Oct. 23, 1951 R. M. ROOKE 2,572,201

METHOD OF HARDENING THE ENDS OF RAILROAD RAILS

Filed Feb. 10, 1948 2 SHEETS—SHEET 1

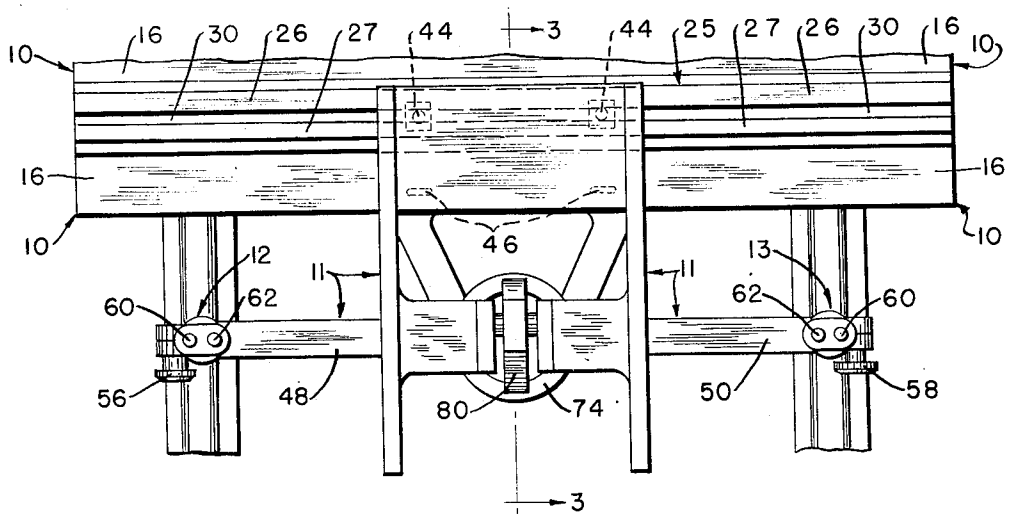


FIG. 1

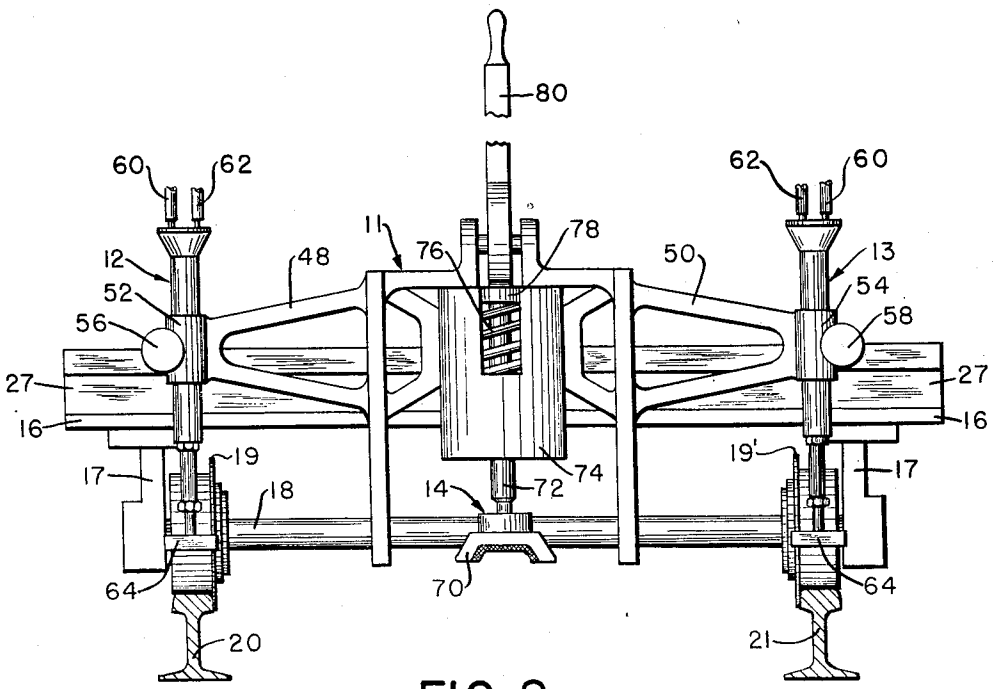


FIG. 2

INVENTOR
ROBERT M. ROOKE
BY
Pennie, Edmonds, Morton & Barrows
ATTORNEYS

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FIG. 3

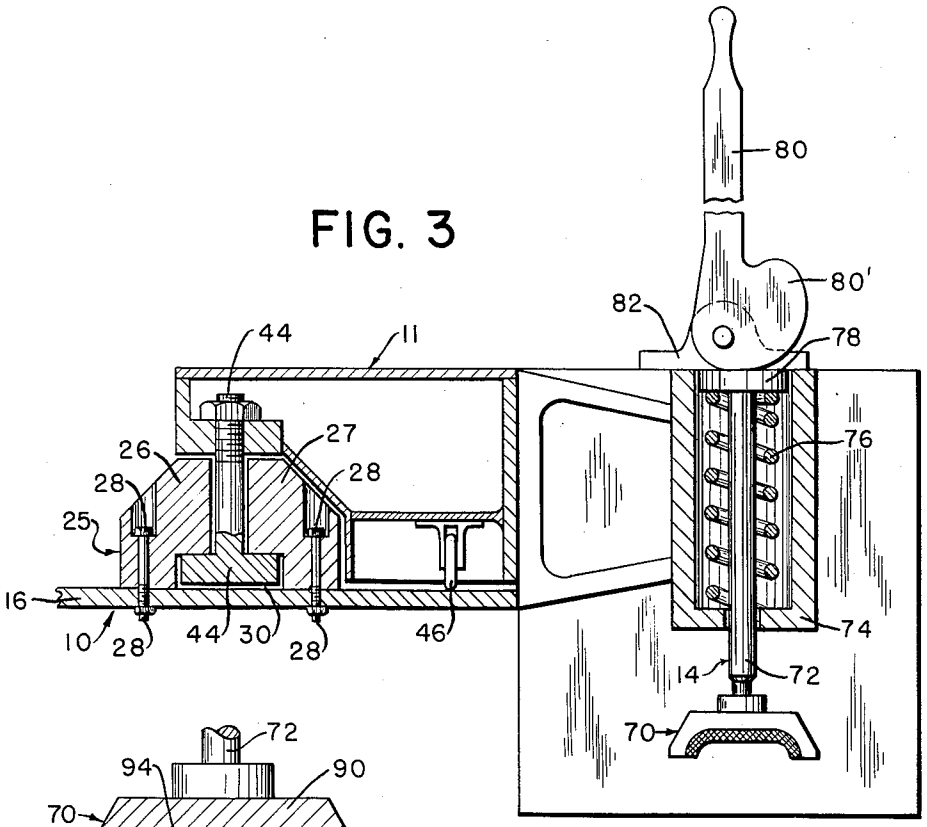


FIG. 4

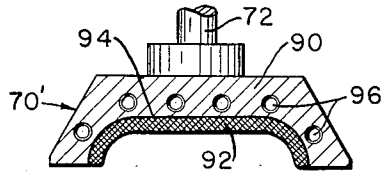


FIG. 5

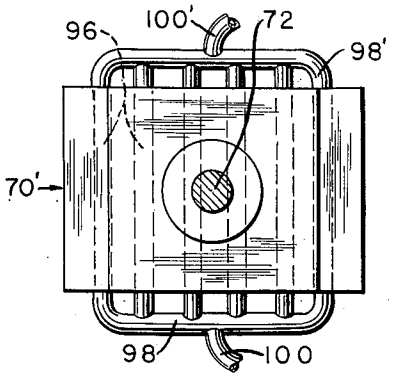


FIG. 6

INVENTOR
ROBERT M. ROOKE
BY
Pennie, Edmonds, Morton & Barrows
ATTORNEYS

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METHOD OF HARDENING THE ENDS OF RAILROAD RAILS

Robert Marton Rooke, Red Bank, N. J., assignor to Air Reduction Company, Incorporated, a corporation of New York

Application February 10, 1948, Serial No. 7,510

1 Claim. (Cl. 148—21.55)

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This invention relates to hardening of the ends of steel rails of railroad tracks and has for its object certain improvements in the method of hardening such rail ends.

When in service, railroad rails take the most wear at their ends due to the battering action of moving locomotives and cars over the rail joints. The wearing of the rail ends obviously results in the various ends being somewhat dissimilar in shape. Some ends, or treads and sides, of the rail heads will be worn more than others and thus result in differently contoured top end rail portions. Further repairs to end rail heads will cause other rail variations among the various rails of a given track. The effect accelerates because the wear becomes much more rapid as the rail ends become more worn. When badly worn at only one of its ends, the whole rail becomes useless. For this reason rail ends are heat treated to harden the vulnerable wear portions, to minimize the wear and to increase the useful life of the rail.

Hardening of rail ends in the field is usually done by flame heating the portion of the rail to be treated and then quenching it to produce the desired hardness. Considerable care must be exercised in this operation to avoid over-hardening the rail end to the point where it is likely to become brittle and thus to fracture in service and yet harden it sufficiently to give it long life. Various methods have been proposed for hardening rail ends in situ but they all have one or more undesirable features such as requiring skilled labor, or the use of heavy and costly equipment such as air compressors, or expendable water supplies to effect the quenching, or where simpler apparatus is used the results of the hardening operation are not satisfactory.

The object of this invention is to provide a method of hardening the ends of railroad rails in such a manner as to overcome objections of the kind enumerated.

In accordance with the method of the invention, the end of the rail to be hardened is heated to or slightly above its critical hardening temperature and then a quench block of heat conducting material, preferably having a pliable metal lining, is quickly applied to the heated surface of the rail and pressed firmly against it to assure rapid heat transfer from the rail to the quench block. The operation may, of course, be repeated if necessary until the desired hardness is obtained.

A cooling medium, such as water, is advantageously passed through one or more conduits in the quench block to hasten withdrawal of heat from the block and hence from the rail, as well

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as to prevent an accumulation of heat in the block so that it may be used promptly for the treatment of another rail end.

Apparatus suitable for carrying out the method of the invention comprises a wheeled truck adapted to run on the rails of the railroad track and on which suitable rail heating means and the quench block are mounted in such a way that after the rail end has been heated to the proper temperature by the heating means the quench block can be quickly moved to a position over the heated rail end, means being provided on the truck which is then operable to move the quench block downwardly and press it firmly into contact with the heated rail end. Although the heating means may be of any suitable type, such as the electric induction type, it is preferably of the gas torch type. Two of such torches may be on a carriage which is mounted on the truck so that it is movable transversely of the truck and the track rails, the carriage in its central position on the truck extending substantially from one track rail to the other and one of the heating torches being mounted at each end of the carriage. The quench block is mounted on the carriage intermediate the heating torches. Thus, a rail end may be heated to the proper temperature by the corresponding heating torch and then the carriage may be shifted transversely of the truck to simultaneously move the heating torch outwardly away from its heating position over the rail end and move the quench block into operative position over the heated rail end, whereupon the means for effecting downward movement of the quench block may be operated to press it firmly into contact with the heated rail end.

The improved method, and one form of apparatus which may be used to carry it out, are illustrated in the accompanying drawings, in which:

Figure 1 is a partial plan view of the apparatus;

Fig. 2 is a front elevation of the apparatus shown in Fig. 1;

Fig. 3 is a sectional view taken along line 3—3 of Fig. 1;

Fig. 4 is a sectional view of the quench block shown in Figs. 2 and 3;

Fig. 5 is a sectional view of a modified form of quench block; and

Fig. 6 is a plan view of the quench block shown in Fig. 5.

Referring first to Figs. 1 and 2, the apparatus shown comprises generally a truck 10, a carriage 11, a pair of spaced torches 12 and 13, and a quench block assembly 14.

Truck 10 is advantageously low and light in weight to facilitate its handling. It consists gen-

erally of a horizontal rectangular platform 16 secured to the tops of a plurality of depending standards 17 (Fig. 2) in which are mounted a pair of spaced transverse axles 18, on each of which there is a pair of flanged wheels 19 and 19' adapted to run on the track rails 20 and 21, respectively, the ends of which are to be hardened. As shown more particularly in Figs. 1 and 3, a transverse guide block 25 extends across the truck near its front end. The guide block may comprise a pair of juxtaposed supports 26 and 27 (Fig. 3) secured to the truck platform by means of a plurality of sunken bolts 28. The supports are so formed and spaced from each other as to provide an inverted T-recess 30. The truck and hence the platform should be large enough to accommodate such auxiliary equipment as may be desired by the operatives in the field.

Carriage 11 consists generally of a frame which extends transversely over the forward end of truck platform 16 toward the rails 20 and 21. As more particularly shown in Fig. 3, the framework extends rearwardly over transverse guide block 25 secured to the truck platform. The frame is so formed as to be complementary in contour to guide supports 26 and 27, particularly the latter. A plurality of spaced inverted T-guide members 44 depend from the framework, as shown, into inverted T-recess 30, with a relatively loose fit, so that the guide members may slide laterally as the carriage is moved on the truck transversely of the track rails. A plurality of spaced wheels 46 are rotatably secured to the framework of carriage 11 above the portion of the platform extending from the guide block to the front end of the truck, the wheels being adapted to roll transversely over the truck platform as the carriage 11 is moved transversely. Two such inverted T-guide members and two such wheels are sufficient to hold the carriage in sturdy but movable position.

As shown in Figs. 1 and 2, the framework of the carriage 11 is provided with a left arm 48 and a right arm 50 extending, when the carriage is centered, to rails 20 and 21, respectively. The left arm terminates in a sleeve or holder 52 into which torch 12 fits. In a similar manner, the right arm terminates in a sleeve or holder 54 into which torch 13 fits. The torches are of standard design and are adapted to be moved up and down in the holders by means of hand wheels 56 and 58, respectively. As is conventional practice, each torch is provided with an oxygen line 60 and a fuel-gas line 62 (Fig. 2). The source of supply for each is advantageously carried by the truck, such as a tank of oxygen and a tank of acetylene to which the lines are connected. The lower end of each torch terminates in a tip 64 for directing the mixture of fuel-gas and oxygen and hence the flame toward the rails.

Quench block assembly 14 comprises generally a quench block per se 70 (Figs. 2 and 3), mounted in any suitable manner on the lower end of a rod 72 extending through an upright cylinder 74 (Fig. 3) secured to the framework of the carriage. The cylinder 74 supports a coil spring 76 within its interior. The upper end of the rod terminates in a head 78 fitting within the upper end of the cylinder and extending over the coil spring. The coil spring is preferably a compression spring of suitable strength and height so that it supports the rod and quench block in their normally raised position. A cam-lever 80 is pivotally secured to a standard 82 rigidly secured to the framework of the carriage 11. The cam portion 80' of the cam-lever is in operative engagement with head 78 so that the rod 72, and hence the quench block, may be lowered and raised by moving the lever in the appropriate direction. As shown in Fig. 3, the rod and quench block are in their normally raised position. By moving the lever 80 downwardly to the right, the cam 80' bears down against the head of the rod 72, thus forcing the head, spring, rod and quench block downwardly. By raising the lever, the cam pressure is gradually released and the spring raises the rod and quench block to their former position.

Referring next to Fig. 4, the quench block 70 comprises an outer layer 90 of rigid heat conducting metal, such as steel, and an inner layer or lining 92 of pliable heat conducting metal, such as copper braid. A metallic bond between the rigid steel layer and the pliable copper braid layer is desirable to facilitate heat transfer, and this may be effected by providing a brazed joint 94 between the two layers.

Figs. 5 and 6 illustrate a modified form of quench block 70' which may be used. It differs from the quench block shown in Figs. 2, 3 and 4 in that the upper layer of steel is provided with a plurality of spaced conduits 96 which communicate at one side of the quench block with an inlet manifold 98 (Fig. 6) connected to an inlet tube 100 communicating with a source (not shown) of cooling medium, such as water. The conduits 96 communicate at the other side of the quench block with a similar outlet manifold 98' connected to an outlet tube 100' for the withdrawal of the cooling medium. The source is advantageously a tank of cool water on the truck platform. Both the inlet tube and the outlet tube may connect with the tank so that the water is passed from the tank to and through the quench block and thence back into the tank. While some circulation of the water will take place due to thermal currents, a pump may be used to accelerate circulation of the water. With a relatively large body of water in the tank, the same water may be used over and over again; the intervals of time between using the quench block normally being sufficient to permit adequate dissipation of heat from the tank.

The apparatus may be used as follows in practicing the method of the invention: Truck 10 is pushed or otherwise moved along the railroad track and brought to rest at an appropriate position with reference to the ends of rails 20 and 21 to be hardened. Assuming that the end of rail 20 is to be hardened first (see Fig. 2), carriage 11 is moved transversely of the truck and railroad track until burner tip 64 of torch 12 lies over the end of the rail. Oxygen line 60 and acetylene line 62 are opened; the imflammable mixture coming through the tip is ignited, and the resulting flame is appropriately adjusted. Hand wheel 56 is turned until the torch, and hence the flame, is located to heat the rail end most effectively. The end of the rail is then heated to or slightly above its critical hardening temperature. The supply of oxygen and acetylene is now cut off and carriage 11 is moved to the left sufficiently far to locate the quench block directly over the heated rail end. Cam-lever 80 is then operated by the operator to force the quench block into contact with the heated rail end. Due to the leverage permitted by the cam-lever, the quench block may be forced against the heated portion of the rail with sufficient pressure to deform its pliable lining 92 and cause it to adjust itself to the surface contour of the rail, thus assuring uniform

and intimate contact between the two. A contact pressure of around 200 pounds per square inch has given excellent results when the quench block is fairly heavy and has a pliable lining consisting of a copper braid about .25 inch in thickness brazed to its lower face. The rate at which heat is withdrawn from the rail depends upon the mass and conductivity of the quench block and the heat transfer conditions at the interface between the rail and quench block. This depends upon the perfection of the contact which, in turn, depends upon the pressure applied by the cam.

When the heated rail end is cooled sufficiently, lever **80** is raised and coil spring **76** returns the quench block to its normal raised position. One such heating and quenching operation is usually sufficient to produce the desired hardening effect, but the operation may of course be repeated if necessary.

If the quenching operation is to occur frequently so that sufficient time is not provided for air cooling of the quench block, it is preferable to use a water-cooled quench block such as the kind shown in Figs. 5 and 6. This quench block may be used, of course, even though the quenching operation is not frequent, particularly when it is desired to accelerate the quenching of a given rail end. While the quench block is in forced contact with the heated rail end, water is passed through inlet tube **100**, inlet manifold **98**, conduits **96** in the quench block, and the corresponding outlet manifold and outlet tube at the other side of the quench block. As already indicated, the source of the water is advantageously a tank located on the truck platform, so that the same water may be used over and over again.

A similar procedure is followed for hardening the end of rail **21** except that carriage **11** is moved to the right, as one looks at Fig. 2, to locate the tip **64** of torch **13** over the rail end, and after the rail end is heated to its critical hardening temperature by this torch, the carriage is moved still further to the right to bring the quench block over the heated rail end. The cam-lever **80** is then pulled down to press the quench block into contact with the heated rail end as above described.

My method of rail end hardening produces a harder surface on the end of the rail than can be achieved by a method in which air quenching is employed and does not involve any risk of over-hardening and subsequent cracking of the rail such as occurs when the rail is quenched by the direct application of quench water.

While the method herein specifically described is particularly applicable to rail end hardening, the principles of the invention may be used in hardening operations in other fields.

I claim:

The method of successively hardening the tread and sides of the end heads of rails forming part of a railroad track which has differently-contoured end heads which comprises positioning a heat source adjacent said differently-contoured end head, heating said end head above its critical temperature, removing said heat source, and while said end head is heated, downwardly pressing a relatively cool deformable body of heat-conducting copper filamentary elements into intimate heat exchange relation with said heated end head in order to effect an efficient quenching, the pressure with which the deformable body is pressed against the heated end head being sufficient to cause the surface of said deformable body to make substantially continuous contact with the surface of the tread of the rail adjacent the end of the rail.

ROBERT MARTON ROOKE.

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