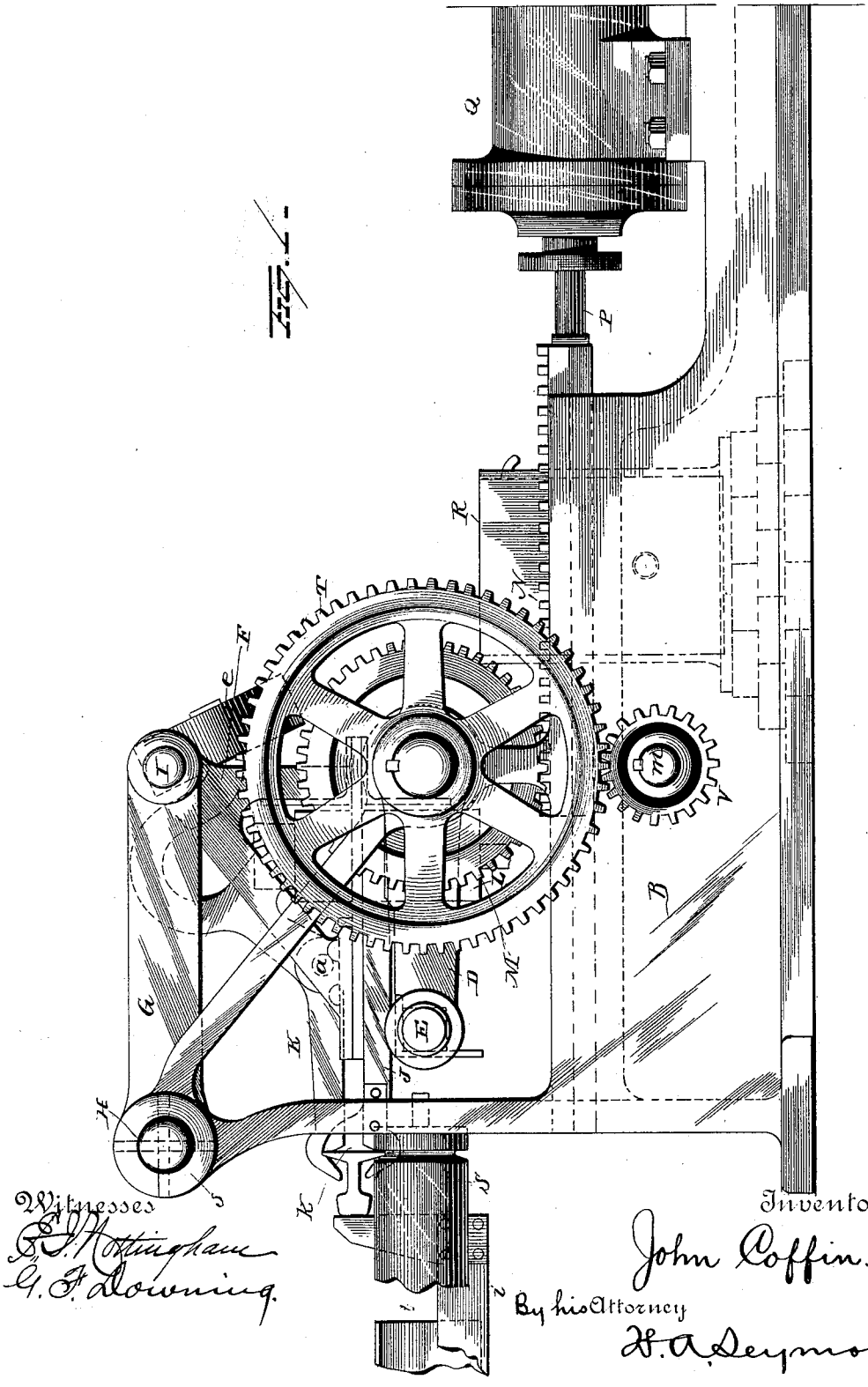
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J. COFFIN.

APPARATUS FOR FACILITATING THE COOLING OF RAILROAD RAILS.

No. 368,132. Patented Aug. 9, 1887.



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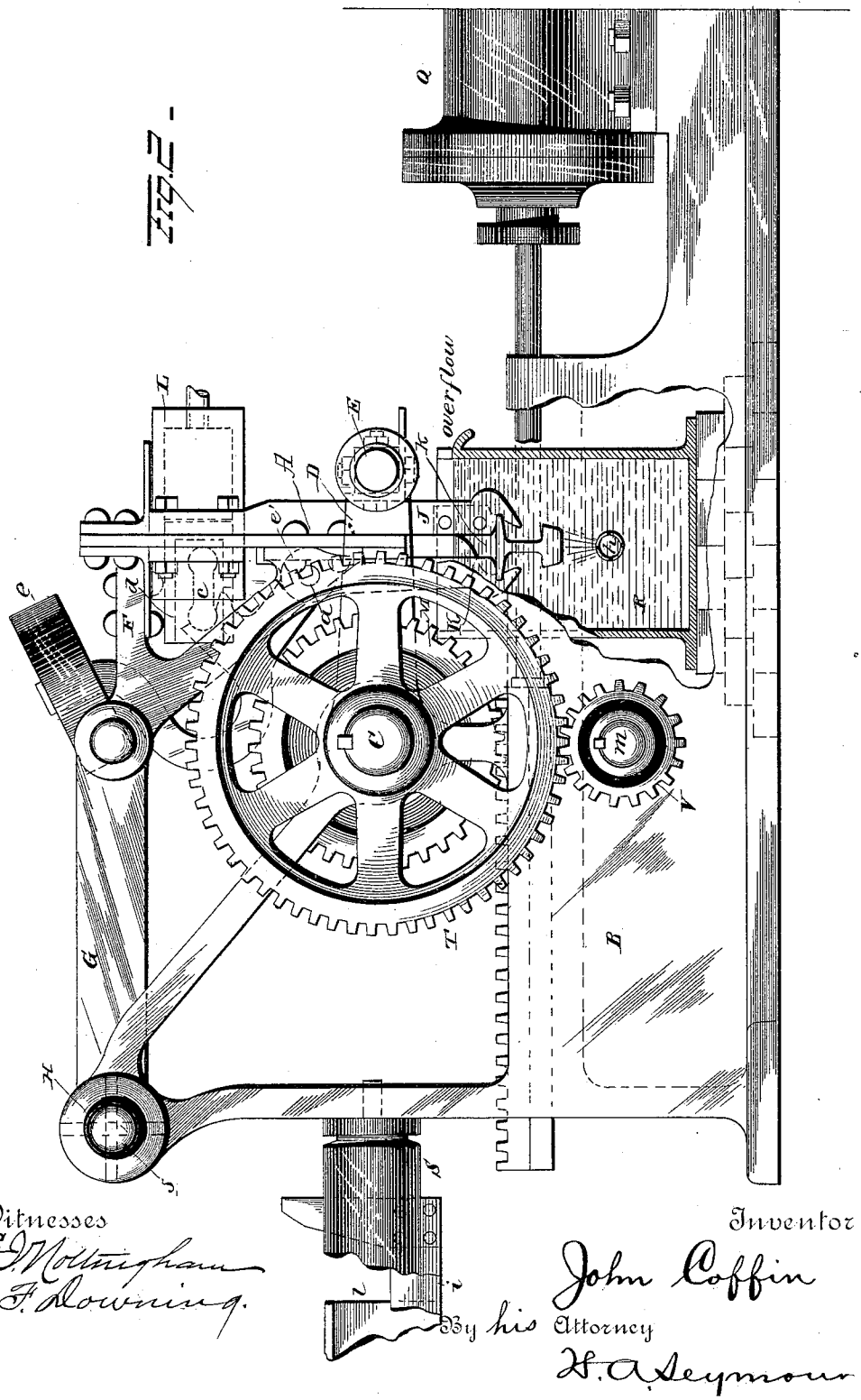
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Fig. 2.



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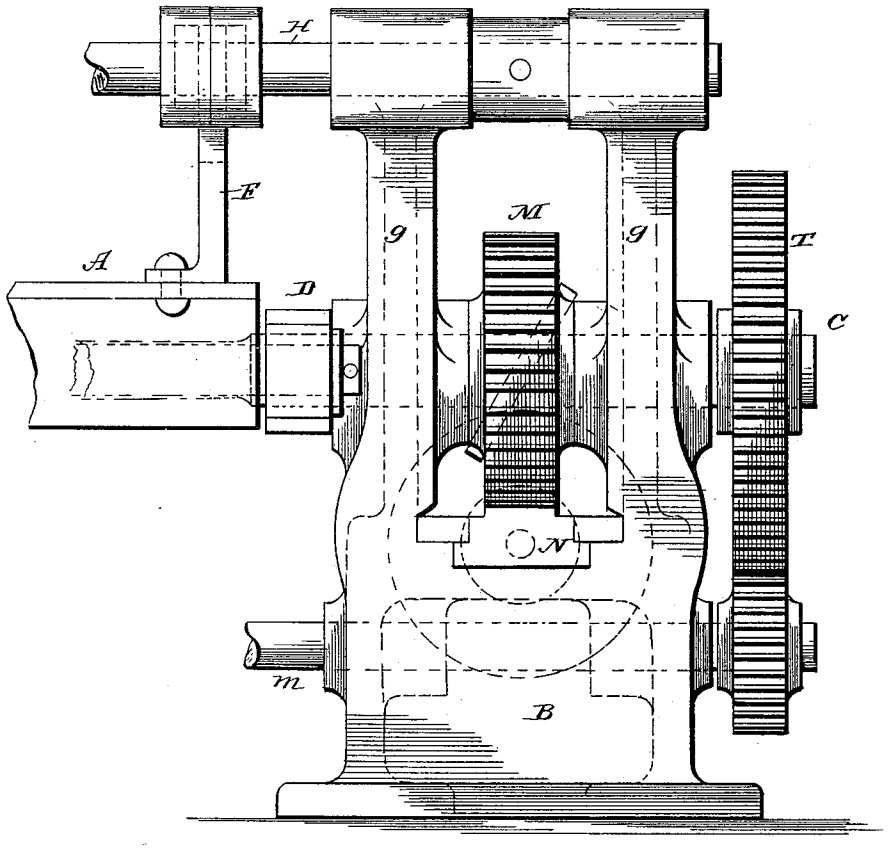
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Fig. 3.



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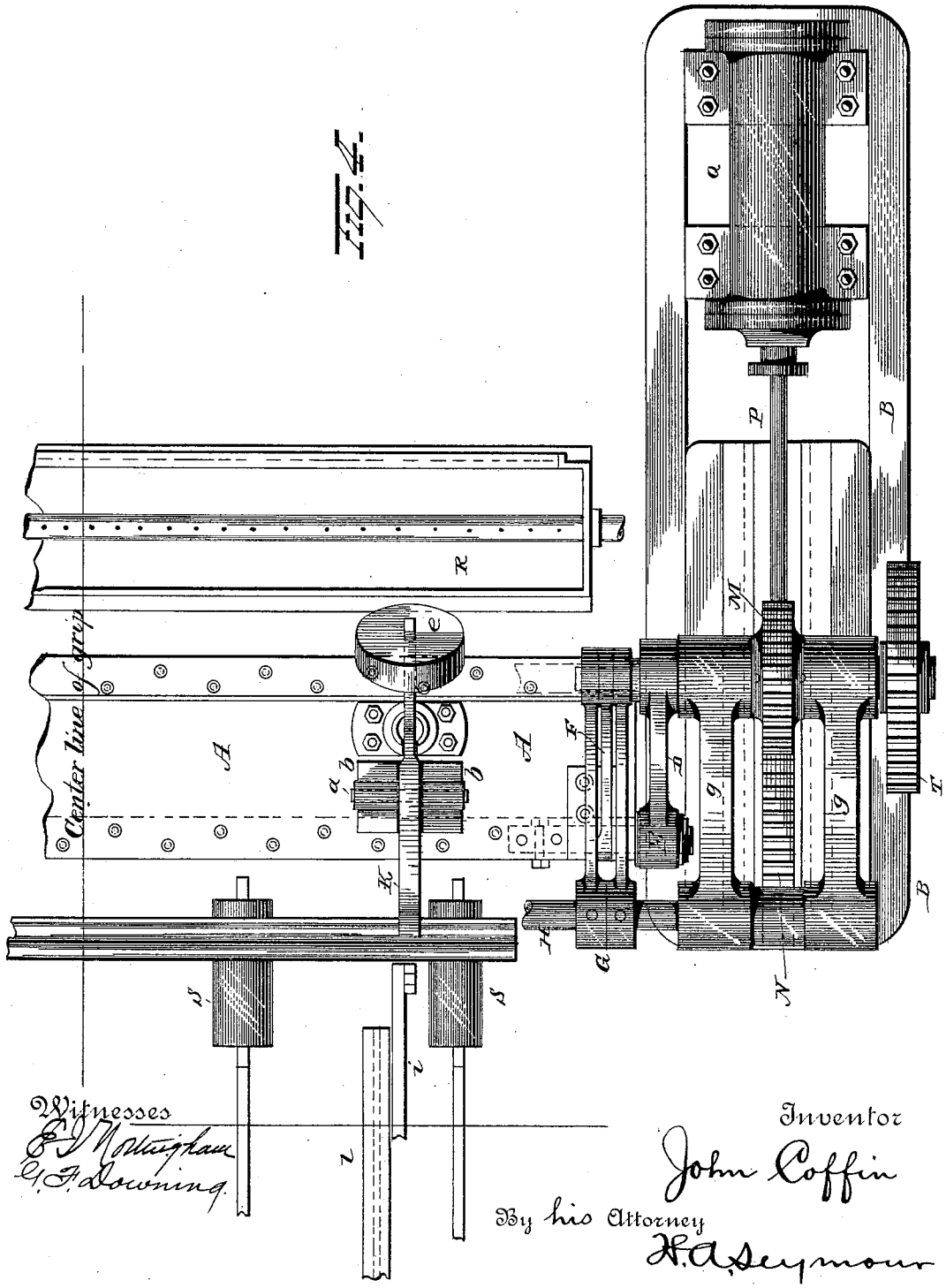
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UNITED STATES PATENT OFFICE.

JOHN COFFIN, OF JOHNSTOWN, PENNSYLVANIA, ASSIGNOR TO THE CAMBRIA IRON COMPANY, OF SAME PLACE.

APPARATUS FOR FACILITATING THE COOLING OF RAILROAD-RAILS.

SPECIFICATION forming part of Letters Patent No. 368,132, dated August 9, 1887.

Application filed May 26, 1887. Serial No. 239,462. (No model.)

To all whom it may concern:

Be it known that I, JOHN COFFIN, of Johnstown, in the county of Cambria and State of Pennsylvania, have invented certain new and useful Improvements in Processes of Toughening Steel Rails and other Bars; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to the manufacture of steel railroad-rails and other steel bars; and it consists in a method of cooling said rails and bars after they leave the rolls, so as to give them a greater amount of toughness and strength. As steel is rolled in the modern mills it leaves the rolls very hot, for the tendency of progress has been toward quicker work; and for several reasons, among them the great wear of finishing-rolls and severe strains on the mill, it is not practicable to work at colder heats.

It has been discovered by numerous experiments that as a steel bar leaves the finishing-rolls, no matter at what heat, the structural arrangement of its molecules is such as to give great strength and toughness if this arrangement can be maintained. If, however, it leaves the rolls very hot, a coarse and weak structure is formed while cooling slowly; but if cooled rapidly through a certain range of temperature such bad structure has not time to form.

The object of my invention is to maintain the good structure due to rolling steel bars by cooling rapidly until a temperature is reached at which no further harm takes place. Although my invention is particularly adapted to railroad-rails, and the devices herein shown are better adapted to toughen railroad-rails than any other form of bar, yet I do not wish to confine myself to this particular class of work, as by a modification of the gripping device other forms of steel bars may be successfully operated upon.

The method of accomplishing the result I seek is as follows: After the crop ends are sawed from the hot rail it is immediately pushed into suitable gripping-jaws attached to a strong girder or supporting-table, which is then moved, bearing the rail with it, so as to bring the rail-head downward in a tank of water, entirely immersing the rail and exposing its head portion to a shower of submerged jets, the object of these jets being to cool the head more rapidly than the remaining part of the rail, not to make it colder, but to bring it to the same heat, for at the time at which the rail is immersed the head is the hottest portion; and, furthermore, the metal being thicker in the head, the remaining portion of the rail would become colder than the head if the rail were only immersed and no special means adopted to carry off the heat faster per unit of surface from the head. While it is cooling and coming to a uniform temperature in the water it is held by the before-mentioned grips at suitable intervals to keep it straight. After it is cooled a proper degree it is removed from the water, being held firmly by the grips attached to the table before mentioned, and deposited by suitable rolls or mechanical devices onto a cooling-bed and allowed to slowly cool. To work the invention successfully the rail should be put in the cooling-bath as soon as possible after being rolled, and removed from this bath at a time when there is enough heat remaining in the interior portion of the rail to bring the rail to a low red heat in the dark after the heat has uniformly diffused itself.

I will now describe the apparatus I use to bring my invention into effect.

Referring to the drawings accompanying this description, Figure 1 is an end elevation of the rail-cooling apparatus, with the rail in position on the swinging table with its flange and head resting on delivery-rolls. Fig. 2 is an end elevation of the rail-cooling apparatus, with the rail held by the swinging table in a position in the "bosh" or water-trough to receive jets of water upon its head. Fig. 3 is a front elevation of one end of the apparatus. Fig. 4 is a plan view of one half of the device, the opposite end being an exact duplicate of the portion shown.

A is a strong platten or table, preferably made of wrought-iron plates that are riveted together or made integral in a manner to afford necessary rigidity and prevent warping under the influence of unequal expansion and

contraction of its surface. This table is made somewhat longer than the rail to be toughened, and for which it is designed to afford a stable support while undergoing treatment. At each end of the table A the frames B are erected, one of which is shown in the drawings. The frame at the opposite end of the table, together with all its attachments or connected mechanism, being exact duplicates of the portions shown, it is deemed unnecessary to illustrate these duplicate parts. Extending through the frames B, and supported in journal-boxes formed on these frames, is a main shaft, C, upon which are mounted the cranks D, that are located and secured to the shaft at such points as to engage with their outer ends the wrist-pins E, which latter are rigidly secured to the table A. F are brackets that are forked to extend and be attached to the ends of the table A at two separated points, *e e'*, (see Fig. 2,) and thus produce stiffening braces for the ends of the table, as well as a means of connecting this table A with the longitudinally-extending shaft H, which is supported in boxes on the frames B at *s*, this connection being effected by the twin links G, that are pivoted at I to the bracket F by one of the ends, the opposite ends being attached to the shaft H. (See Figs. 1 and 2.)

As the table A is made to occupy two principal positions while the apparatus is in use, one horizontal and the other vertical, these changes of location are exhibited in the figures. An inspection of Figs 1 and 4 shows the horizontal position, the table being exhibited as vertically adjusted in Figs. 2 and 3 of the drawings.

Gripping devices are located at spaced intervals on the flat surface of one side of the table A. These grips, that are intended to grasp and hold the rail in position upon the table A, are located at several points on this table; but as they are all alike but one is shown, and a description of one will answer for the entire series.

J and K are grip-bars. J is firmly attached to the girder A. K is pivoted on the pivot *a*, which passes through the brackets *b b*, that in turn are firmly affixed to the table A. The grip-lever K extends beyond the pivot *a*, and is connected by connecting-blocks *c* to the plunger *d*, which works in the hydraulic cylinder L. It is also farther extended with a curved form to clear a portion of the table A, and carries on its outer end the counterpoise-weight *e*. The hydraulic cylinder L is served through the pipe *f*, which has some suitable flexible connection with the pressure system from which power is derived. The frame B is formed with two upright sides, *g g*, Fig. 2. Between these two upright sides, and attached to the main shaft C by means of a diagonal pin, is a gear-wheel, M, which engages with the rack N, that is attached to the hydraulic-piston rod P, which is actuated by the piston situated within the main hydraulic cylinder Q.

Ingress and egress openings, with suitable controlling devices, (not shown,) are provided, so that the hydraulic piston, carrying with it its piston-rod P and rack N, may be moved from one end to the other of its stroke at the will of the operator.

R is the water-tank or bosh, provided with a perforated pipe, *h*, running through it lengthwise, as shown in the drawings, and so situated that when the rail is in the position shown in Fig. 2 the submerged jets will be projected on the head of the rail. *i* is one of a series of pusher-bars to move the rail sidewise when it is brought into position to be engaged by these bars, which have a limited movement endwise, they being actuated by machinery that is not shown. Any suitable method of moving these bars may be utilized. The position assumed by the rail after it has been shoved by the pusher-bars *i* is shown in plan view, Fig. 4.

k is a stop-block that is attached to the grip-jaw J, and bears against the lower surface of the base-flange of the rail when the rail is placed in the position shown in Fig. 4. This stop-block *k* is intended to restrict the pushing movement just described, and hold the rail in proper position to be engaged by the gripping-jaws J K.

S S are two of a series of driven rollers that are properly supported and rotated to transport a rail placed on them away from the table A of the apparatus, which has been described, the driving mechanism that rotates the rollers S, and by their agency moves a rail endwise to the cooling-table, is not shown.

T is one of a pair of gear-wheels attached to each end of shaft C.

m is a shaft passing through both main frames, B, it being supported to revolve in boxes of these frames, and bears on each end attached thereto the pinions V, which engage with the gear-wheels T, receiving rotary motion therefrom. The longitudinal motion imparted by the hydraulic motor through the rack N is such that the gear-wheel M will be caused to revolve through half of a circle, or one hundred and eighty degrees.

Having now described the several parts of my invention, I will proceed to show how it works, following the rail from the time it is sawed until it is delivered on the cooling-beds.

The line *o p* represents the position of the rail while it is being sawed. We will suppose the rail is in this position ready for treatment. The pusher-bars *i* push it up to the position shown in Fig. 3, and hold it against the stops *k*, while water is admitted to the hydraulic cylinder L through the flexible connection and orifice *f*, thereby raising the plunger *d*, and, through the connection *c*, raising the outer end of the grip-lever K, which turns on the pivot *a* and firmly grips the rail in the position shown in Figs. 1 and 4. Pressure is then admitted to the hydraulic cylinder Q, so as to advance the rack N and revolve gear M through one half-revolution; and as the crank D and the gear M are both keyed to the main

shaft C, the crank D is thereby revolved through the half circle and comes to the position shown in Fig. 2, carrying with it the table A. The location of the lever G, and its length together, with the length of the crank D, determine the position of the table A, the proportion being such between these parts and their connections that while the crank is turning through an angle of one hundred and eighty degrees the swinging table A is turned through an angle of ninety degrees at the same time, being carried over from the position shown in Figs. 1 and 4 to that shown in Fig. 2. The motion of the rail in its movement from one position to the other is something as follows: It is first raised almost vertically, then carried over horizontally, and at the same time turned. It is then lowered to its second position, the latter part of this movement being almost vertical. Having now brought the rail to the position shown in Fig. 2, it is entirely immersed by the movement in the bosh R, and its head is exposed to a shower of water from the immersed jets. After being in this position for a short time the action of the apparatus is reversed and the rail is delivered in its first position, as shown in Figs. 1 and 4. The delivery-rolls S are now started by suitable mechanism and the rail is delivered on its cooling-bed. The temperature of the rail is now such that there is some incandescence shown in the diffused daylight of the mill, and in the dark it is an even low red. It is necessary that the cranks D on each end of the girder A should work in unison, and as the rigidity of the shaft C is not enough to assure this the shaft *m*, with its gear-connections, is introduced to help attain this result. It has been previously stated that the two main frames B are exact duplicates in all their parts and attachments. It will be understood that the one not shown at the other end of the girder also carries a hydraulic cylinder and rack, the fluid inlet and outlet pipes being so connected to both cylinders that the two pistons will work in unison. Therefore the torsional strains to be provided for are mainly accidental.

I am aware that a process has been devised by which the heads of steel railroad-rails are hardened by means of jets of water made to impinge upon them. I do not claim such a process or a rail so hardened; nor do I seek to harden a rail-head or a steel bar. My invention, when carried into effect as herein described, does not attain it, as I do not cool or try to cool the head more than other parts of the rail, but by sprays of water thrown upon it I cause it to be so reduced in temperature that when removed to the table the heat will be uniformly diffused through the entire body of the rail and toughened structural mass result from the operation.

It is evident that analogous features of construction may be adopted to carry into effect the process herein described; hence I do not desire to be restricted to exact forms and arrangement of parts shown; but,

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The process herein described of toughening a steel railroad-rail or other steel bar, consisting of immersing it in a suitable cooling-bath as soon as may be after it has been rolled, partially cooling it therein, and then removing this steel bar or rail from the bath while there is sufficient heat remaining in the rail to bring the whole mass by diffusion to a low red heat in the dark, substantially as set forth.

2. The process herein described, consisting of clamping a steel railroad-rail or steel bar in a rigid position to prevent warping or twisting of its body, and afterward immersing and spraying jets upon it to reduce the temperature measurably, leaving sufficient heat in the mass to bring it when diffused to a low red heat in the dark, substantially as set forth.

3. In an apparatus for toughening steel rails or steel bars, the combination, with a bosh or water-trough, of a swinging table, a support for the table, and a means of swinging the table, substantially as set forth.

4. In an apparatus for toughening steel rails or bars, the combination, with a bosh or water-trough, of a frame, a swinging table, and a means of swinging the table on the frame, substantially as set forth.

5. In an apparatus for toughening steel rails or bars, the combination, with two end frames, of a swinging table supported to rock or swing edgewise on these frames, substantially as set forth.

6. In an apparatus for toughening steel rails or bars, the combination, with two end frames, of a swinging table pivoted at its ends and supported to swing edgewise on the end frames, substantially as set forth.

7. In an apparatus for toughening steel rails or bars, the combination, with a bosh, of two end frames and a swinging table pivotally supported on the frames, substantially as set forth.

8. In an apparatus for toughening steel rails or bars, the combination, with a bosh, of two end frames, a swinging table, and a means of swinging the table edgewise, substantially as set forth.

9. In an apparatus for toughening steel rails or bars, the combination, with a supporting-frame, of a swinging table pivoted at its ends on the frame, and clamping devices that are attached to the swinging table, substantially as set forth.

10. In an apparatus for toughening steel rails or bars, the combination, with two frames that are adapted to swingingly support a flat table between their uprights, of a swinging table and a series of gripping-jaws arranged to hold a bar or rail on the table, substantially as set forth.

11. In an apparatus for toughening steel bars or rails, the combination, with two frames

that are adapted to swingingly support a flat table between their upright portions, of a swinging table pivoted on its ends, a series of gripping-jaws, and a hydraulic motor to operate the grip-jaws, substantially as set forth.

12. In an apparatus for toughening steel rails or bars, the combination, with two duplicate frames that have uprights, a flat swinging table that is supported pivotally between the uprights of the duplicate frames, and a series of gripping jaws attached to the swinging table, a hydraulic motor to close the grip-jaws and hold them closed, and a means of swinging the table edgewise, substantially as set forth.

13. In an apparatus for toughening steel rails or bars, the combination, with a swinging table supported to be transferred laterally from a horizontal to a perpendicular position and the reverse, of a hydraulic motor and mechanism by which the table is transferred or made to swing, substantially as set forth.

14. In an apparatus for toughening steel rails, the combination, with a swinging table, frames to support the table, gripping-jaws, and a motor to move the jaws, of a hydraulic motor to swing the table, and a bosh or water-trough to receive the table when it is transferred from a horizontal to a vertical position, substantially as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

JOHN COFFIN.

Witnesses:
A. S. ELDRIDGE,
AUG. YOUNG.