting means remains stationary.

8. Apparatus for hardening by heat treatment the tread surface areas of rail ends in situ, comprising the combination of supporting means adapted to rest at least upon one rail of a track, said supporting means being stationary during a heat treating operation; a source of heat mounted for movement on said supporting means and adapted to be disposed above the tread surface of a rail; means for adjusting said source of heat with respect to the end of a rail so as to position such source of heat properly for starting a heat treating operation; and means for simultaneously reciprocating said source of heat transversely of the rail head and moving the same diagonally across the rail while said supporting means is stationary.

9. Apparatus for simultaneously heat treating in situ tread surface areas at the ends of abutting rails at a rail joint, comprising the combination of a support; at least two sources of heat mounted for movement on said support and adapted to be disposed above the tread surfaces near the extreme ends of the heads of the abutting rails; and means for moving said sources of heat longitudinally of the rails in opposite directions from their abutting ends.

10. Apparatus for simultaneously heat treating in situ tread surface areas at the ends of abutting rails at a rail joint, comprising the combination of a support; at least two sources of heat mounted for movement on said support and adapted to be disposed above the tread surfaces near the extreme ends of the heads of abutting rails; means for moving said sources of heat longitudinally of the rails in opposite directions from their abutting ends; and means for moving said sources of heat transversely of the rail heads simultaneously with their longitudinal movement along the rails.

11. Means for simultaneously heat treating the tread surfaces at the ends of abutting rails, comprising the combination of a wheeled truck; apparatus including at least two burners mounted on said truck and adapted to be disposed above the ends of abutting rails for applying gaseous flames to the tread surfaces thereof; means for moving said burners longitudinally of the rails in opposite directions from their abutting ends; and means for moving said burners transversely of the rails simultaneously with their longitudinal movement along the rails.

12. Apparatus for heat treating the tread surfaces of rails comprising a frame; a member pivotally mounted on said frame and adapted to extend longitudinally of a rail; a carriage movable along said member; a source of heat mounted on said carriage and adapted to be disposed above the tread surface of the rail; and means for oscillating said pivotally mounted member and for moving said carriage along said frame.

13. Means for heat treating the tread surfaces of rails comprising a wheeled truck having braking means; a support including a bracket secured to and extending from one end of said truck; and apparatus according to claim 12 mounted on said support.

14. Apparatus for heat treating the tread sur-

faces of rails comprising the combination of a frame; a member pivotally mounted on said frame and adapted to extend longitudinally of a rail; mechanism for oscillating said pivotally mounted member; a carriage; mechanism for moving said carriage along said member; a burner mounted on said carriage and adapted to be disposed above the tread surface of the rail; a single means for actuating said oscillating mechanism and said carriage moving mechanism; and means for rendering said carriage moving mechanism inoperative.

15. Apparatus for heat treating the tread surfaces of rails comprising the combination of a support; a frame mounted for movement on said support; a member carried by said frame adapted to extend longitudinally of a rail; a carriage; means for moving said carriage on said member; a source of heat mounted on said carriage and adapted to be disposed above the tread surface of the rail; and means for moving said frame transversely of said support and across the rail head and for driving said carriage longitudinally of said member and along the rail.

16. Apparatus for heat treating the tread surfaces of rails comprising the combination of a support adapted to extend longitudinally of a rail; a frame mounted for transverse movement on said support; a member pivotally mounted on said frame and adapted to extend longitudinally of the rail; a carriage movable along said member; a source of heat mounted on said carriage and adapted to be disposed above the tread surface of the rail; and means for oscillating said pivotally mounted member and for driving said carriage and for moving said frame transversely on said support.

17. Rail heat treating apparatus according to claim 16, in which said means for oscillating said pivotally mounted member and for driving said carriage and for moving said frame transversely on said support comprises a single drive shaft.

18. Means for heat treating the tread surfaces of rails in situ, comprising a wheeled truck having braking means; and apparatus according to claim 14 in which said support comprises a bracket secured to and extending from one end of said truck.

19. Apparatus for heat treating the tread surfaces of rails comprising the combination of a support adapted to extend longitudinally of a rail; a frame; mechanism for moving said frame transversely on said support; a member pivotally mounted on said frame and adapted to extend longitudinally of the rail; a carriage; mechanism for moving said carriage along said member; a burner mounted on said carriage and adapted to be disposed above the tread surface of the rail; means for oscillating said pivotally mounted member and for actuating said frame and carriage moving mechanisms; and means for rendering said frame and carriage moving mechanisms inoperative.

HARRY S. GEORGE.