J. C. RUSSELL.

TREATING STEEL RAILROAD RAILS AND OTHER LIKE BARS.

APPLICATION FILED MAR. 12, 1910.

993,410.

Patented May 30, 1911.

2 SHEETS—SHEET 1.

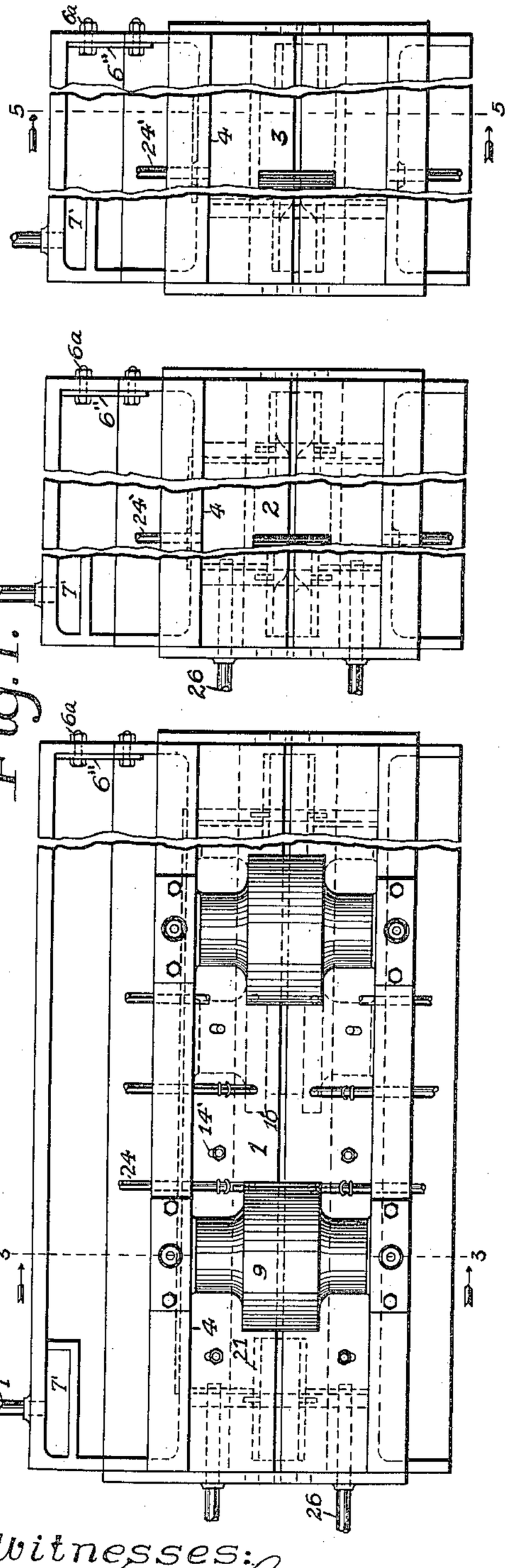

Fig. 1.

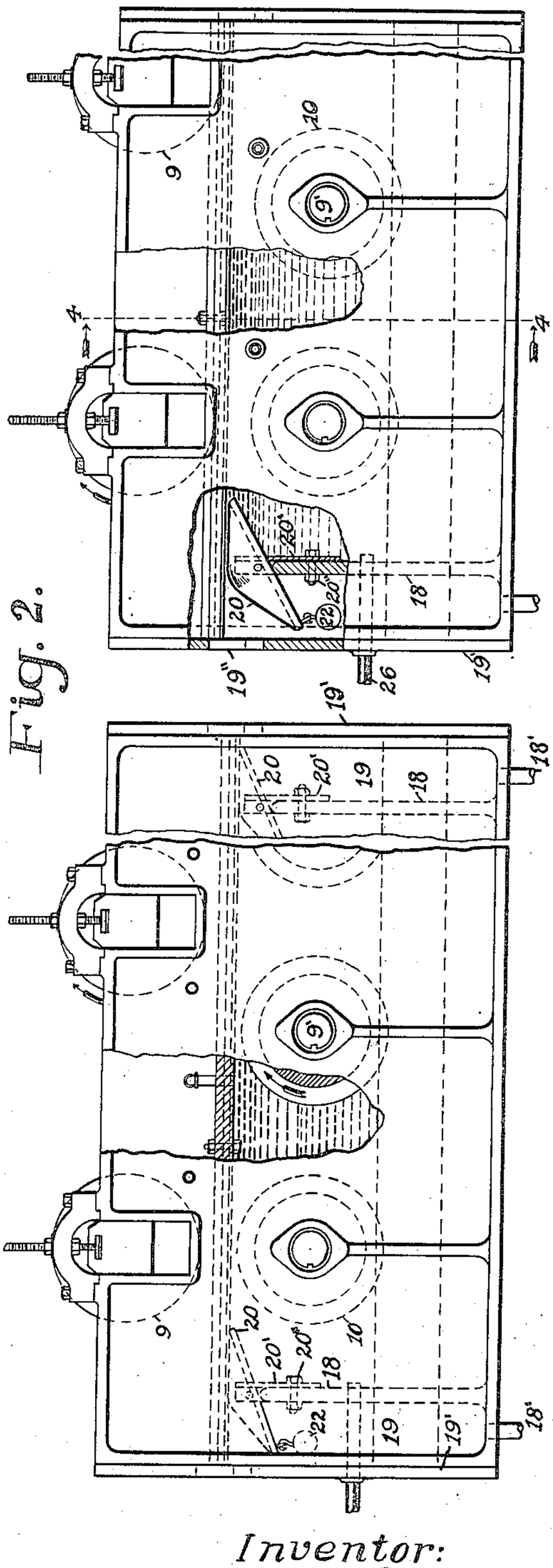

Fig. 2.

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Fig. 3.

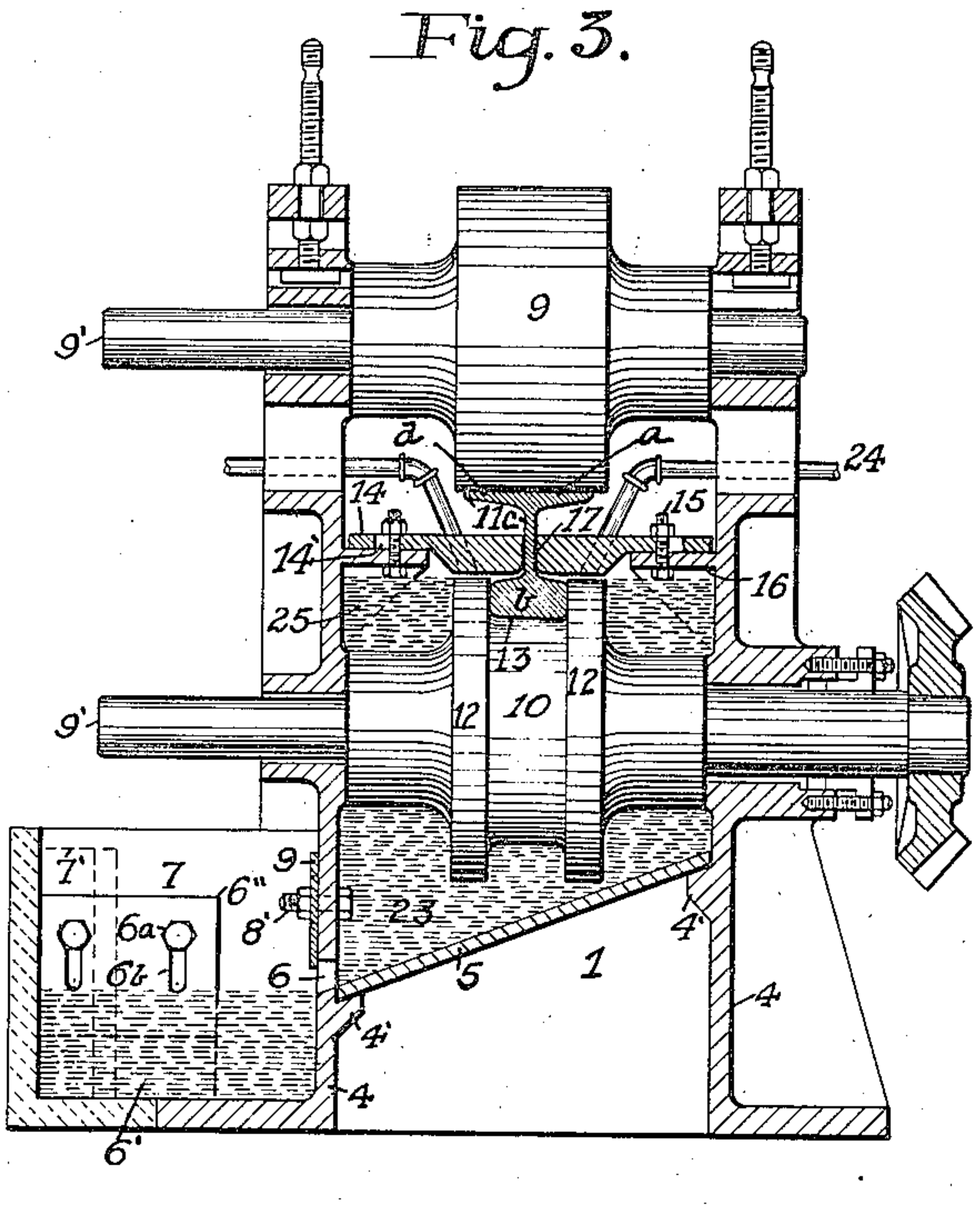


Fig. 4.

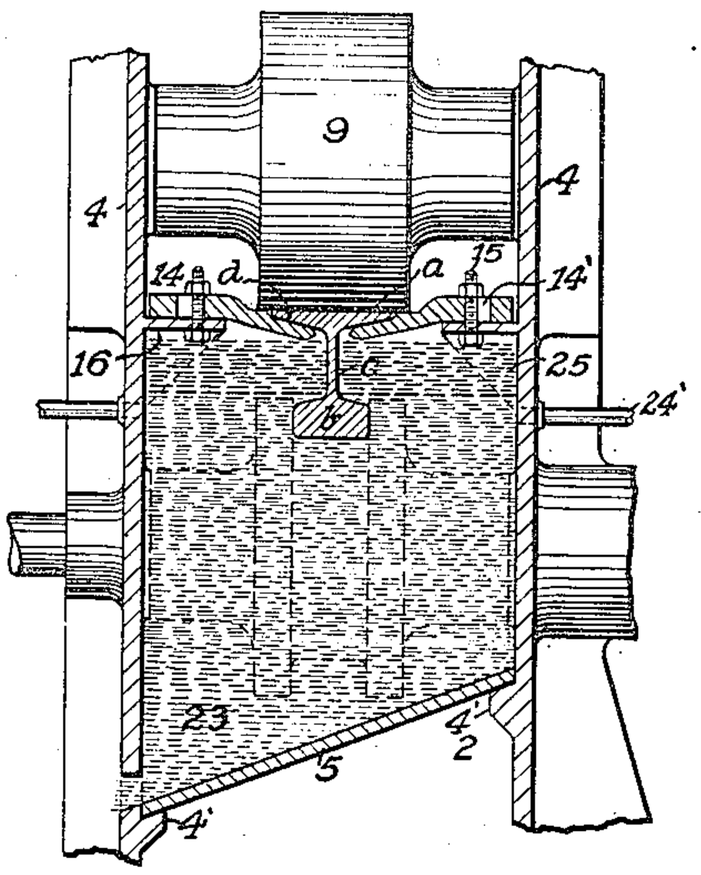
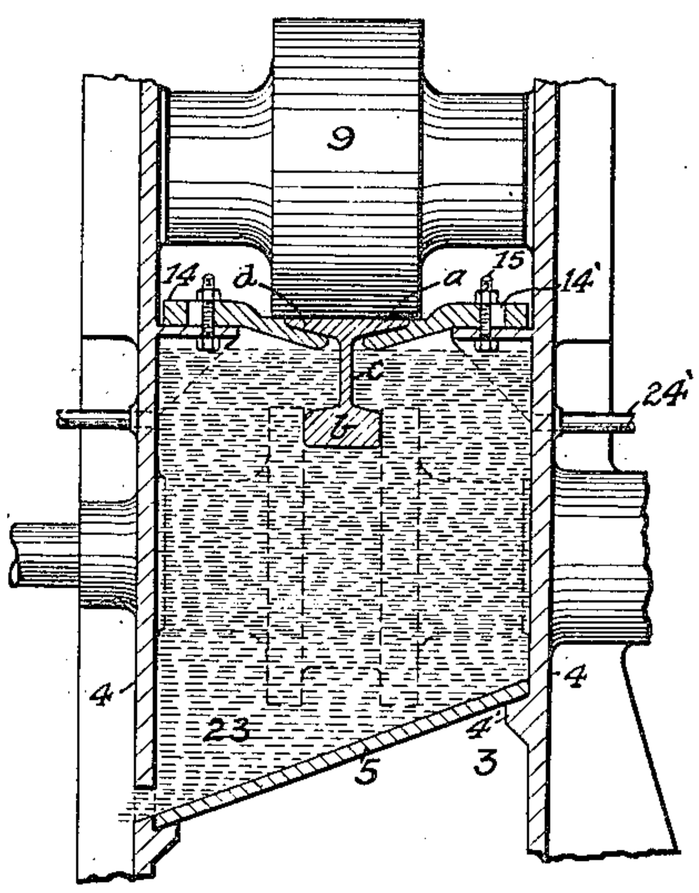


Fig. 5.



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UNITED STATES PATENT OFFICE.

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TREATING STEEL RAILROAD-RAILS AND OTHER LIKE BARS.

993,410. Specification of Letters Patent. Patented May 30, 1911.

Application filed March 12, 1910. Serial No. 548,932.

To all whom it may concern:

Be it known that I, JAMES C. RUSSELL, a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Treating Steel Railroad-Rails and other Like Bars; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to the treating of steel railroad rails and other like bars, and has special reference to soft steel or low carbon rails and bars.

The object of my invention is to provide a cheap, simple and efficient method for treating a soft or low carbon steel rail or bar, which will enable such rail or bar to have its head hardened to the extent desired for the purpose for which it is to be used, while the web and flange or flange of the same will be maintained in its soft and tough condition to properly support such head, and said head will be rendered in such a condition that it will be equal to the high carbon rail in hardness.

To these ends my invention consists, generally stated, in the novel method for treating steel railroad rails and bars, as hereinafter more specifically set forth and described and particularly pointed out in the claims.

To enable others skilled in the art to which my invention appertains to construct and use my improved method for treating steel railroad rails and bars, I will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a plan view of an apparatus for carrying out my invention in which three troughs are shown. Fig. 2 is a side elevation of the same, partly broken away with the third trough omitted. Fig. 3 is an enlarged cross-section on the line 3—3 Fig. 1. Fig. 4 is a like section on the line 4—4 Fig. 2. Fig. 5 is a similar view on the line 5—5 Fig. 1.

Like symbols of reference herein indicate like parts in each of the figures of the drawings.

As illustrated in the drawings, the apparatus for carrying out my invention is shown at A, and preferably consists of three troughs 1, 2 and 3, which are separate from each other and are provided with a bottom 5 within the same. This bottom 5 is set at an incline within the troughs 1, 2 and 3 and rests upon projections 4′ on the sides 4 of said troughs, while an opening 6 is formed in such sides of said troughs, which are at the downward side of such inclined bottom therein, which openings lead from said troughs to a drain trough 7 on that side of said troughs, and the size is regulated or is closed by means of an adjustable trap-plate 9 mounted on such trough sides by the bolts 8′. An overflow box 7′ is formed at the front end of each of the drain troughs 7 and from the same leads a pipe 7″ for draining any water collected in said troughs, when desired. An opening 6′ is formed in the rear end of the drain troughs 7, which is opened and closed by means of a gate 6″ supported by bolts 6^a on said ends and mounted in slots 6^b in such gate to adjust the height of said gate.

Within the troughs 1, 2 and 3 are a series of upper and lower rolls 9 and 10, which are journaled in the sides 4 of said troughs in the usual manner by their shafts 9′, and the upper and lower rolls at the entering or front ends of said troughs are placed in a vertical line with each other, while the balance of said rolls are staggered with each other. The upper rolls 9 are provided with the flat face 11 thereon, while the lower rolls 10 are provided with flanges 12 thereon for forming a groove 13 between such flanges, and these rolls are all revolved in the same direction, as shown by the arrows in Fig. 2, by means of suitable gearing (not shown) connected to the shafts 9′ of the same, which gearing is connected in any suitable manner through suitable devices to the usual source of power to operate and revolve such rolls thereby.

Extending between the sides 4 of the troughs 1, 2 and 3 are the cover-plates or shields 14, which are preferably formed in two sections, and are removably connected to said sides by means of the bolts 15 passing through the same and engaging with the supporting brackets 16 for said shields on the sides 4. The sections of the shields 14 are adapted to form a guiding slot 17 between the same, and such shields are also adjustably connected to the brackets 16 through the bolts 15 passing through elongated openings or slots 14′ in said shields in order to vary the size of the said guiding slot between the shield sections, when desired.

At the forward end of each of the troughs

1, 2 and 3 and within the same is the vertical wall 18, which is adapted to form an overflow compartment 19 in said troughs and between the front ends 19′ of the same and said walls, and leading from the lower end of the compartment 19 is a drain-pipe 18′. At the upper ends of the wall 18 is an overflow regulating plate 20′, which is adjustably mounted on said wall by means of the bolts 20″ and is adapted to regulate the height of the treating fluid materials in the troughs 1, 2 and 3. Within and pivoted to the upper end of each of the walls 18 is a trap 20 for extending between its trough and the overflow from said trough, and this trap is of trough-shape form having triangular shaped sides 21 on each side of the same, while a weight 22 is hung from the forward end of the trap to hold the rear end of the same in a raised normal position.

Within the troughs 1, 2 and 3, water, such as is shown at 23, is placed, by means of the pipes 24 entering through and connected to the shields 14 in the trough 1, and in the troughs 2 and 3 pipes 24′ for supplying such water to these troughs enter the same through the sides 4 of said troughs. Above the water in the troughs 1 and 2 a suitable oil bath, such as is shown at 25, is placed by means of pipes 26 entering the front end 19′ of said troughs and through the overflow compartment 19 and wall 18. The oil bath 25 in the trough 1 is adapted to extend only around the head *b* of the ordinary railroad rail *a* when passed through the same as hereinafter described, and the shields 14 in such trough are placed so that the bottom of the same is adjacent to the under face of such rail head. In the trough 2, the water bath 23 surrounds the head of the passing rail *a* as hereinafter described, and the shield 14 in said trough is placed so that the oil 25 can extend around the web *c* of the rail, while the upper face of the flange *d* on the rail will rest upon and come against the top surface of said shield to assist in supporting and guiding the rail. In the trough 3, the shield 14 therein is in the same position as in the trough 2, and the absence of the oil bath 25 therein will allow the water 23 to extend entirely around the head *b* and web *c* of the rail *a* in the passing of said rail through the same as hereinafter described.

The use and operation of the apparatus A is as follows—After the finished rail *a* leaves the usual devices for sawing the same into proper lengths and while in a heated condition its end is passed in any suitable manner through an opening 19″ in the front end 19′ of the trough 1 and over the overflow compartment 19 in said trough, where such front end strikes against the rear end of the trap 20, which will throw said trap into a horizontal position and so allow the head *b* of said rail to fit within the same. After entering into the trough 1 through the opening 19″ the web *c* of the rail *a* fits within the slot 17 formed between the sections of the shields 14, while the flange *d* of said rail extends above said shield, so that after the end of the rail has passed beyond the rear end of the trap 20 the head of said rail will enter into the oil bath 25 in said trough and in the further passing of said rail in said trough it will be caught by the first two forward rolls 9 and 10, with its head *b* fitting in the groove 13 in the lower roll 10 and with the bottom of its flange *d* against the flat face 11 on the upper roll 9. After being so caught by the forward rolls 9 and 10, the rail *a* is drawn thereby, so that it can pass to and be caught by the other rolls 9 and 10 within the trough 1 to continue its drawing through the said trough and allow its head *b* to be still immersed in the oil bath 25 therein to harden said head, while at the same time it is guided in a straight line by the slot 17 in the shield 14 and by said rolls so engaging the head *b* and flange *d* of said rail, which will keep the rail in its proper finished shape and alinement and at the same time the web *c* and flange *d* of such rail are protected from being in contact with said oil bath to prevent hardening of the same by the shields 14. After the front end of the rail *a* has passed the rear rolls 9 and 10 in the trough 1, it strikes against the rear end of the trap 20 at the rear end of said through to throw said trap to its horizontal position, which will allow the head *b* of said rail to fit within the same, and then such rail end enters the opening 19″ in the rear end of such through to allow the rail to pass out of said trough. As the rail *a* thus passes out of the trough 1 it enters and passes through the trough 2 in like manner as in trough 1, and the head *b* of the same is immersed in the water bath 23 in said trough 2, while the web *c* of the same is immersed in the oil bath 25 in said trough to further harden said head and said web. After passing through the trough 2 the rail *a* enters and passes through the trough 3 in like manner as in the troughs 1 and 2, and the head *b* and web *c* on said rail are immersed in the water bath 23 in said trough 3 to further harden said head and web. After the rail *a* has left the traps 20 in the troughs 1, 2 and 3 such traps will resume their normal positions, as shown in Fig. 2 through their weighted front ends, which will enable the inclined sides 21 on the rear ends of the same and such ends to come against the under faces on the shields 14 and thereby prevent the oil or water in said troughs from escaping into the compartments 19. While the rail *a* is thus passing through the troughs 1 and 2 and is having its head *b* and web *c* hardened by the water baths 23 and oil baths 25 therein, any overflowing of such oil from the troughs 1

and 2 caused by the movement of such rail head through the same will pass over the walls 18 at the front and rear ends of said trough and into the overflow compartments 19 at such ends, where it can be drawn therefrom by the pipes 18′ to a suitable receptacle or returned to the bath 25 through the water 23 to cool the same, as desired. Any overflowing of the water 23 in the trough 3 caused by the passing of the rail *a* through the said trough during the hardening of the rail head *b* and web *c* by such water therein, will pass over the walls 18 at the front and rear ends of said trough and into the compartments 19 at such ends, where it can be drawn off by the pipes 18′ to a suitable receptacle or returned to the bath 23 in said trough, as desired. During this passing of the rail *a* through the troughs 1, 2 and 3 the water 23 in said troughs is drained therefrom into the drain troughs 7 through the openings 6 in the sides 4 of said troughs, as well as any scale from said head or web through the hardening of the same by said oil and water baths, which scale will pass down the inclined bottoms 5 in said troughs and into said troughs 7 through said openings to collect the same, while such water can pass from said drain troughs through the openings 6′ at the rear ends of the same to a suitable receptacle, or be returned to said troughs 1, 2 and 3, as desired. In case of any overflow in the troughs 7 the water therefrom can be passed into the overflow boxes 7′ in said troughs and be withdrawn therefrom by the pipes 7″ to a suitable receptacle or be returned to the troughs 1, 2 and 3, as desired, while the scale can be removed from troughs 7, as desired.

It will be evident that the troughs 1, 2 and 3 can be of sufficient width to enable two or more rails or bars to be passed through the same at one time, and if desired a suitable heating furnace can be placed in front of said trough 1 and between said troughs 2 and 3 to maintain the rails or bars at the proper heat for hardening the heads or webs of the same in said troughs. In the latter case with the usual pyrometer attached to such furnace, the rail or bar could pass slowly through the same, which would keep such rail or bar at a uniform heat, and where a high carbon steel rail or bar of an extra hardness is used, the furnace in front of the first trough will heat said rail or bar to a uniform temperature, while the furnace between the second and third troughs will act to reduce the hardness of the rail or bar, so that the steel in such rail or bar can be heated to the proper color for hardening and then be cooled in the last trough by the water medium. The head alone or both the head and web of the rail can be tempered or treated by the cooling fluid or medium, and in either case a single or two troughs can be used for such hardening or treating, while either high or low carbon rails, bars, long shear knives, or other bars that require a hard and soft surface can be treated in like manner.

It is well known that in the use of oil in the treatment of steel after it is finished that the article so treated would be of a very tough and close grain, which would add to the wear and strength of such article, but in the treatment of a rail of low carbon it may not be necessary to use oil for such treatment, in which case when water alone is used for the treatment, the rail would be of a better quality than the ordinary present high carbon one, although such oil treatment would make a better rail, as it could be hardened at a higher heat, as the oil seems to have an affinity for the steel by closing the pores of the same and adding greatly to its strength.

Various other modifications and changes in carrying out the method or process employed, may be resorted to without departing from the spirit of the invention, or sacrificing any of its advantages.

It will thus be seen that a very soft tough steel or low carbon steel railroad rail or other like bar, can have its head or web hardened so that these parts of the same will become as hard as the ordinary high carbon rails now in use and while being so tempered the rail is kept in its finished shape and in proper alinement. When the rail head is so being hardened, the web and flange of the same are protected from the tempering material, and when the head and web are being hardened the flange is protected from such material, so that such web and flange, or such flange will still maintain their or its softness and toughness when cooled to properly support said head or such head and web, and thereby keep the rail from breaking under any quick jar or heavy strain, as is common with the high carbon steel rails or bars now in use. It will also be seen that while the rail is being treated in the troughs and passing through the shield over the treating or cooling medium, the web of such rail will fit closely in the guiding slot of such shield and thereby prevent the oil from burning from the heat of such rail.

The advantages of the process briefly summarized are as follows—1. A rail of the kind contemplated would prevent many wrecks and save the lives of many persons, which would be caused by the breaking of the ordinary or present high carbon steel rail, as in the manufacture of the present standard of railroad rail, in order to get the head hard enough to wear it must be made of high carbon steel, as well as the web and flange of the same, so on account of the web and flange of such rail being thinner than the head, the running of cold water on the rolls to clean

the scales from such rail while finishing the same often cools the web and flange, and their being of such high carbon steel tends to make them brittle and more apt to break. 2. In such a rail being formed of low carbon steel, when the head becomes worn and has been taken up on account of such condition, it can be marketed as new billets or bars, the price of which is always close to the same price as new rails, and as such it can be used in the making of all kinds of soft steel bars, wire rods, cotton-ties, spikes, nails, bolts and other articles. 3. On account of the high carbon steel in the rail now used and the difference in the thickness of the flange and head, one cools quicker than the other, which causes an unequal strain in the metal, so that the high carbon steel being hard and brittle would cause it to break much easier when any severe strain comes upon it, while the low carbon steel being very soft and tough and so treated would be apt to give and eliminate such strain, thereby forming a rail which would bend to a very great extent before breaking, and the tempering of the head of such rail would make it dense and tough and of a better wearing quality. 4. In the casting of high carbon steel ingots it is a well known fact that they "pipe" more than the ingots of low carbon, in fact the "piping" in the latter is unusual, so that under the present method of making high carbon rails a large portion of the same must be cut away in order to insure there being no "pipage" or seams in the finished rail, and you cannot heat the high carbon steel to weld the same as in the low carbon steel. On account of the low carbon steel ingot not "piping" it would be necessary to cut very little, if any, of the "sinking" or "pipe" end of the ingot, so that there would be little waste and therefore amount to a great saving in the manufacture of these rails, and often in the "piping" of high carbon steel ingots a sufficient amount is not severed from the "pipe" end of the same, which would cause the "pipe" to work out in the finished rail, and not be seen in such rail, and would make the same weak and more liable to break, all of which would be eliminated in the low carbon steel rail by reason of not having such an amount of "pipe" end to contend with.

What I claim as my invention and desire to secure by Letters Patent is—

1. The process of treating metal articles, comprising the steps of passing the hot finished article through a cooling medium bath of oil extending around a portion only of such article, and then passing the article through a cooling medium bath wherein water extends around said portion.

2. The process of treating metal articles, comprising the steps of passing the hot finished article through a cooling medium bath of oil extending around a portion only of such article, and then passing the article through cooling medium baths of water and oil extending around said portion and another portion of said article, respectively.

3. The process of treating metal articles, comprising the steps of passing the hot finished article through a cooling medium bath of oil extending around a portion only of such article, then passing the article through a cooling medium bath wherein water extends around said portion only, and then passing said article through another cooling medium bath of water extending around said portion and another portion of said article.

4. The process of treating metal articles, comprising the steps of passing the hot finished article through a cooling medium bath of oil extending around a portion only of such article, then passing the article through cooling medium baths of water and oil extending around said portion and another portion of said article, respectively, and then passing said article through another cooling medium bath of water extending around said portions.

5. The process of treating rails, comprising the steps of passing the hot finished rail through a cooling medium bath of oil extending around the head only of such rail, and then passing the article through a cooling medium bath wherein water extends around said head.

6. The process of treating rails, comprising the steps of passing the hot finished rail through a cooling medium bath of oil extending around the head only of such rail, and then passing the article through cooling medium baths of water and oil extending around the head and web of said rail, respectively.

7. The process of treating rails, comprising the steps of passing the hot finished rail through a cooling medium bath of oil extending around the head only of such rail, then passing the article through a cooling medium bath wherein water extends around said head, and then passing said rail through another cooling medium bath of water extending around the head and web of said rail.

8. The process of treating rails, comprising the steps of passing the hot finished rail through a cooling medium bath of oil extending around the head only of such rail, then passing the article through cooling medium baths of water and oil extending around the head and web of said rail, respectively, and then passing said article through another cooling medium bath of water extending around said head and web.

9. The process of treating metal articles, comprising the steps of passing the hot finished article through a cooling medium bath

of oil extending around a portion only of such article while protecting the balance of said article from said medium, and then passing the article through a cooling medium bath wherein water extends around said portion while protecting the balance of said article from said medium.

10. The process of treating metal articles, comprising the steps of passing the hot finished article through a cooling medium bath of oil extending around a portion only of such article while protecting the balance of article from said medium, and then passing the article through cooling medium baths of water and oil extending around said portion and another portion of said article, respectively, while protecting the balance of said article from said medium.

11. The process of treating metal articles, comprising the steps of passing the hot finished article through a cooling medium bath of oil extending around a portion only of such article while protecting the balance of said article from said medium, then passing the article through a cooling medium bath wherein water extends around said portion while protecting the balance of said article from said water, and then passing said article through another cooling medium bath of water extending around said portion and another portion of said article while protecting the balance of said article from said medium.

12. The process of treating metal articles, comprising the steps of passing the hot finished article through a cooling medium bath of oil extending around a portion only of such article while protecting the balance of said article from said medium, then passing the article through cooling medium baths of water and oil extending around said portion and another portion of said article, respectively, while protecting the balance of said article from said medium, and then passing said article through another cooling medium bath of water extending around said portions while protecting the balance of said article from said medium.

13. The process of treating rails, comprising the steps of passing the hot finished rail through a cooling medium bath of oil extending around the head only of such rail while protecting the balance of said rail from said medium, and then passing the article through a cooling medium bath wherein water extends around said head while protecting the flange of said rail from said bath.

14. The process of treating rails, comprising the steps of passing the hot finished rail through a cooling medium bath of oil extending around the head only of such rail while protecting the balance of said rail from said medium, and then passing the article through cooling medium baths of water and oil extending around the head and web of said rail, respectively, while protecting the flange of said rail from said bath.

15. The process of treating rails, comprising the steps of passing the hot finished rail through a cooling medium bath of oil extending around the head only of such rail while protecting the balance of said rail from said medium, then passing the article through a cooling medium bath wherein water extends around said head only while protecting the flange of said rail from said medium, and then passing said rail through another cooling medium bath of water extending around the head and web of said rail while protecting the flange of said rail from said bath.

16. The process of treating rails, comprising the steps of passing the hot finished rail through a cooling medium bath of oil extending around the head of such rail while protecting the balance of said rail from said medium, then passing the article through a cooling medium bath of water and oil extending around the head and web of said rail, respectively, while protecting the flange of said head from said medium, and then passing said article through another cooling medium bath of water extending around said head and web while protecting the flange of said rail from said bath.

In testimony whereof, I, the said JAMES C. RUSSELL, have hereunto set my hand.

JAMES C. RUSSELL.

Witnesses:
JAMES L. WEHN,
T. B. HUMPHRIES.