Dec. 5, 1939. F. M. GRAHAM 2,182,120

APPARATUS FOR HARDENING THE ENDS OF TRACK RAILS

Filed March 12, 1938 19 Sheets-Sheet 1

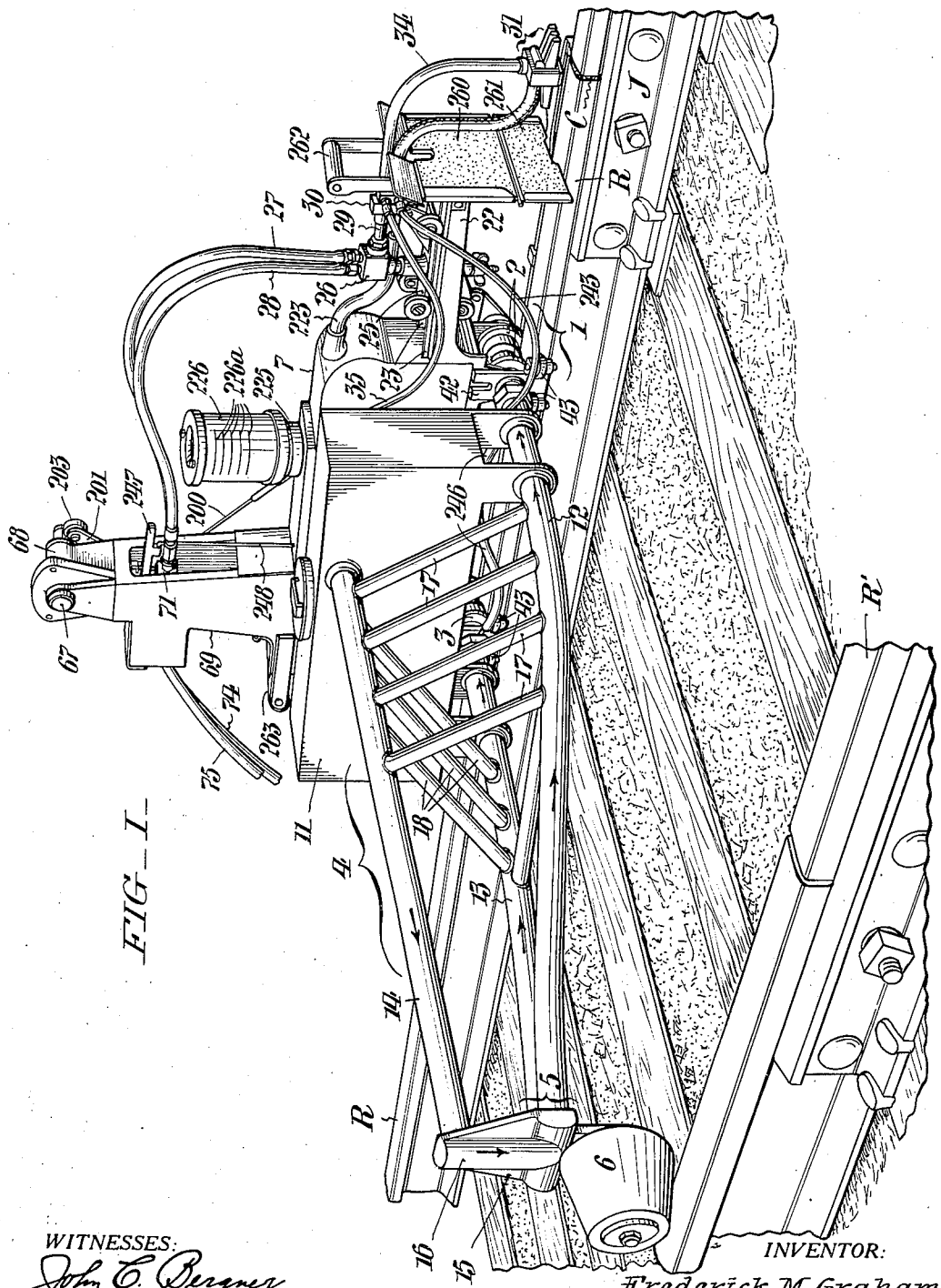


FIG. 1.

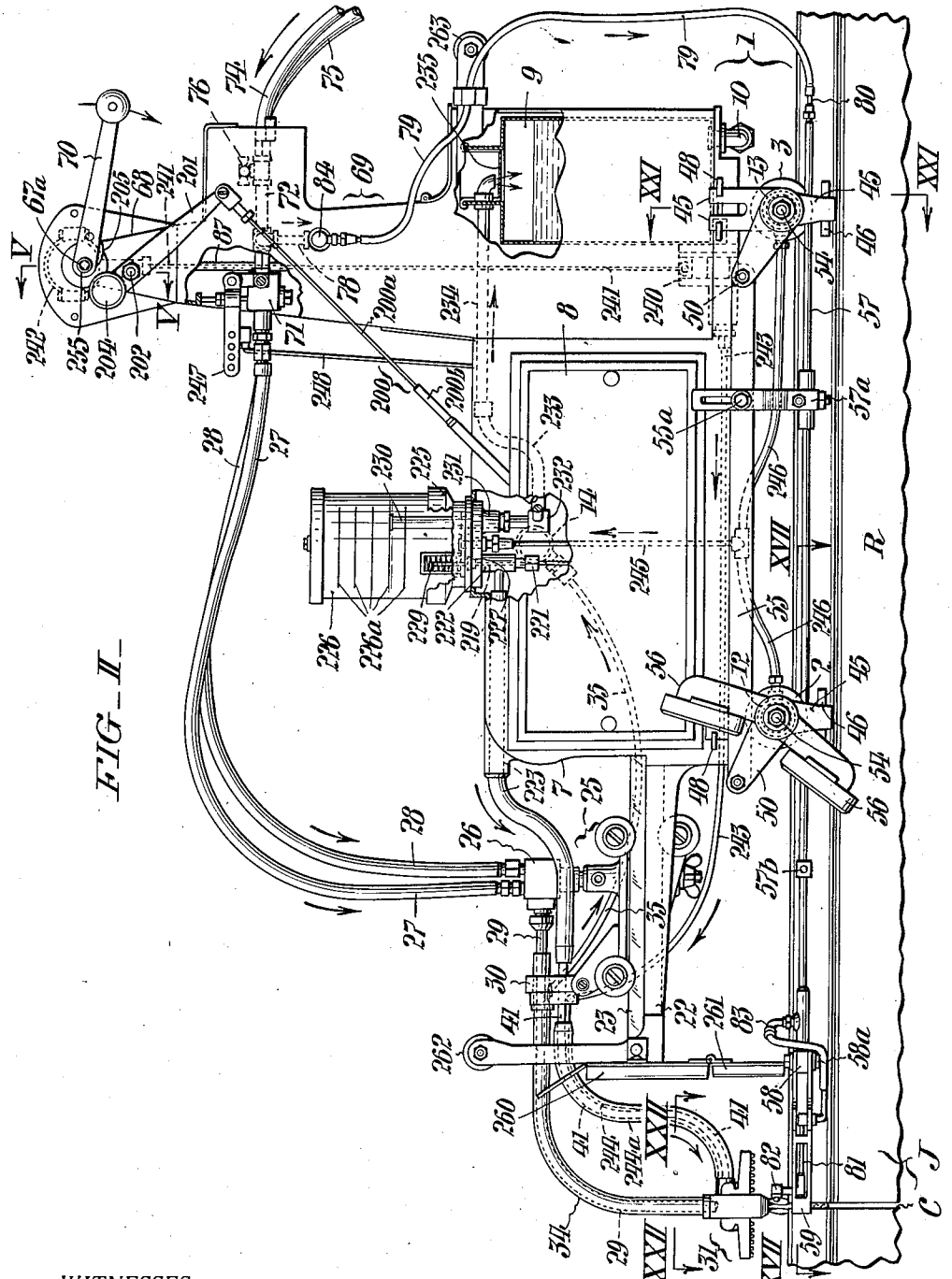
WITNESSES:
John C. Bergner
Hubert Fuchs

INVENTOR:
Frederick M. Graham,
BY Paul & Paul
ATTORNEYS.

Dec. 5, 1939. F. M. GRAHAM 2,182,120

APPARATUS FOR HARDENING THE ENDS OF TRACK RAILS

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FIG_II_

WITNESSES:
John C. Bergner
Hubert Fuchs

INVENTOR:
Frederick M. Graham,
BY Paul Paul
ATTORNEYS.

Dec. 5, 1939. F. M. GRAHAM 2,182,120

APPARATUS FOR HARDENING THE ENDS OF TRACK RAILS

Filed March 12, 1938 19 Sheets-Sheet 3

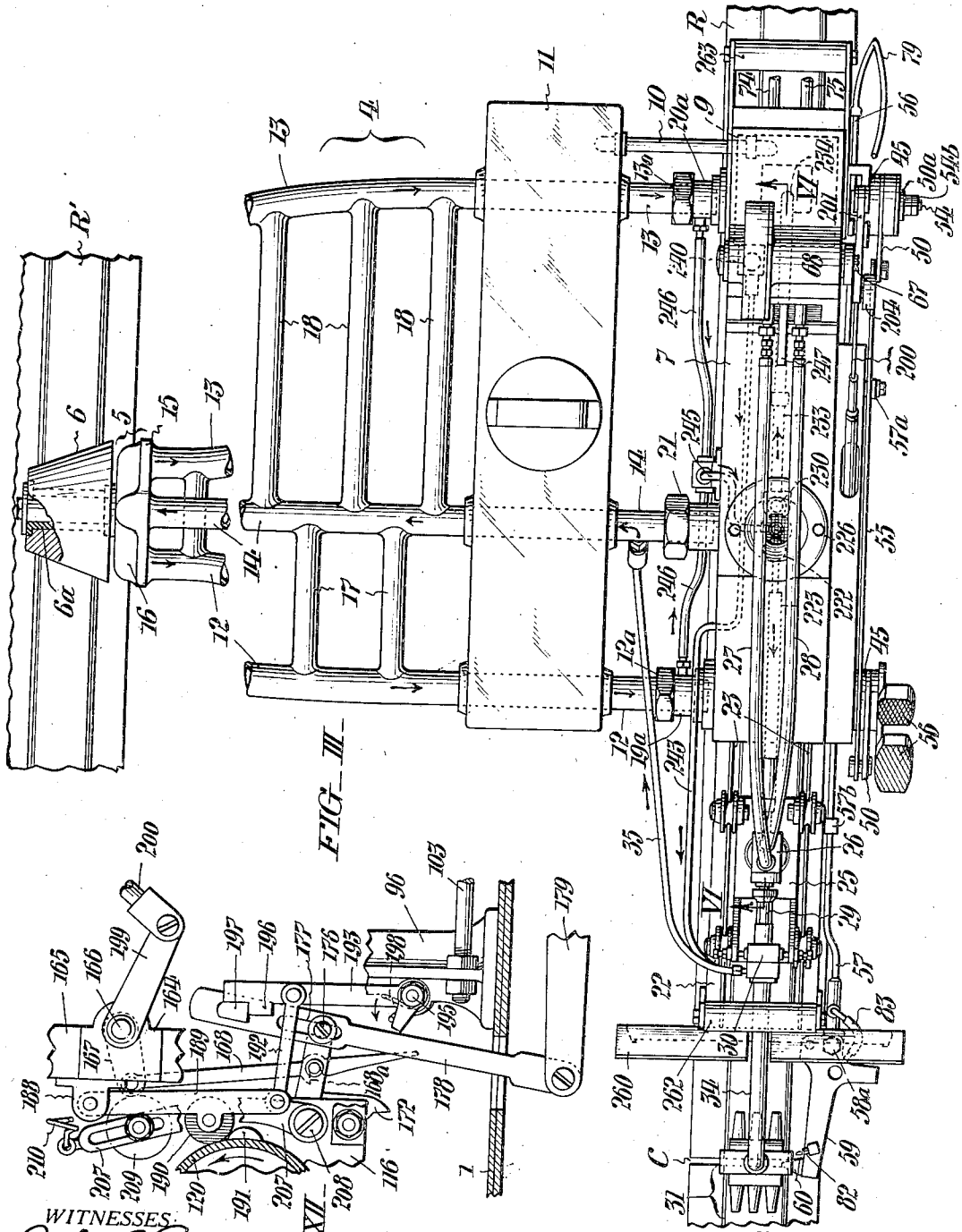


FIG. III.

FIG. XII.

WITNESSES:
John C. Bergner
Hubert Hicks

INVENTOR:
Frederick M. Graham,
BY Paul & Paul
ATTORNEYS.

Dec. 5, 1939. F. M. GRAHAM 2,182,120

APPARATUS FOR HARDENING THE ENDS OF TRACK RAILS

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FIG. IV.

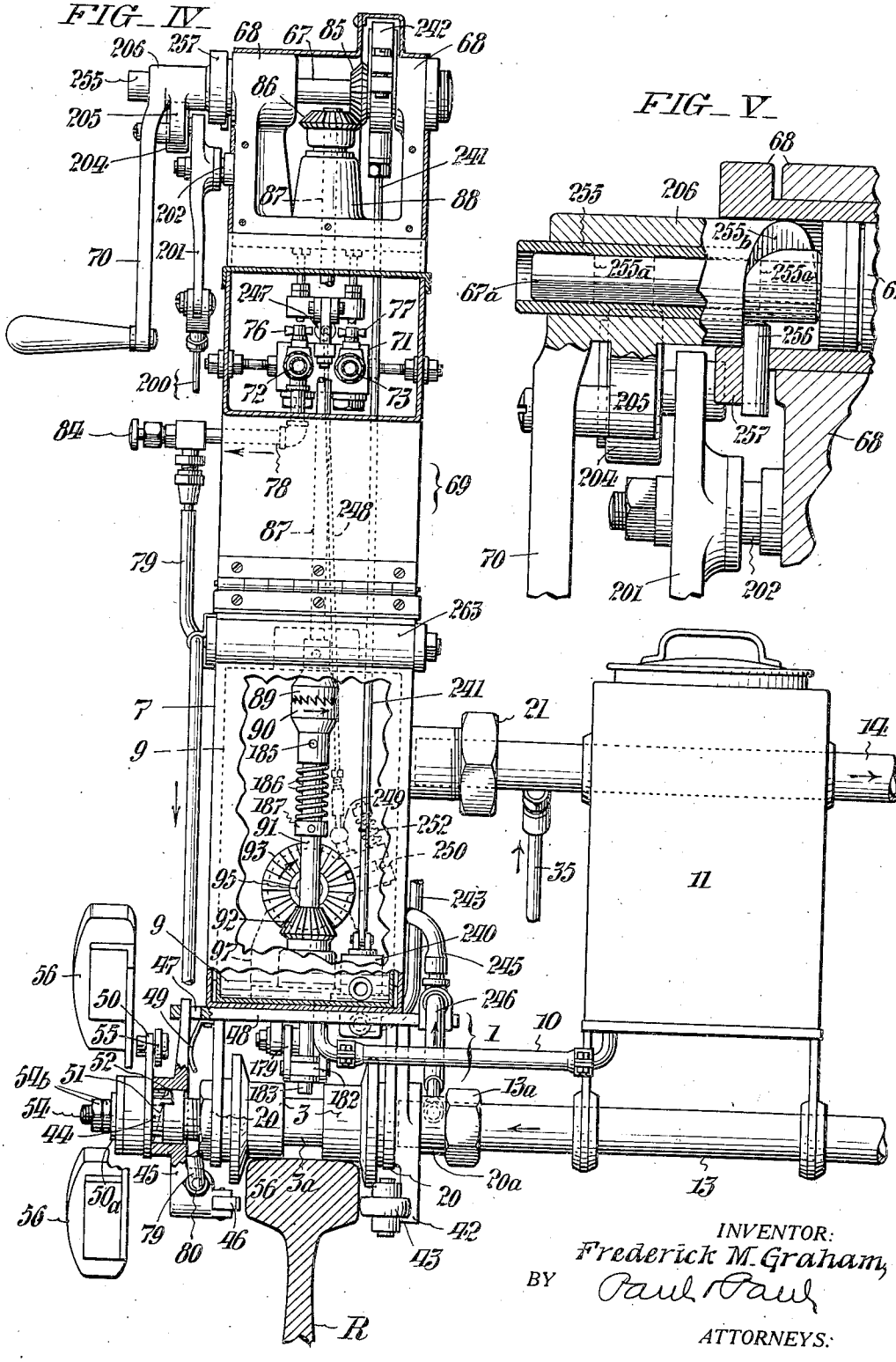


FIG. V.

INVENTOR:
Frederick M. Graham,
BY Paul & Paul
ATTORNEYS.

Dec. 5, 1939. F. M. GRAHAM 2,182,120

APPARATUS FOR HARDENING THE ENDS OF TRACK RAILS

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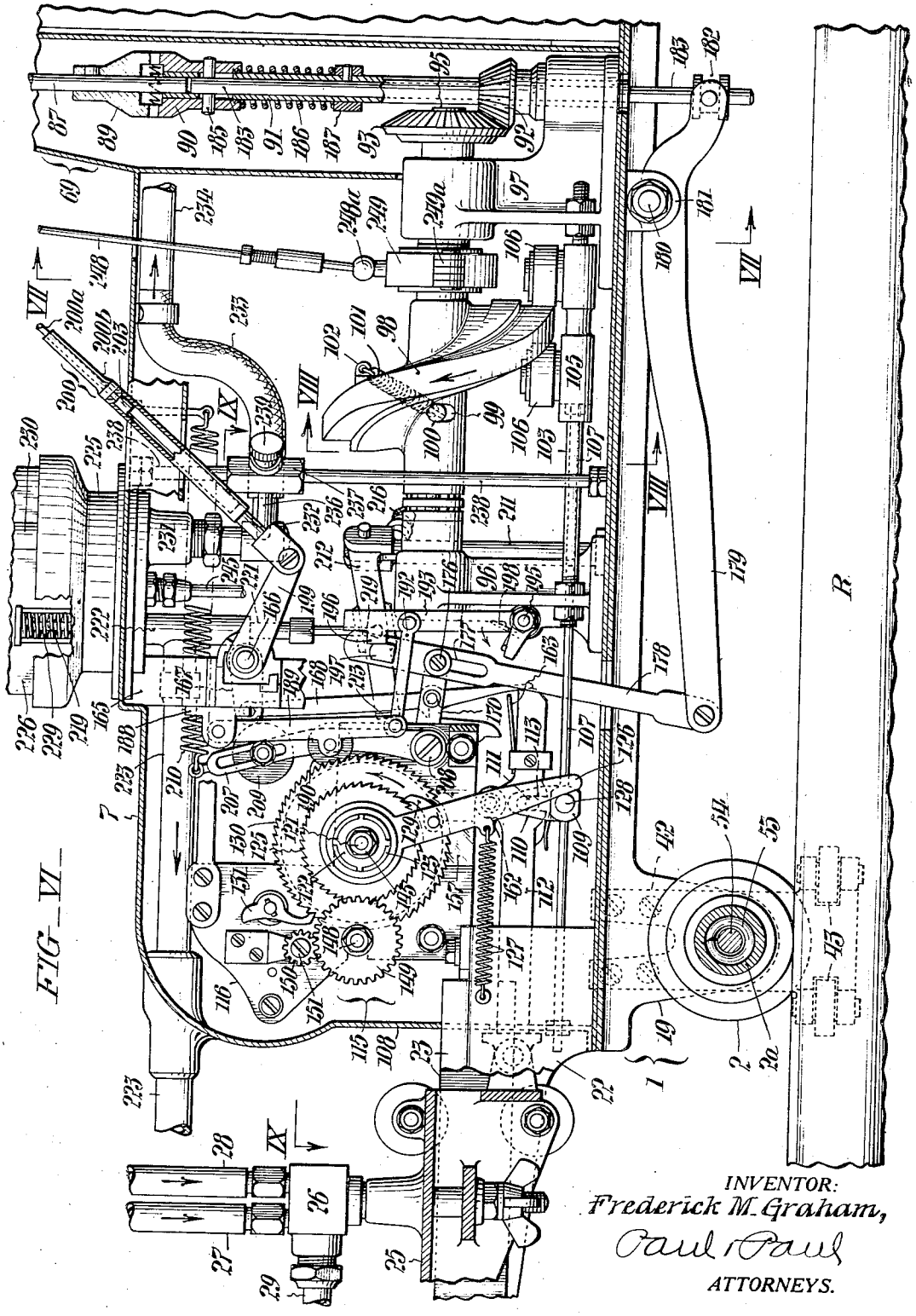


FIG. 7A.

INVENTOR:
Frederick M. Graham,
Paul & Paul
ATTORNEYS.

Dec. 5, 1939. F. M. GRAHAM 2,182,120

APPARATUS FOR HARDENING THE ENDS OF TRACK RAILS

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FIG. VII.

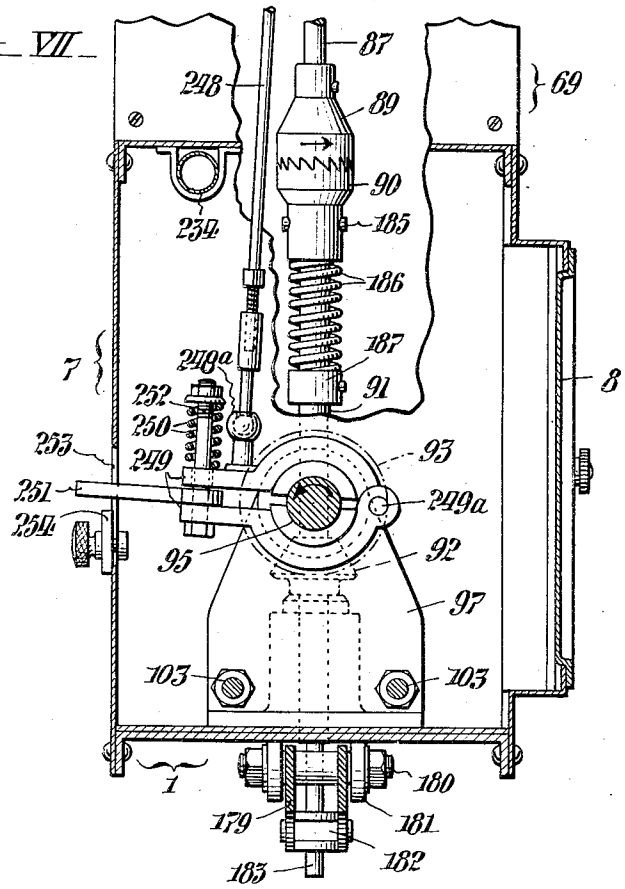
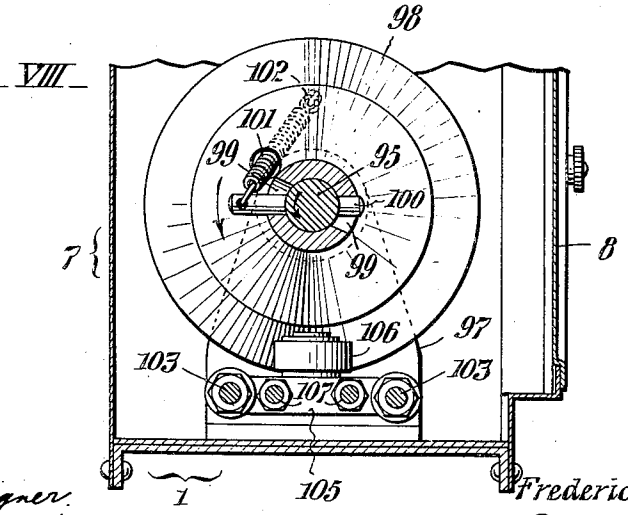


FIG. VIII.



WITNESSES:
John C. Bergner.
Hubert Fuchs

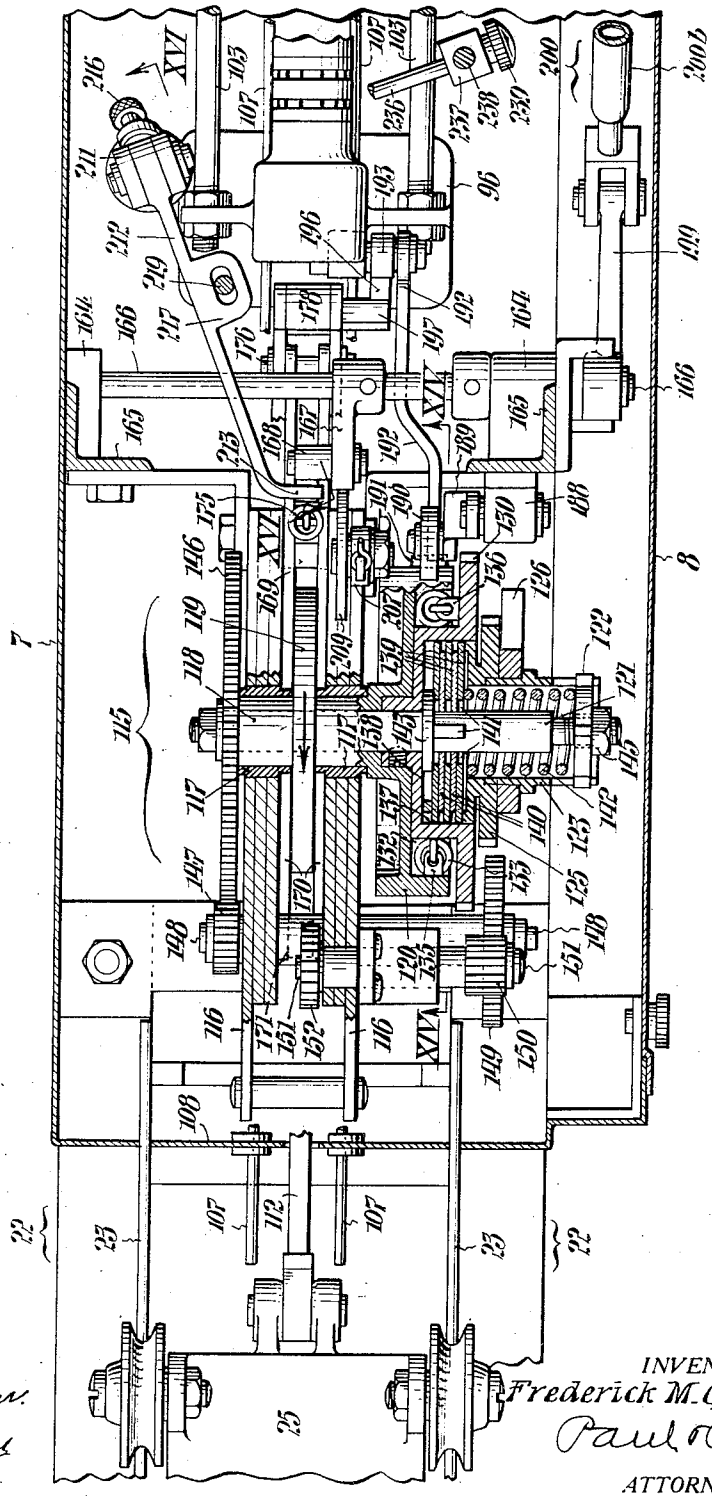
INVENTOR:
Frederick M. Graham,
BY Paul Paul
ATTORNEYS.

Dec. 5, 1939. F. M. GRAHAM 2,182,120

APPARATUS FOR HARDENING THE ENDS OF TRACK RAILS

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FIG. IX.



WITNESSES:
John C. Bergner.
Hubert Fuchs

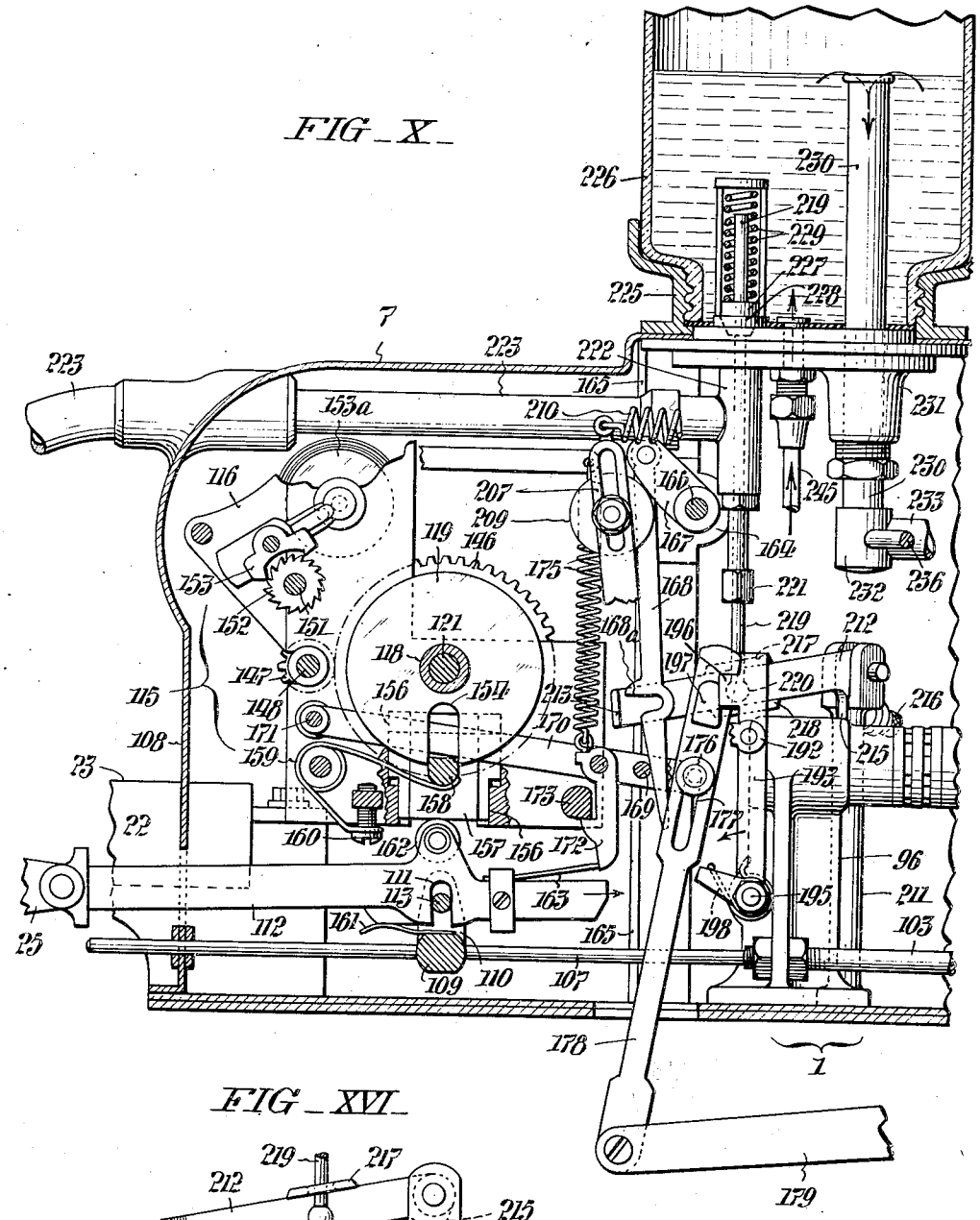
INVENTOR:
Frederick M. Graham,
Paul & Paul
ATTORNEYS.

Dec. 5, 1939. F. M. GRAHAM 2,182,120

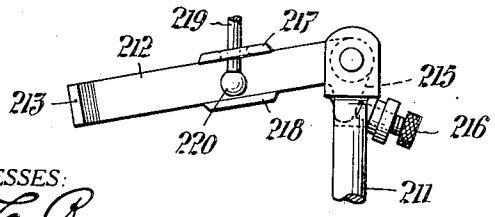
APPARATUS FOR HARDENING THE ENDS OF TRACK RAILS

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FIG_X_



FIG_XVI_



WITNESSES:
John C. Bergner
Hubert Fuchs

INVENTOR:
Frederick M. Graham,
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ATTORNEYS.

Dec. 5, 1939. F. M. GRAHAM 2,182,120

APPARATUS FOR HARDENING THE ENDS OF TRACK RAILS

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FIG. XI.

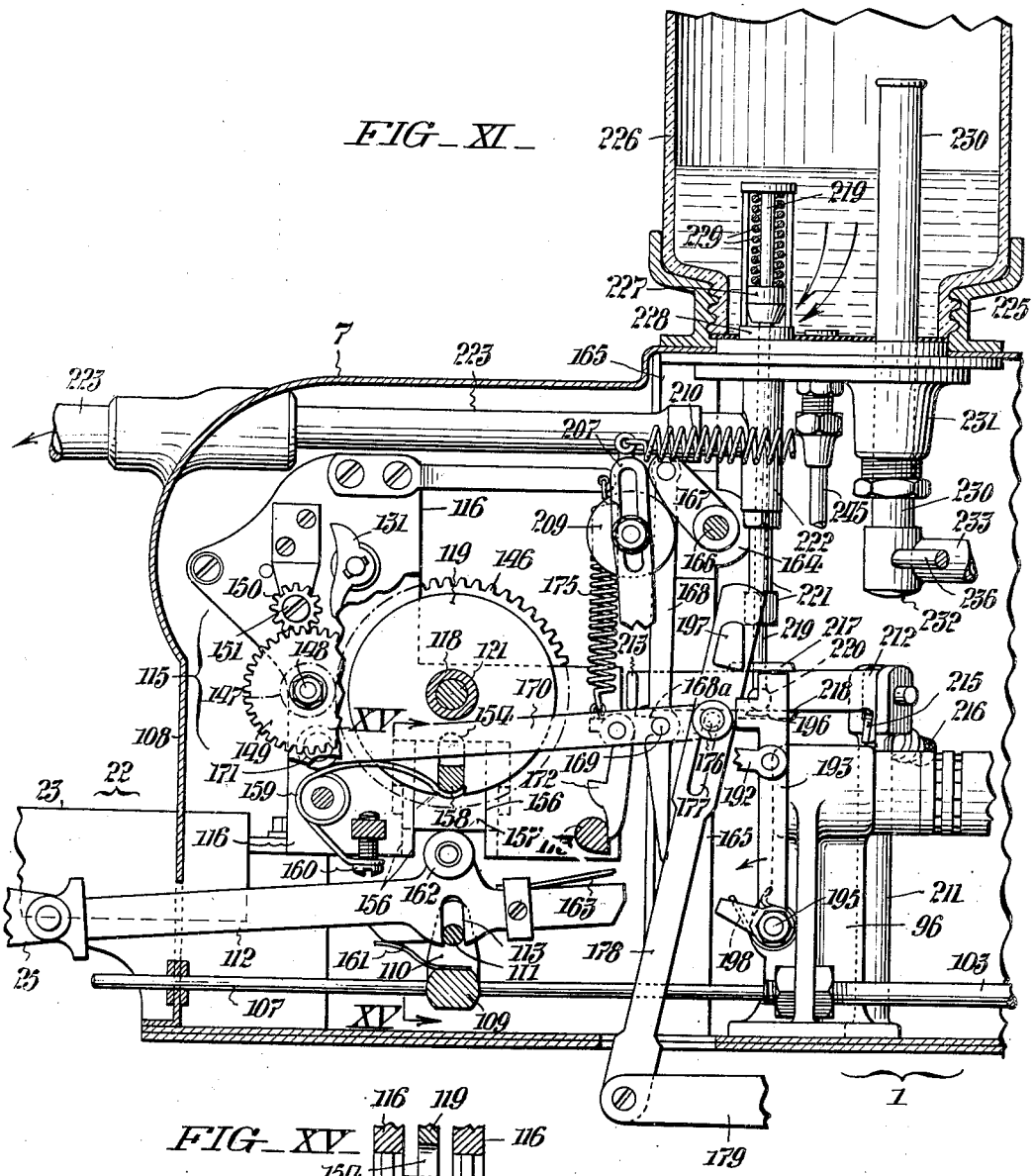
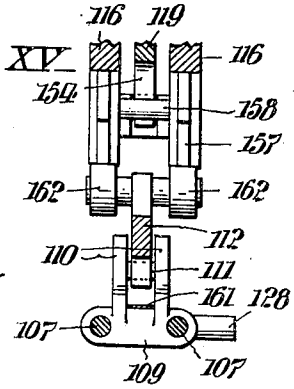


FIG. XV.



WITNESSES:
John C. Bergner
Hubert Fuchs

INVENTOR:
Frederick M. Graham,
BY Paul & Paul
ATTORNEYS.

Dec. 5, 1939. F. M. GRAHAM 2,182,120

APPARATUS FOR HARDENING THE ENDS OF TRACK RAILS

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FIG. XVII.

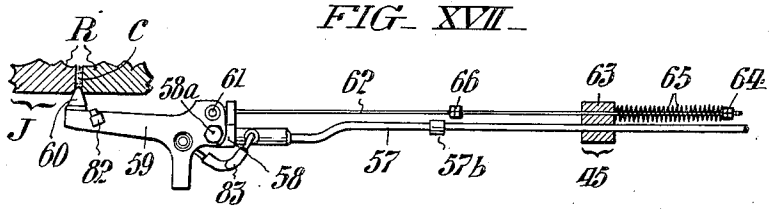


FIG. XIII.

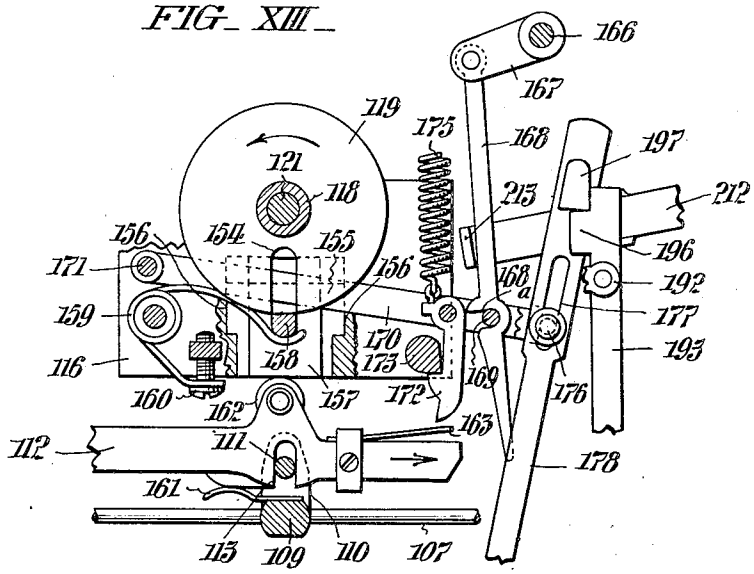
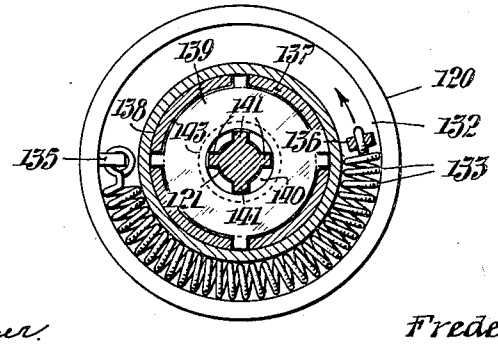


FIG. XIV.



WITNESSES:
John C. Bergner.
Herbert Fletcher

INVENTOR:
Frederick M. Graham,
BY Paul Paul
ATTORNEYS.

Dec. 5, 1939. F. M. GRAHAM 2,182,120

APPARATUS FOR HARDENING THE ENDS OF TRACK RAILS

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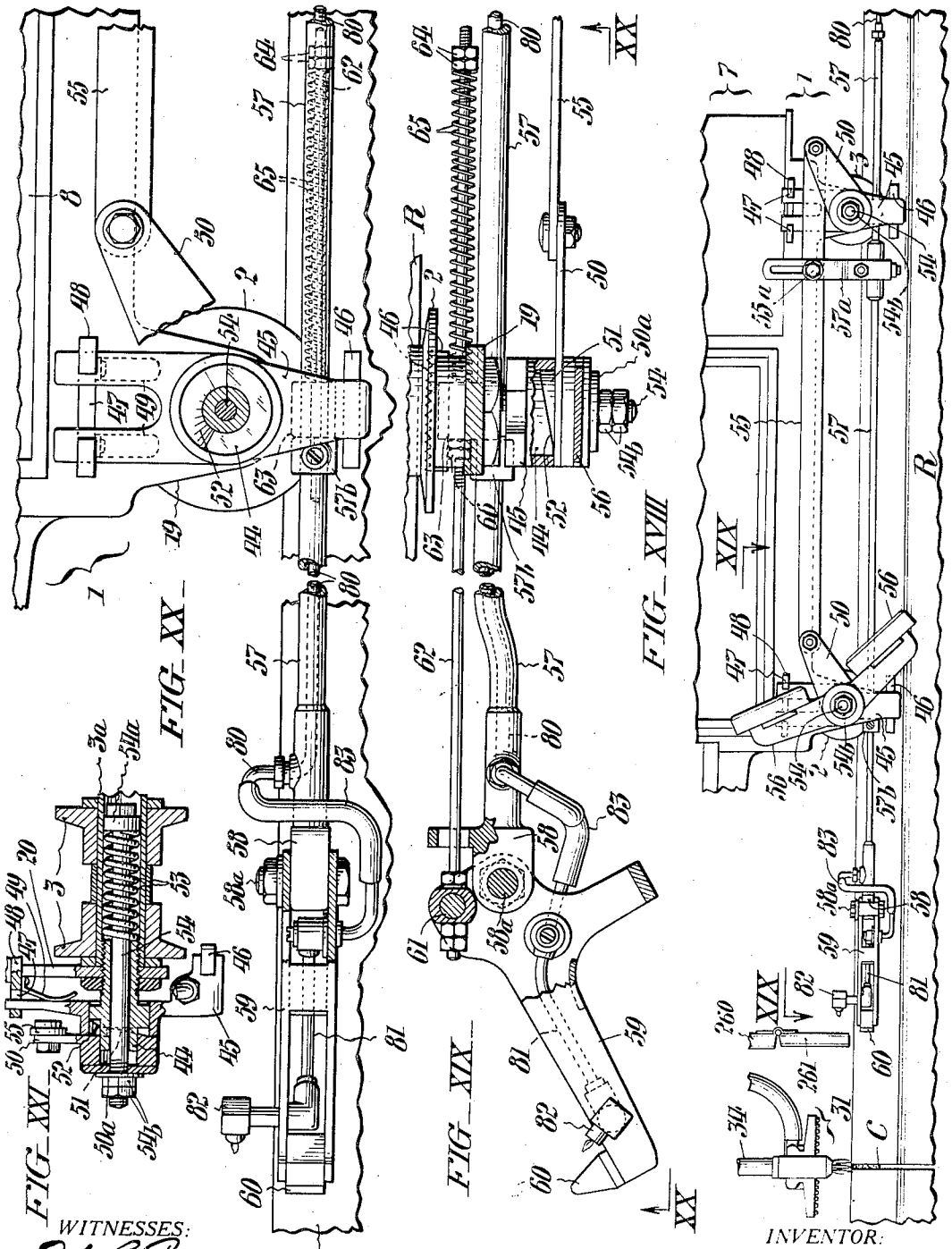


FIG. XX

FIG. XXI

FIG. XIX

FIG. XVIII

WITNESSES:
John C. Berger
Hubert Fuchs

INVENTOR:
Frederick M. Graham,
BY Paul & Paul
ATTORNEYS.

Dec. 5, 1939. F. M. GRAHAM 2,182,120

APPARATUS FOR HARDENING THE ENDS OF TRACK RAILS

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FIG. XXII

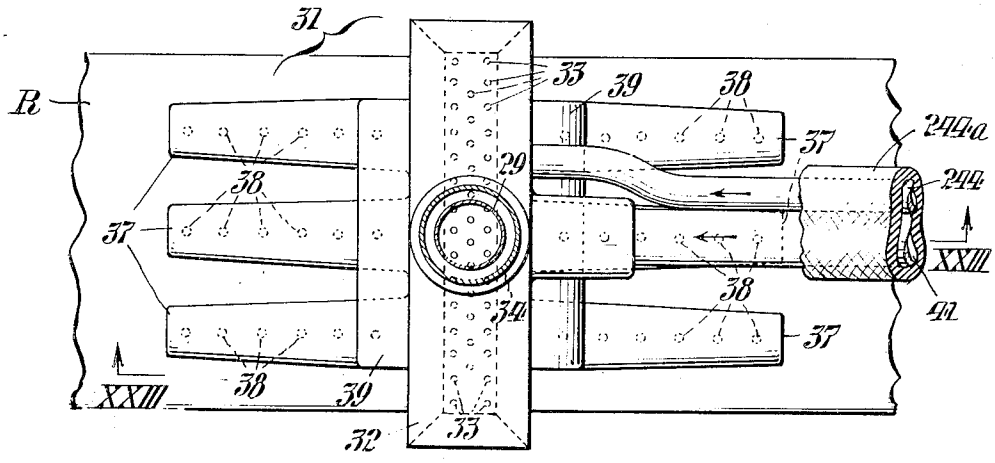
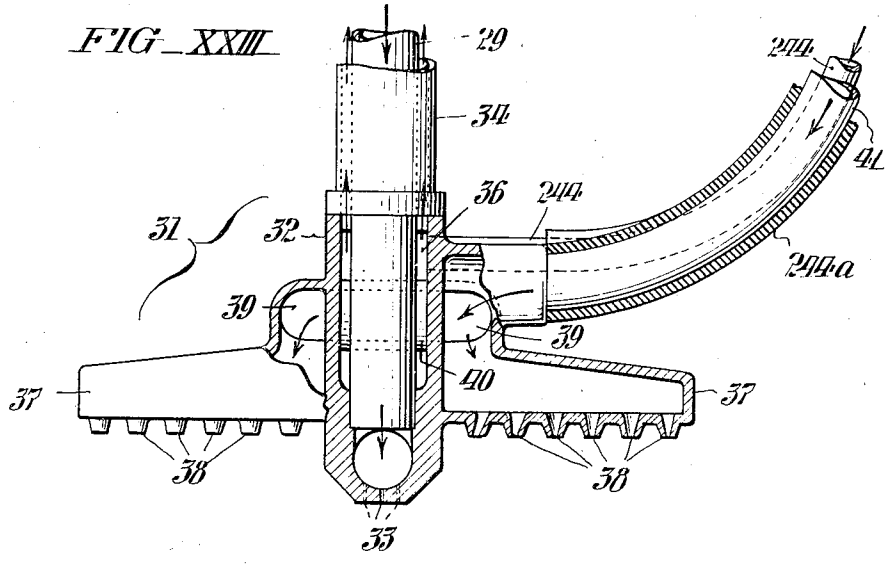


FIG. XXIII



WITNESSES:
John C. Bergner
Herbert Fuchs

INVENTOR:
Frederick M. Graham,
BY Paul & Paul
ATTORNEYS.

Dec. 5, 1939. F. M. GRAHAM 2,182,120

APPARATUS FOR HARDENING THE ENDS OF TRACK RAILS

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FIG. XXV

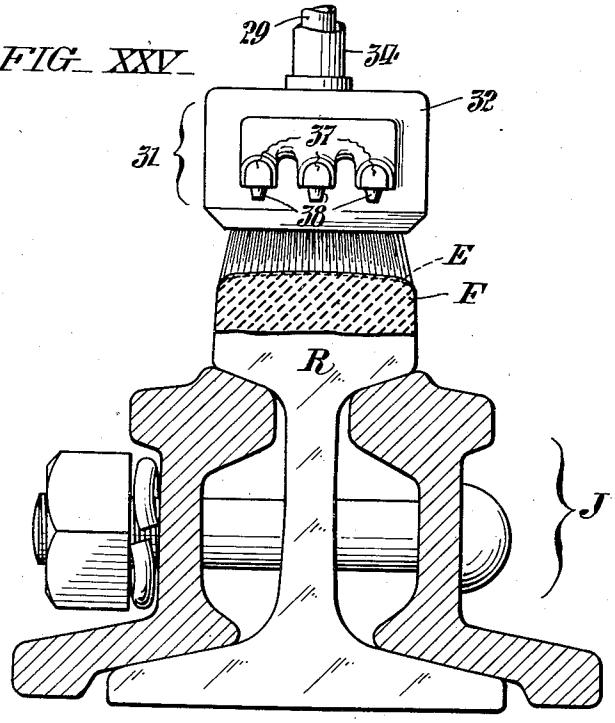
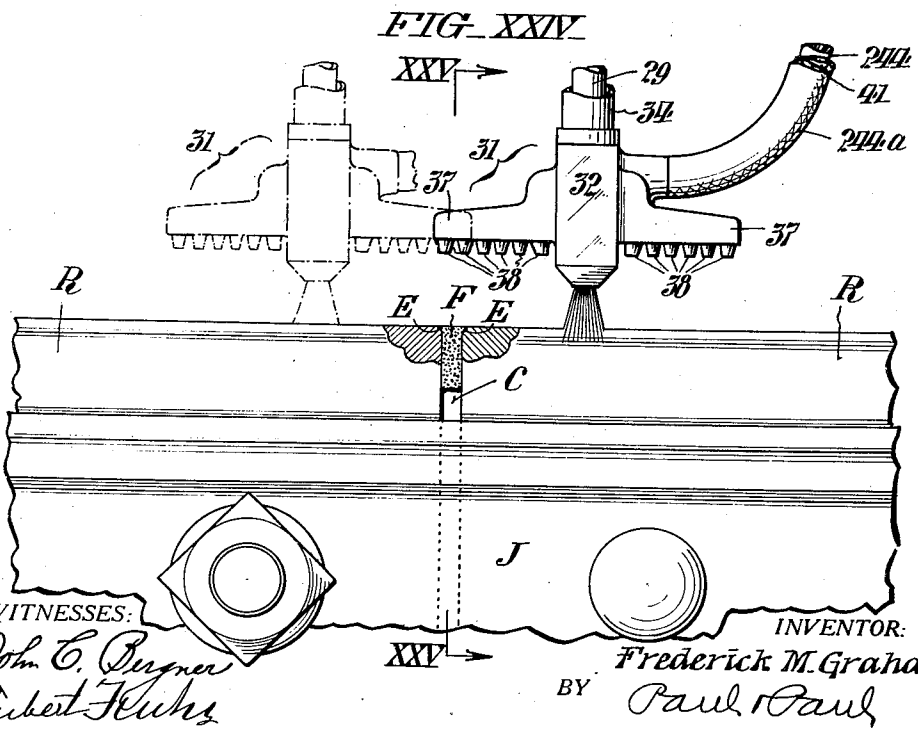


FIG. XXIV



WITNESSES:
John C. Bergner
Hubert Hahs

INVENTOR:
Frederick M. Graham,
BY Paul & Paul
ATTORNEYS.

Dec. 5, 1939. F. M. GRAHAM 2,182,120

APPARATUS FOR HARDENING THE ENDS OF TRACK RAILS

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FIG. XXVI

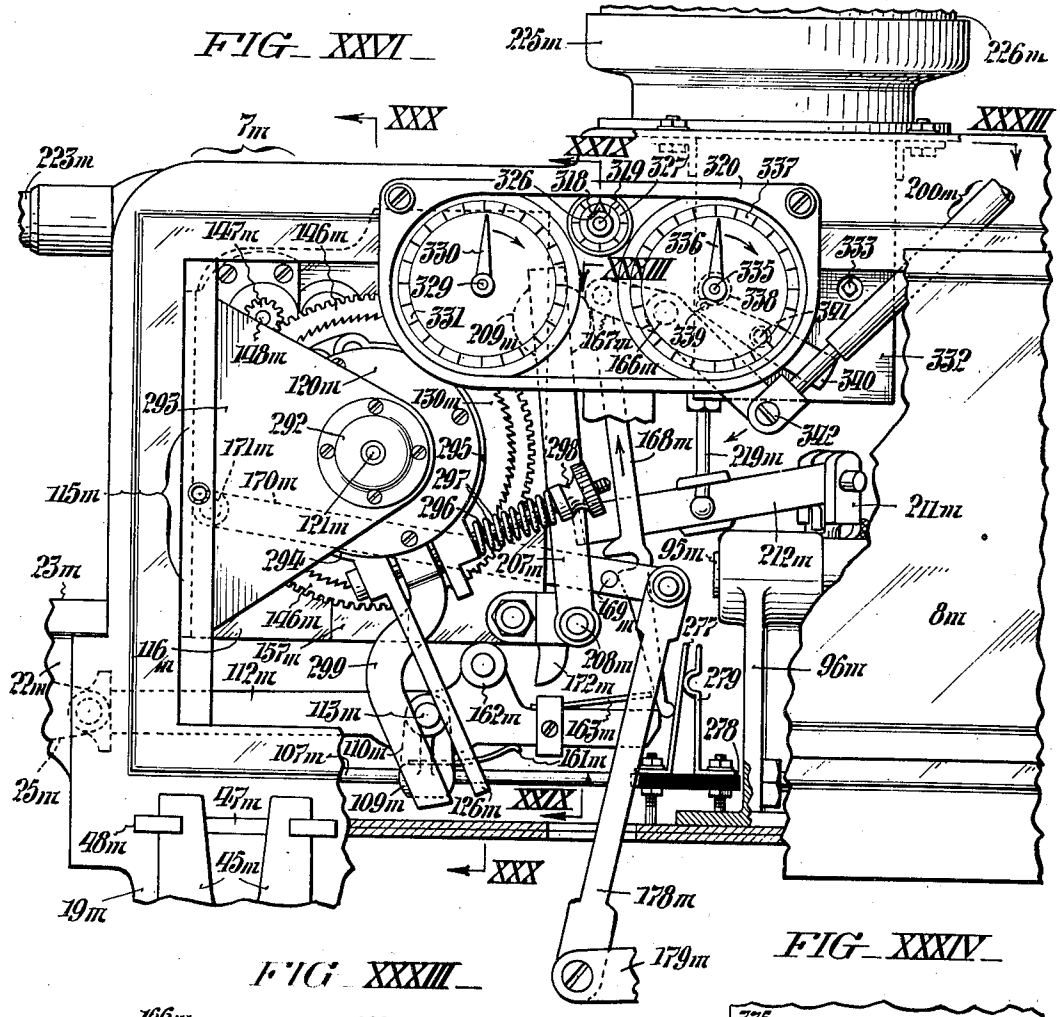


FIG. XXXIII

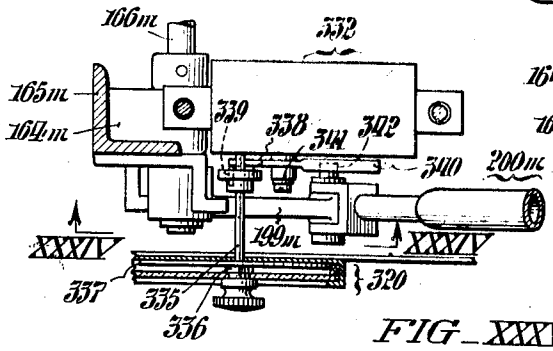


FIG. XXXIV

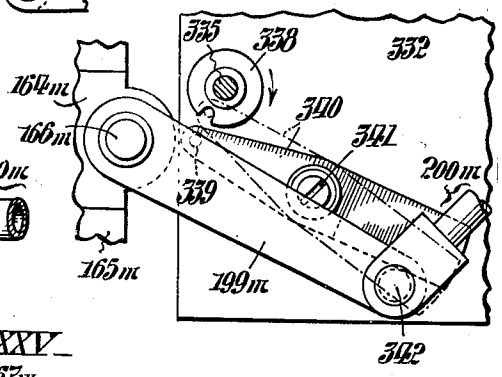
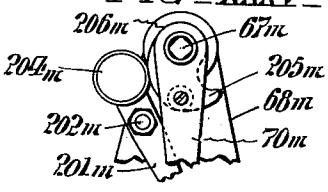


FIG. XXXV



WITNESSES:

John C. Bruner

Hubert Fickes

INVENTOR:

Frederick M. Graham,

BY

Paul Paul

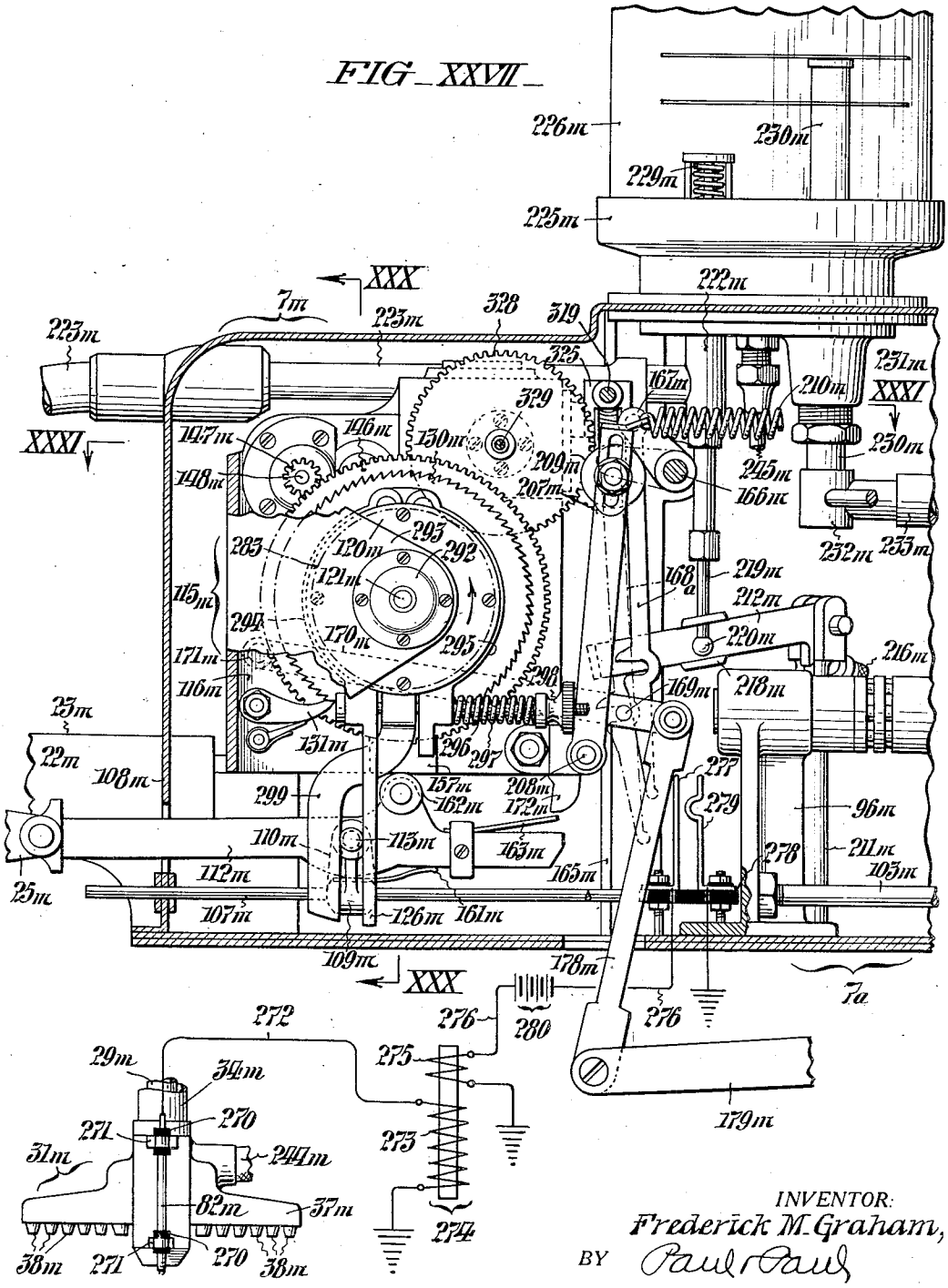
ATTORNEYS.

Dec. 5, 1939. F. M. GRAHAM 2,182,120

APPARATUS FOR HARDENING THE ENDS OF TRACK RAILS

Filed March 12, 1938 19 Sheets-Sheet 15

FIG. XXVII



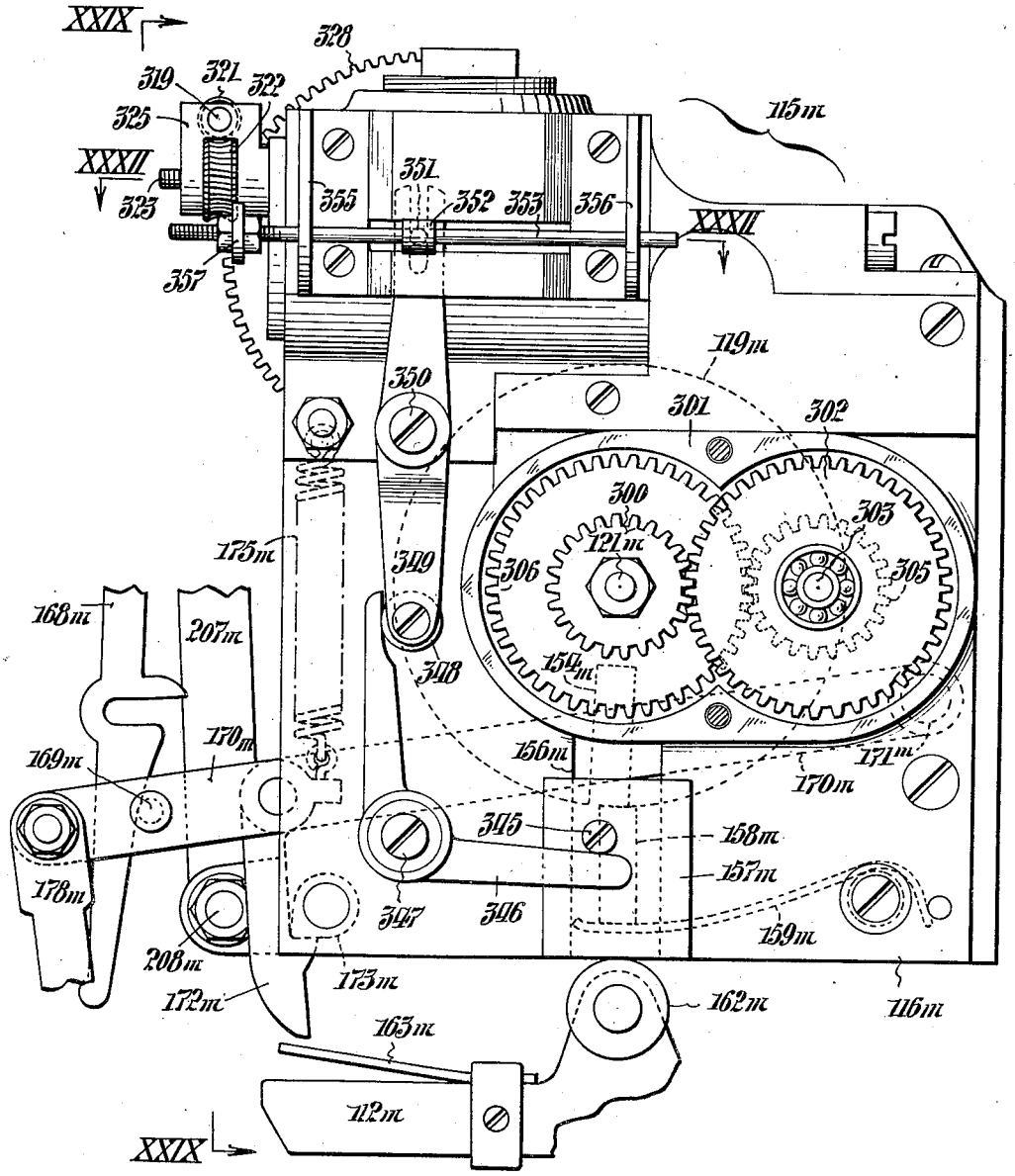
INVENTOR:
Frederick M. Graham,
BY Paul & Paul
ATTORNEYS.

Dec. 5, 1939. F. M. GRAHAM 2,182,120

APPARATUS FOR HARDENING THE ENDS OF TRACK RAILS

Filed March 12, 1938 19 Sheets-Sheet 16

FIG. XXVIII



WITNESSES:

John C. Bergner.

Hubert Kuhn

INVENTOR:

Frederick M. Graham,

BY Paul & Paul

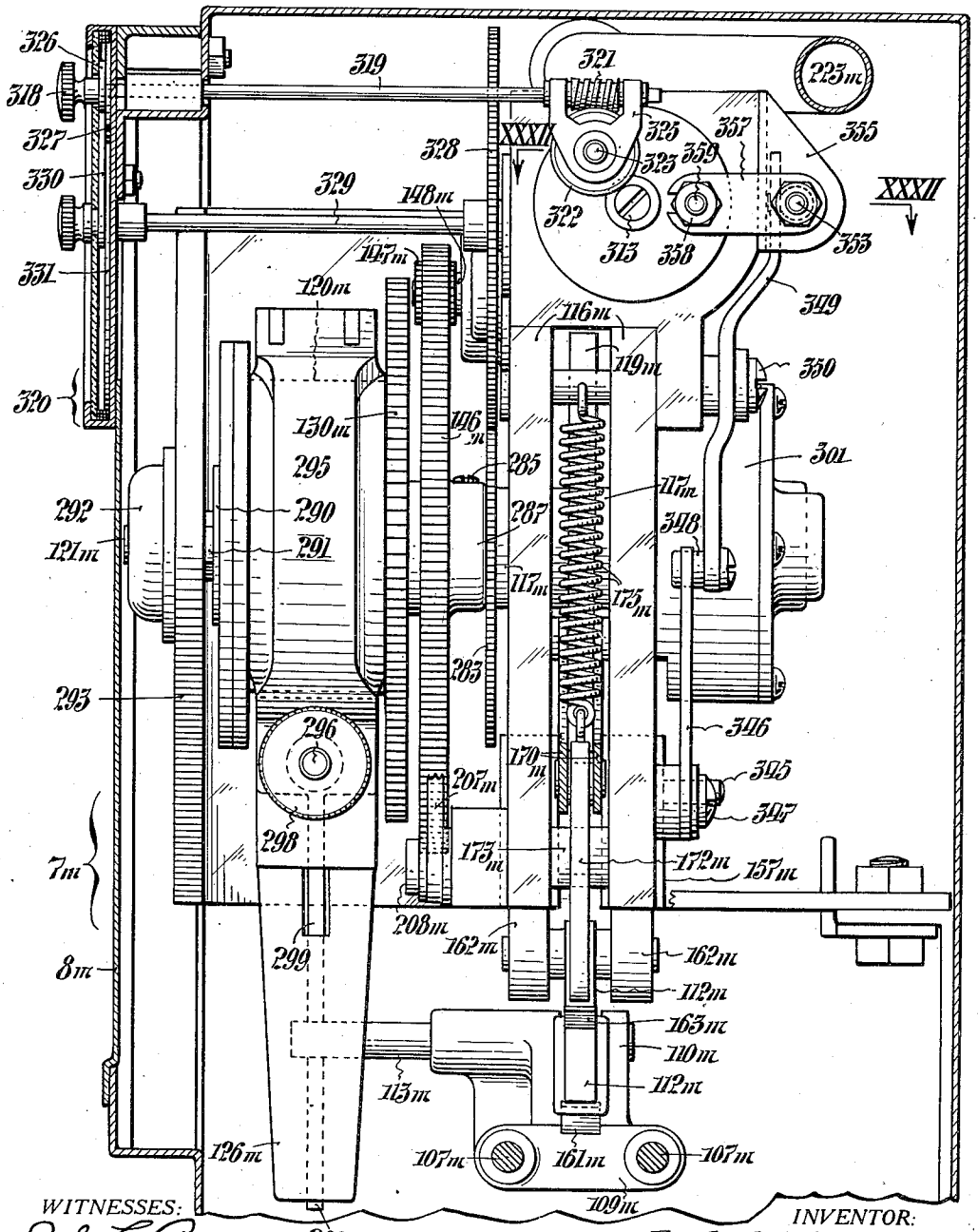
ATTORNEYS.

Dec. 5, 1939. F. M. GRAHAM 2,182,120

APPARATUS FOR HARDENING THE ENDS OF TRACK RAILS

Filed March 12, 1938 19 Sheets-Sheet 17

FIG. XXIX.



WITNESSES:
John C. Bergner
Hubert Hahn

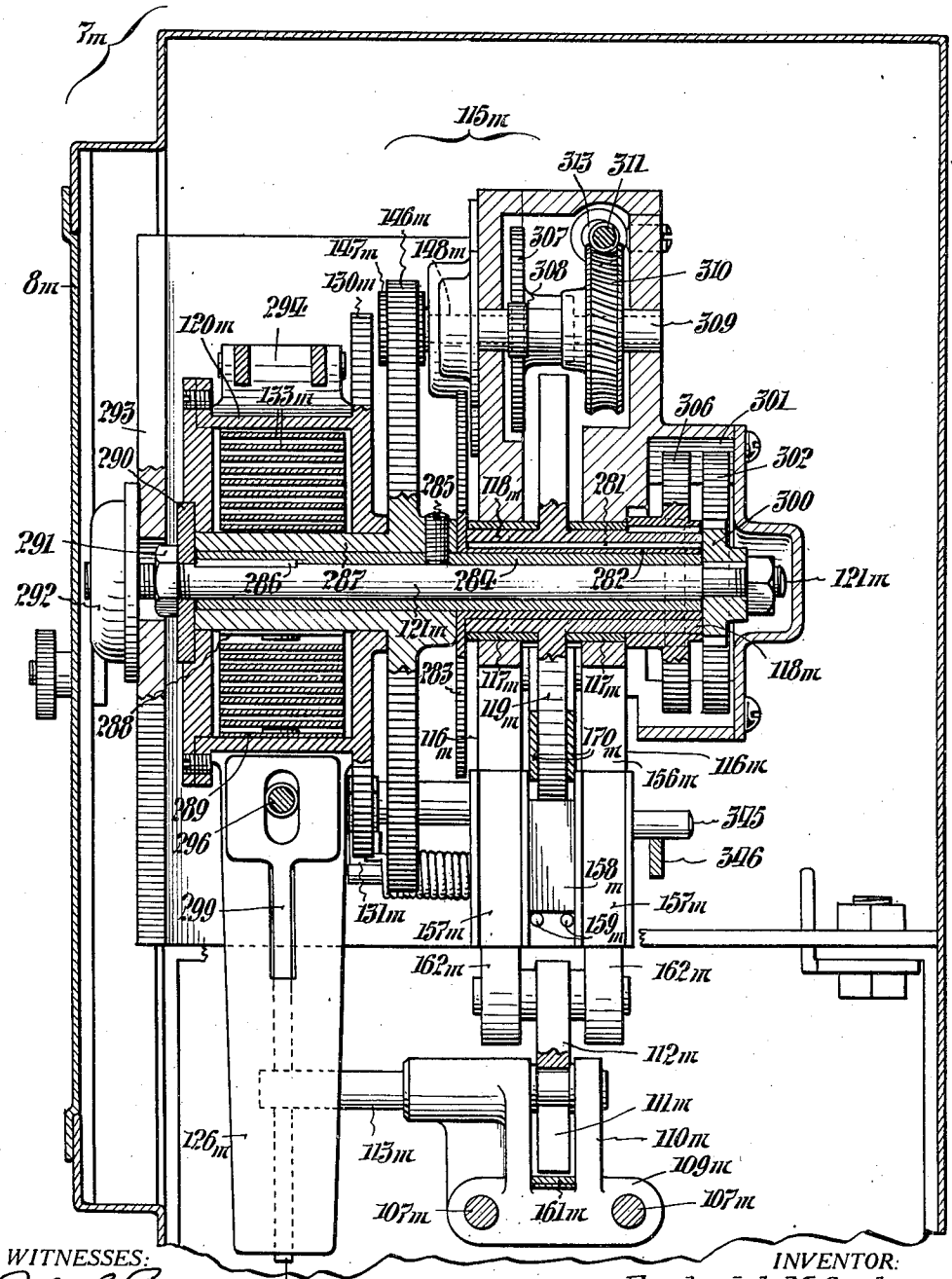
INVENTOR:
Frederick M. Graham
BY Paul & Paul
ATTORNEYS.

Dec. 5, 1939. F. M. GRAHAM 2,182,120

APPARATUS FOR HARDENING THE ENDS OF TRACK RAILS

Filed March 12, 1938 19 Sheets-Sheet 18

FIG. XXX.



WITNESSES:
John C. Bergner
Hubert Hughes

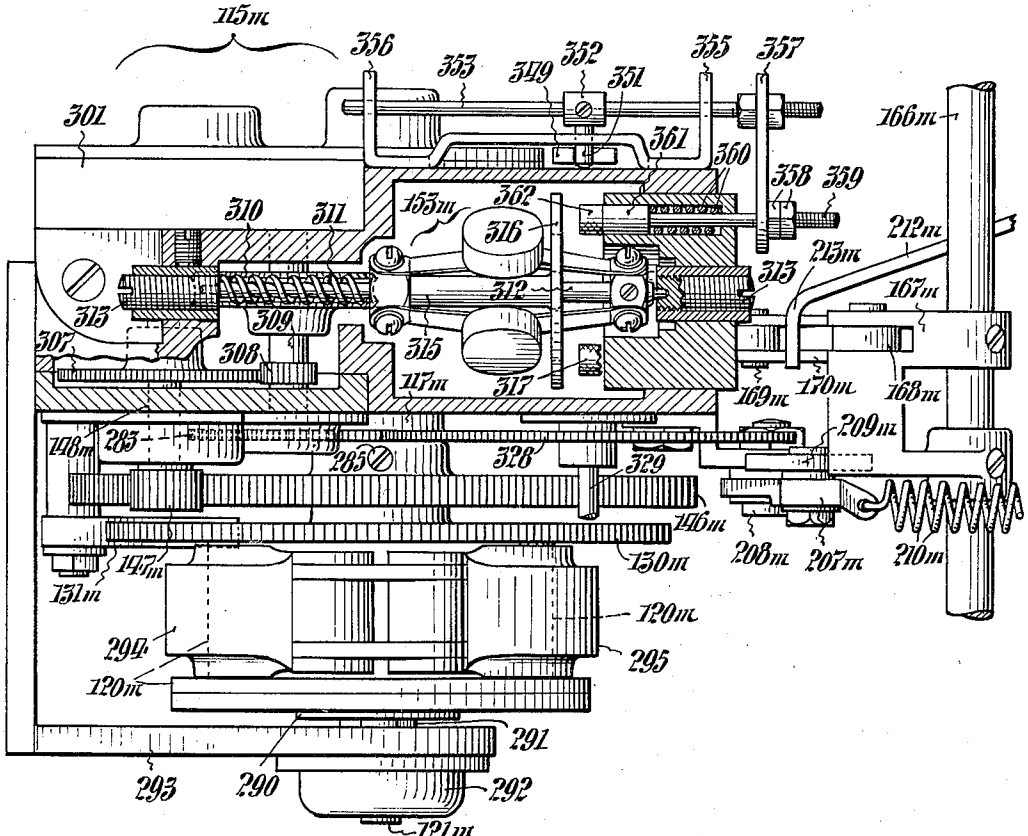
INVENTOR:
Frederick M. Graham,
BY Paul & Paul
ATTORNEYS.

Dec. 5, 1939. F. M. GRAHAM 2,182,120

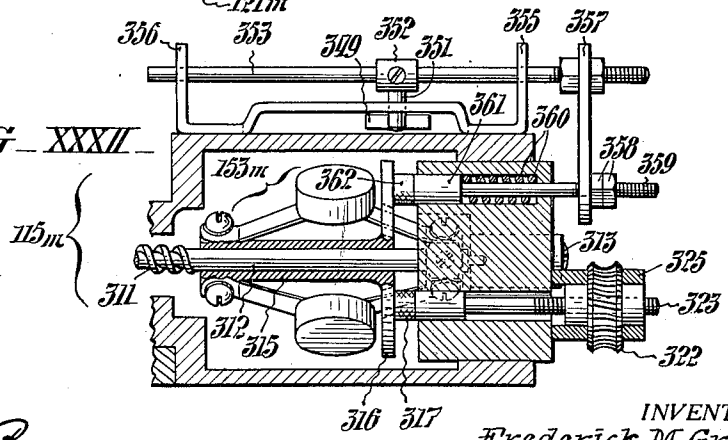
APPARATUS FOR HARDENING THE ENDS OF TRACK RAILS

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FIG_XXXI_



FIG_XXXII_



WITNESSES:
John C. Bergner
Hubert Fuchs

INVENTOR:
Frederick M. Graham,
BY Paul & Paul
ATTORNEYS.

Patented Dec. 5, 1939 2,182,120

UNITED STATES PATENT OFFICE

2,182,120

APPARATUS FOR HARDENING THE ENDS OF TRACK RAILS

Frederick M. Graham, Hollidaysburg, Pa.

Application March 12, 1938, Serial No. 195,477

28 Claims. (Cl. 266—4)

This invention relates to apparatus for heat treating the contiguous ends of track rails at joints for the purpose of hardening them to better withstand the action of the wheels of passing trains, and thereby reduce or prevent what is ordinarily termed "batter".

The present invention constitutes an improvement over the rail treating apparatus disclosed in my United States Patent No. 1,882,417, of October 11, 1932, and has for its chief aims to render the operation of such apparatus entirely automatic and hence free from the necessity for dependence upon the judgment of the operator as regards the duration of the treatment, time of application of the quenching fluid, and the quantity of the latter which is to be used, so that the rail ends are tempered to the same degree at one joint as at another.

In connection with rail treating apparatus having the above attributes, it is a further object of my invention to secure greater efficiency in the operation of the torch by which heat is applied to the rail and at the same time preclude back-firing thereof; to obviate the necessity for moving the entire apparatus, as heretofore, in order to traverse the torch back and forth over the area of the rail joint being treated; and to facilitate the location of the apparatus on the rails for exact centralization of the torch relative to the rail joints.

Other important objects and attendant advantages of my invention will appear from the following detailed description of the attached drawings, wherein Fig. I is a perspective view of an apparatus for heat treating rails conveniently embodying the present improvements.

Fig. II is a side elevation of the apparatus viewed from the right of Fig. I.

Fig. III is a broken out plan view of the apparatus.

Fig. IV is a fragmentary view partly in front end elevation and partly in cross section with portions broken out to expose some of the parts at the interior.

Fig. V is a detail sectional view taken as indicated by the arrows V—V in Fig. II.

Fig. VI is a fragmentary view in longitudinal section taken as indicated by the arrows VI—VI in Fig. III showing the operating mechanism of the apparatus.

Figs. VII and VIII are fragmentary detail views taken as indicated respectively by the arrows VII—VII and VIII—VIII in Fig. VI.

Fig. IX is a fragmentary view in horizontal section taken as indicated by the arrows IX—IX in Fig. VI.

Figs. X and XI are views corresponding to Fig. VI with the parts of the operating mechanism in different positions.

Fig. XII is likewise a fragmentary view corresponding to Fig. VI with the operating mechanism in another position.

Fig. XIII is a similar view with the parts in still another position.

Fig. XIV is a detail sectional view taken as indicated by the arrows XIV—XIV in Fig. IX.

Fig. XV is a detail sectional view taken as indicated by the arrows XV—XV in Fig. XI.

Fig. XVI is a detail view looking as indicated by the arrows XVI—XVI in Fig. IX.

Fig. XVII is a fragmentary detail section taken as indicated by the arrows XVII—XVII in Fig. II.

Fig. XVIII is a fragmentary view in side elevation corresponding to Fig. II showing the rail clamping means of the carriage in operative position.

Fig. XIX is a detail plan section taken as indicated by the arrows XIX—XIX in Fig. XVIII.

Fig. XX is a fragmentary view partly in side elevation and partly in section taken as indicated by the arrows XX—XX in Fig. XIX.

Fig. XXI is a fragmentary detail sectional view taken as indicated by the arrows XXI—XXI in Fig. II.

Fig. XXII is a detail sectional view taken as indicated by the arrows XXII—XXII in Fig. II, showing the torch nozzle and incorporated quenching head.

Fig. XXIII is a view partly in side elevation and partly in section taken as indicated by the arrows XXIII—XXIII in Fig. XXII.

Fig. XXIV is a fragmentary detail view in side elevation and on a larger scale showing the action of the torch flame upon the rail ends.

Fig. XXV is a cross section through the rail joint taken as indicated by the arrows XXV—XXV in Fig. XXIV.

Fig. XXVI is a fragmentary broken out view in side elevation of an alternative embodiment of my invention, with a modified form of timing mechanism.

Fig. XXVII is a longitudinal sectional view of the alternative embodiment corresponding in scope to Fig. XXVI but showing the moving parts in different positions.

Fig. XXVIII shows the rear elevation of the modified timing mechanism.

Fig. XXIX is a fragmentary cross section taken

as indicated by the arrows XXIX—XXIX in Fig. XXVI.

Fig. XXX is a fragmentary cross sectional view taken as indicated by the arrows XXX—XXX in Figs. XXVI and XXVII.

Fig. XXXI is a horizontal sectional view taken as indicated by the arrows XXXI—XXXI in Fig. XXVII.

Fig. XXXII is a fragmentary detail sectional view taken as indicated by the arrows XXXII—XXXII in Fig. XXIX.

Fig. XXXIII is a fragmentary plan section taken as indicated by the arrows XXXIII—XXXIII in Fig. XXVI.

Fig. XXXIV is a detail sectional view taken as indicated by the arrows XXXIV—XXXIV in Fig. XXXIII; and

Fig. XXXV is a fragmentary view in side elevation of a modified form of actuating crank handle used in the alternative embodiment of my invention.

As organized in Figs. I–XXIII, my improved rail treating apparatus comprises a carriage 1 which is supported by double-flanged front and rear wheels 2 and 3, arranged to engage the track rail R which is to be treated at the joints of its contiguous sections, one of said joints being shown at J in Figs. I and II. Extending laterally from one side of the carriage 1 is an outrigger arm 4 with a journal bearing 5 at its outer end for a single flangeless frusto-conical wheel 6 which is adapted to engage the other rail R' of the track, and which has an insulate bushing 6a (Fig. III) to prevent operation of signals by the track circuits. By this arrangement, the apparatus is stably supported for mobility along the railway. The operating mechanism of the apparatus is disposed in the front part of a housing 7 mounted on the carriage 1 and having a door 8 at one side thereof (Fig. II) for convenience of access to said mechanism. In the rear of the housing is a service water tank 9, which, through a pipe connection 10 at the bottom, is in communication with a supply reservoir 11 supported on the outrigger arm 4 immediately inward of the housing 7. From Figs. I and III, it will be observed that the outrigger arm 4 is formed of tubing, with a pair of spaced lower pipes 12, 13 and a single upper pipe 14 disposed substantially midway of said lower pipes but at a higher elevation. As shown, the lower pipes 12 and 13 converge toward the outer end of the outrigger arm and are welded or otherwise secured to a bracket member 15 on which the wheel 6 is journaled, said bracket member having a T-shaped hollow portion 16 by way of which said pipes communicate. At intervals along their lengths the lower pipes 12 and 13 are joined with the upper pipe 14 by inclined tubular connecting branches 17 and 18 with resultant formation of a cooling radiator for a purpose later on explained.

The "dead" inner ends of the lower pipes 12 and 13 of the outrigger arm 4 are detachably connected, by means of coupling nuts 12a, 13a, to lateral boss projections 19a, 20a, on the innermost pair of the pendant wheel-journal brackets 19, 20 of the carriage 1. By a similar coupling 21, the "dead" inner end of the upper pipe 14 of the outrigger arm 4 is detachably connected to the inner side of the housing 7. The outrigger arm 4 can thus be removed from the carriage 1 for convenience in shipping the apparatus or to facilitate cleaning of its tubes in case they should become clogged.

Projecting forwardly from the carriage 1 is a horizontal shelf 22 which provides longitudinally extending guide rails 23 for a smaller roller carriage 25 (see Figs. I, II and III). Supported by the carriage 25 is a hollow juncture and mixing head 26 with nipples at the top for connection of flexible tubes or hoses 27, 28 through which oxygen and acetylene gas are respectively conducted. Connecting into the front of the mixing head 26 is a single pipe 29 which extends horizontally forward through an upwardly-reaching supporting bracket 30 on the carriage 25 and thence downwardly toward the track rail R. Attached to the bottom end of the pipe 29, for support horizontally at a fixed distance above the track rail R, is a torch 31.

As shown in detail in Figs. XXII and XXIII, the torch 31 is in the form of a hollow jacketed casting with a relatively narrow transverse center portion 32 of a length substantially equal to the width of the heads of the track rails and having multiple jet perforations 33 in its bottom through which the combustible gas mixture is discharged downwardly upon the track rail head. The pipe 29 is surrounded by a larger pipe 34 (Fig. II) with resultant formation of a jacket for flow of cooling water, the last mentioned pipe communicating directly with the hollow 36 of the center portion 32 of the torch 31, and being connected through a flexible tube 35 with the upper pipe 14 of the outrigger arm radiator 4. Projecting forwardly and rearwardly from the center portion 32 of the torch 31 are laterally spaced hollow extensions 37 with jet outlets 38 at their bottoms through which quenching water is discharged as later on explained. As shown in Fig. XXII, the extensions 37 communicate by way of hollow manifolding jackets 39 at opposite sides of the center portion 32 of the torch, said manifolding jackets being in turn communicative through connecting cross ducts, whereof one is shown at 40 in Fig. XXIII. Quenching water is conducted to the jacketing of the torch 31 through a curved pipe 41 whereof the upper horizontal portion is secured, with the pipe 29, in the bracket 30 of the carriage 25. During operation of the apparatus, the carriage 25 is moved back and forth on the guides 23 and the torch 31 thereby traversed a fixed distance longitudinally of the rail R in a manner more fully explained later.

In order to properly position the apparatus relative to the rail joint at which the contiguous rail ends are to be hardened, and to secure it against movement during its operation, I have provided means as follows:

Rigidly secured to each of the inner wheel journal brackets of the carriage 1 is a clamp member 42 with rollers 43 (Figs. II and IV) which under the thrusting action of the frusto-conical wheel 6 are caused to bear against the inner side of the head of the track rail R. Slidable on a fixed sleeve extension 44 adjustably secured in the outer end of each of the carriage wheel shafts 2a, 3a is a clamp member 45 with a serrated gripping jaw 46 which is adapted to bear against the opposite side of the rail head. The upper end of each clamp member 45 is confined to a guide slot 47 in a transverse plate 48 affixed to the bottom of the carriage 1 and is thereby held against rotation about the wheel axle 2a (or 3a) with capacity, however, for movement inwardly toward the rail R in opposition to a spring shown at 49 in Figs. IV and XXI. Oscillatable on each of the wheel axle extensions 44

outward of the movable clamp member 45 is an arm 50 whereof the fulcrum boss is formed with a lateral cam tooth 51 (Figs. IV, XIX) arranged to coact with an opposing cam surface 52 on the corresponding axle extension. The cam surfaces 51, 52 are in each instance maintained in operative contact by a helical spring 53 in compression between the inner end of the sleeve extension 44 and a collar 54a at the inner end of an axially free rod 54 which passes outward of the hollow of the wheel axle through said sleeve extension. A pair of nuts 54b at the outer end of the rod 54 bears with interposition of a washer 50a against the outer face of the fulcrum boss of the arm 50. As shown in Fig. XVIII, the two arms 50 are connected for actuation in unison by a horizontal link 55. Extending from opposite sides of the boss of the arm 50 at the front wheel 2 of the carriage 1 is a double pedal arm 56 by which foot actuation of the clamp means is made possible. Accordingly, when the pedal 56 is moved from the position shown in Fig. I to that shown in Fig. XVIII, the arms 50 are simultaneously turned clockwise and at the same time shifted inward on the axle extensions 44 as the cam teeth 51 ride down the inclines of the cam 52, with the clamp members 45 following suit to grip the outer side of the rail head with their serrated jaws 46 in opposition to the rollers 43 which engage the rail head at the other side. When the pedal 56 is moved back to the position of Fig. I and the arms 50 incidentally turned anti-clockwise, the cam teeth 52 react upon the cam surfaces 52 to shift said arms outwardly on the axle extensions 44 against the action of the springs 53, thereby permitting the finger springs 49 to withdraw the clamp members 45 from engagement with the rail R. Slidably supported by the movable clamp members 45 is a longitudinally-extending tubular bar 57 which carries a vertical coupling member 57a with a slot engaged by a stud bolt 55a on the link 55. To the front end of the bar 57 is secured a knuckle 58 for connection, by means of a vertical pivot bolt 58a to an arm 59 which, for a reason which will become apparent presently, I term a "finder". As shown in Figs. III and XIX, the finder 59 has a tapered lateral nose projection 60 at its free end adapted to enter the gap C at the joint J between adjacent sections of the rail R. Pivotally connected at one end to the finder arm 59 at a point 61 eccentric to the pivot 58a is a horizontal rod 62 which passes rearwardly through a guide boss 63 formed on the forward movable clamp member 45. In compression between the boss 63 and the adjustable abutment nuts 64 at the rear end of the rod 62 is a helical compression spring 65 which tends to move the finder 59 yieldingly inward toward the rail R as shown in Fig. XVII. The rod 62 also has nuts 66 thereon adapted to engage with the front face of the boss 63 on the forward movable clamp member 45 when the finder 59 is retracted as in Fig. XIX. As a consequence of the arrangement just described, upon movement of the link 55 incident to actuation of the movable clamp members 45 to secure the carriage 1, the tubular bar 57 is drawn rightward from the position of Fig. II to that of Fig. XIX, as far as permitted by engagement of a collar 57b thereon with the front face of the boss 63 on the forward movable clamp member 45. At the initiation of the rightward shift of the bar 57 the rod 62 recedes under the influence of the spring 65 until the nuts 66 abut the boss 63 of the forward movable clamp member 45, whereupon the finder 59 is swung upon the pivot 58a until it is retracted as shown in Fig. XIX. Upon completion of the rightward shift of the bar 57 and clamping of the carriage 1 to the rail, the finder 59 comes to rest in a position clear of the rail joint J well out of the zone of the torch 31 as shown in Fig. XVIII.

The parts of the actuating mechanism of the apparatus all derive their movement from a shaft 67 (Figs. II and IV) journaled in a bearing bracket 68 at the top of a hollow pylon 69 upstanding from the housing 7. The shaft 67 may be operated by power or it may be operated manually by means of a crank handle such as shown at 70 in Figs. II and IV. Suitably supported within the pylon 69 is a double gas control valve 71 into the casing of which the hoses 27 and 28 connect at their rear ends. Extending rearwardly from the control valve 71 are pipes 72 and 73 with flexible continuations 74 and 75 through which the oxygen and the acetylene gas are respectively conducted to said valve. The hoses 74 and 75 may extend to a car (not shown) carrying supply tanks for the two gases. Interposed in the pipes 72 and 73 are hand cocks 76 and 77 (Fig. IV) whereby the gas flow may be shut off when the apparatus is not in use. Connecting into the pipe 72 is a branch pipe 78 (Fig. II) which, through a flexible tube 79, is connected to the rear end of a pipe 80 extending longitudinally through the tubular rod 57 (Figs. XIX, XX) which joins the movable clamp members 45 of the clamping means hereinbefore referred to. Through the provisions just described some of the acetylene gas is conducted to an extension pipe 81 (Figs. XIX, XX) carried by the finder 59 and terminating in a pilot burner 82 for starting the torch 31. An interposed flexible coupling tube section shown at 83 permits swinging of the finder 59 about its fulcrum. The flow of acetylene gas to the pilot 82 is controllable by means of a hand valve shown at 84 in Figs. II and IV.

Affixed to the crank shaft 67 is a bevel gear 85 wherewith meshes a companioned bevel gear 86 at the top of a transmission shaft 87 (Figs. II and IV) which extends downwardly of the hollow of the pedestal 69 through a vertical bearing 88 centrally of the bracket 68. A toothed clutch member 89 (Figs. IV, VI, VII) at the lower end of the shaft 87 is adapted to coact with an opposing toothed clutch member 90 on the contiguous end of a coaxial tubular extension 91 of said shaft. Through a bevel pinion 92, rotary movement is transmitted from the shaft extension 91 to a bevel gear 93 affixed to a horizontal longitudinally extending shaft 95 (Fig. VI) which at its opposite ends is journaled in bearing pedestals 96 and 97 internally of the housing 7. Mounted on the shaft 95 midway between the bearings 96, 97 is a spiral cam 98 which has capacity for limited independent rotary movement relative to said shaft within limits prescribed by coaction between a slot 99 in its hub and a diametrical key pin 100 of the shaft. A helical biasing spring 101 in tension between the key pin 100 and an anchorage 102 near the periphery of the cam 98, see Figs. VI and VIII, tends to normally maintain one end of the slot in the cam hub 99 in engagement with said pin. Guided for back and forth movement on laterally spaced rods 103 extending longitudinally of the bottom of the housing 7 between the bearing pedestals 96, 97, is a cross head 105 with rollers

106 engaging the spiral cam 98 from opposite sides, see Fig. VI. Parallel rods 107 extending forwardly from the cross head 105 and passing through guide openings respectively in the bearing pedestal 96 and in the front end wall 108 of the housing 7 (Fig. VI), carry a block 109 with an upstanding clevis 110 whereof the extremities are spanned by a pin 111. By means of a link bar 112, having slots 113 upward from its bottom edge in engagement with the pin 111, the block 109 is coupled with the rear end of the small roller carriage 25 at the front end of the main carriage 1. Thus during rotation of the spiral cam 98, the cross head 105 is reciprocated longitudinally and its motion in turn transmitted to the carriage 25 as a consequence of which the torch 31 is traversed back and forth over the rail R.

Forwardly within the housing 7 (Figs. VI, IX, X, XI, XII, XIII) is a timing device 115 whereof the frame comprising a pair of rigidly-connected spaced side plates 116 with bearings 117 (Fig. IX) for a transverse rotary sleeve 118 which, in the intervals between said plates, carries a disk 119, and at the end nearest the observer in Fig. IX, a drum 120. Axially within the sleeve 118 is a shaft 121 with a circumferentially-toothed collar 122 which is engaged by the longitudinally-slotted hollow hub 123 of a ratchet wheel 125. Mounted for oscillation on the ratchet wheel hub 123 is an arm 126, see Figs. VI and IX, which is subject to the pull of a spring 127 so that its end is maintained in engagement with a stud 128 projecting laterally from the cross head 109 on the rods 107, said arm carrying a pawl 129 for racking the ratchet wheel 125. A larger ratchet wheel 130 is rigidly secured to the shaft 128 by a set screw (Fig. IX) and engaged by a detent pawl 131 having pivotal support on one of the side plates 116 of the timing device 115. Confined in a hollow 132 in the front face of the cam drum 120 is a segmented helical spring 133 (Figs. IX and XIV) whereof one end is secured to an anchorage 135 on said drum, and whereof the other end is secured to an anchorage 136 at the back of the ratchet wheel 130. The spring 133 thus constitutes a yielding connection between the drum 120 and the ratchet wheel 130. As shown in Fig. IX, the ratchet wheel 125 has an enlarged hollow rearwardly-extending body portion 137 which extends into the frontal cavity 132 of the drum 120 and which is circumferentially notched (see Fig. XIV) for engagement by the peripheral teeth of a group of clutch plates 139. Cooperating clutch plates 140 disposed in alternation with the clutch plates 139 engage keys 141 on the shaft 121, see Fig. IX. By means of a coaxial helical compression spring 142 within the hollow outwardly-projecting hub 123 of the ratchet wheel 125, the clutch plates 139, 140 are maintained in frictional contact, the action of the spring being opposed by a circumferential flange 143 on the shaft 121 against which flange the innermost of the plates 139 abuts. The pressure of the spring 142 is regulatable by means of a nut 145 threaded on the outer end of said shaft and bearing against the collar 122 which constitutes the outer abutment for said spring. To the inner end of the shaft 121 is affixed a relatively large spur gear 146 which meshes with a pinion 147 on the corresponding end of a transverse countershaft 148 journaled in the frame of the timing device 115. A spur gear 149 at the front end of the shaft 148 meshes in turn with a spur pinion 150 on a second countershaft 151 which is journaled in the front side plate 116 of the timing mechanism 115. At its inner end, the shaft 151 carries a toothed wheel 152 wherewith cooperates an oscillating escapement element 153 (Fig. X) which is governed by a spring-restrained balance wheel 153a. From Figs. X and XI, it will be noted that the cam disk 119 has a radial notch 154. Movable up and down in vertical guideways 156 at the bottoms of the side plates 116 is a slide 157 with a transverse bar 158 which is adapted to ride the periphery of the cam 119. As shown, the slide 157 is yieldingly urged upward by a finger spring 159 capable of regulation by means of a set screw 160, the upward movement of the slide 157 being limited by the top edges of the guide ways 156. The coupling bar 112 previously referred to herein is likewise urged upwardly by a finger spring 161 on the cross head 109, so that rollers 162 thereon (Figs. X, XI and XV) are yieldingly maintained in contact with the bottom edges of the slide 157. For a purpose also later explained, the link 112 is provided with a rearwardly extending flexible tongue 163.

Journaled at its opposite ends in bearings 164 near the top of a pair of vertical supporting angle bars 165 internally of opposite sides of the housing 7 is a rock shaft 166 with a short forwardly reaching arm 167 from which is pivotally suspended a link 168. As shown, the link 168 is provided with a lateral notch 168a for capacity to engage a cross pin 169 on a horizontal arm 170 which is fulcrumed at 171 on the frame of the mechanism 115. Pivoted on the horizontal arm 170 is a pendant hook 172 which is adapted to interlock normally with a fixed cross bar 173 on the frame of the timing device 115 as shown in Fig. X. A helical tension spring 175 tends to urge the hook 172 toward the bar 173. At its outer end the arm 170 carries a cross pin 176 which engages a longitudinal slot 177 in a vertical link 178, which, at its lower end, is pivotally connected to the front end of a horizontal lever 179 fulcrumed at 180 on a bearing bracket 181 beneath the housing 7, see Fig. VI. At its rear end, the lever 179 has a sliding pivotal connection 182 with the bottom end of a rod 183 which extends upward through the hollow of the tubular shaft 91 previously referred to, and to which the toothed clutch collar 90 is secured at the top by a cotter pin 185. A helical spring 186 in compression between the clutch collar 90 and the collar 187 affixed to the tubular shaft 91 tends to urge the rod 183 upward for maintenance of said clutch member 90 yielding in engagement with the companion clutch collar 89 on the shaft section 87 as shown in Fig. VI.

Pivotally suspended from a bracket 188 on one of the vertical angle bars 165 is an arm 189 with a roller 190 therein adapted to be acted upon by a peripheral rise 191 on the cam drum 120, see Fig. XII. By means of a horizontal link 192, the arm 189 is connected at its lower end to the top end of a latch 193 fulcrumed at 195 on the bearing pedestal 96. Above its pivotal connection with the link 192, the latch 193 has a forward lug projection 196 adapted to interlock with a lateral lug projection 197 at the top of the slotted link 178 as shown in Fig. XII. A torsion spring 198 serves to yieldingly urge the latch 193 forwardly for maintenance of the roller 190 on the arm 189 in yielding contact with the periphery of the cam drum 120.

To the rock shaft 166 is also secured a rearwardly extending arm 199, which, by means of an

inclined link 200, is connected to one end of a lever 201 fulcrumed for swinging movement about a stud projection 202 at one side of the bearing 68 at the top of the pylon 69, see Figs. II, IV and V. As shown in Fig. VI, the upper section 200a of the link telescopically engages the lower section 200b which is tubular so that lost motion can take place between them for a purpose hereinafter explained. The extent of such lost motion is limited in one direction by engagement of a terminal head 203 on the section 200a with the upper end of the hollow of the section 200b, and in the other direction by engagement of said head with the bottom of said hollow. At its upper end beyond the fulcrum stud 202, the lever 201 carries a roller 204 in the path of a rotary cam 205 on the hub 206 of the actuating crank 70. Movement of the rock shaft 166 is yieldingly resisted by means including a vertical arm 207 (Fig. VI) which is fulcrumed at its lower end upon a stud 208 on the frame of the timing device 115, and which near its upper end carries a roller 209, the latter being held in engagement with the arm 167 on said shaft under the pull of a spring shown at 210.

Pivotally connected to the top of a post 211 within the housing 7 is an arm 212 with a lateral projection 213 at its free end extending crosswise over the arm 170 (Figs. VI, IX and X), the downward movement of said arm being limited by engagement of a lug 215 (Fig. XVI) on its hub with a stop screw 216 on the post 211. At its midpoint, the arm 212 has laterally projecting parallel flanges 217, 218 whereof the upper one is longitudinally slotted for passage of an upwardly-extending rod 219, while the lower one serves as an abutment for a ball 220 at the lower end of said rod. As shown in Figs. VI and X, the rod 219 passes through the stuffing box 221 of a terminal angle fitting 222 for connection of a flexible tube 223, said fitting entering a screw socket 225 at the top of the housing 7, which forms the base of a relatively small transparent removable measuring receptacle 226 for quenching water. Affixed to the rod 219 is a conical valve 227 which closes against a seat 228 at the top of the fitting 222 within the receptacle 226 and which is urged toward its seat by a compression spring 229. A constant level of water is maintained within the receptacle 226 by a stand pipe 230 which passes down through a stuffing box 231 on the socket member 225, and at its bottom end has an elbow fitting 232 for connection of a flexible tube 233 which is in turn connected to a pipe 234 that leads to the filler neck of the reservoir 9 (see Fig. II), any sludge or dirt contained in the water being arrested by a removable inset screen 235 in said filler neck. The stand pipe 230 is thus adjustable up and down in order that the charge of the quenching water maintained in the receptacle 226 may be varied in accordance with horizontal graduations 226a, see Fig. II, on said receptacle. As shown in Figs. II and III, the receptacle 226 has a cover with a screened opening through which water may be introduced at starting. From Fig. VI, it will be observed that the fitting 232 is supported by a rod 236 from a collar 237 which is slidable on a fixed vertical rod 238 within the housing 7 and provided with a set screw 239 to secure the stand pipe 230 in adjusted position.

Water is circulated in the torch cooling system by means of a piston pump 240 (Figs. II and IV) in communication with the bottom of the reservoir 9 and actuated through a strap rod 241 from an eccentric 242 on the crank shaft 67. A flexible flow pipe 243 extends from the pump 240 to the bracket 30 of the reciprocating carriage 25 at the front end of the apparatus and connects with the flexible tube 244 that leads to the water manifold of the torch 31. As shown in Fig. II, the tubes 41 and 244 parallel each other and are wrapped together with heat insulation for protection against the intense heat of the torch 31. Extending downwardly from the center of the receptacle 226 is a branch pipe 245 which, at the bottom, joins a pipe 246 extending between the lower pipes 12 and 13 of the outrigger arm radiator 4. Accordingly during operation of the pump 240, the glass receptacle 226 is kept charged with cooled water to the level of the stand pipe 230.

The lever 247 of the valve 71 for controlling the supply of oxygen and acetylene gas to the torch 31 is operated through a rod 248 extending downward into the housing 7, said rod having a ball and socket connection at 248a, see Fig. VII, with a friction arm 249 on the shaft 95. As shown the arm 249 consists of a pair of opposing clamp components which are interpivoted at 249a and contracted upon the shaft 95 by a helical spring 250. A friction release arm 251 loosely engaging the guide bolt 252 for the spring 250 extends outward through a vertical guide slot 253 in the inner side wall of the housing 7 and is adapted to engage a vertically adjustable stop 254 extending crosswise of said slot.

As shown in Fig. V, crank shaft 67 has a polygonal end portion 67a whereto the operating crank handle 70 is removably attached, which is surrounded by a bushing 255 fixed within the boss 206 of said handle. The hollow of the bushing 255 is polygonal as shown at 255a to key with the polygonal end 67a of the shaft 67 for the purpose of a positive drive connection. The end of the boss 206 of the crank handle 70 is finished off as a spiral cam edge 255b and adapted to coact with an inwardly-projecting stud 256 fixed in the bushing 257 of the bearing on the pedestal 68. Thus during the initial turn of the handle 70 clockwise in Fig. II in beginning the operation of the apparatus, said handle is shifted outward on the shaft 67 by a distance equal to the pitch of the spiral cam edge 255b of its boss 206, said boss being thereby moved beyond the path of the roller 204 on the arm 201 after the latter has been actuated to set the timing device 115 in a manner presently explained.

A shield 260 of asbestos or the like affixed to the forward end of the bracket 22 protects the parts of the apparatus immediately adjacent the torch 31 from the heat of the latter, said shield having a pendant edge portion 261 capable of clearing any obstructions on the rail R as the apparatus is shifted therealong from one rail joint to another. For convenience in shifting the apparatus, handles 262 and 263 are provided respectively on the front of the bracket 22 and at the back end of the housing 7, see Figs. I–III. Preparatory to setting the apparatus into operation, I chamfer or bevel the upper corners of the contiguous rail ends which are to be treated as at E in Fig. XXIV, and pack the crevice C between them with moist fire clay or the like as shown at F.

The operation of the apparatus is as follows:

Let it be assumed that the apparatus has been properly positioned with the torch centrally over the joint J in the rail R (Fig. II); the finder 59 of the locating means retracted from the field of the heating and out of contact with said rail as shown in Figs. XVIII and XIX; and the apparatus clamped against movement to the rail by the

securing means in the manner already understood. With this preparation, the operator presses the needle valve 84 to increase the flow of the acetylene gas to the pilot burner 82, and at the same time starts turning the shaft 67 in the direction of the arrow in Fig. II by means of the crank handle 70. At the initiation of the first revolution of the handle 70 the cam 205 thereon engages the roller 204 on the arm 201, causing the latter to be moved on its fulcrum 202 whereby the rod 200 is pulled and the shaft 166 turned counter-clockwise through the medium of its arm 199. As a consequence of this movement the other arm 167 on the shaft 166 is simultaneously turned counter-clockwise in Fig. XI and depresses the latch 168 which, at this time, is locked with the pin 169 on the arm 170, thereby, in turn, causing the latter to be depressed with attendant dislodgment of the cross bar 158 of the slide 157 from the radial notch 154 in the disk 119 of the timing mechanism 115. As the arm 170 moves downward, the arm 212 drops with it, pushing down the stem 219 and allowing the quench water drain valve 227 in the measuring receptacle 226 to be closed by its spring 229. Upon being released as above explained, the disk 119 is rotatively shifted slightly in the direction of the arrow in Fig. XII by action of the segmented spring 133, with the result that its notch 154 is advanced somewhat beyond the cross bar 158 of the slide 157, and its cam lug 191 brought beneath the roller 190 on the arm 189 (Fig. XII). Through the movement thus induced in the arm 189, the latch arm 193 is actuated and its lug 196 thereby withdrawn from beneath the lug 197 on the link 178. As a consequence, the link 178 is released together with the lever 179 (Fig. VI) to which it is connected and the spring 186 allowed to bring the clutch member 90 on the lower section 91 of the shaft 87 into engagement with the clutch member 89 on the upper section of said shaft, for impartation of rotary motion to the horizontal cam shaft 95. Immediately upon initiation of the rotation of the cam shaft 95, the friction arm 249, in following suit, pulls downward upon the rod 248 and opens the valve 71 to permit flow of oxygen and acetylene gas to the torch 31 which is instantly lighted from the projected flame from the pilot 82, whereupon the operator releases the needle valve 84. The above events follow each other in such quick succession as to be substantially simultaneous. The extent of opening of the gas control valve 71 is limited by encounter of the release extension 251 of the friction arm 249 with the stop 254 (Fig. VII), and the intensity of the flame at the torch 31 thereby predetermined. Also, by the arrest of the friction arm extension 251, the effect of the spring 250 is modified to reduce friction of the arm with the cam shaft 95 and correspondingly lighten the load on the crank handle 70 during continued operation of the apparatus. As the arm 170 is depressed by the link 168 in the manner above explained, the latch 172 automatically locks beneath the fixed cross bar 173 on the frame of the timing mechanism 115 as shown in Fig. XIII, to temporarily hold the arm 170 depressed. In the meantime, the slide rods 107 are being shifted back and forth endwise by the spiral cam 98 on the shaft 95. Upon the first rightward movement of the coupling link 112, the end of the latter strikes the latch 168 as shown in Fig. VI and disconnects it from the pin 169 of the arm 170, whereupon the spring influenced roller arm 207 reacts upon the arm 167 and causes the shaft 166 to be turned back to its original position, this being permitted by virtue of the freedom of the section 200*a* of the rod 200 to move independently of the section 200*b*. Thereafter by continued rotation of the spiral cam 98, the small roller carriage 25 will be horizontally reciprocated and the torch 31 moved back and forth at a uniform rate of travel in both directions over the rails R. Due to centralization of the torch 31 initially by the locating means and to its fixed throw under the action of the rotary cam 98, the contiguous end portions of the heads of adjacent rail sections at the joint J, will be flame-lapped from above to equal extents to opposite sides of the crevice C across the width of said heads as shown in Figs. XXIV and XXV. During the operating phase of the torch 31, water is continuously circulated through the jacket 36 to keep the torch cool and to prevent it from backfiring. This circulation is maintained by the pump 240 which draws water from the tank 9 and forces it, through the tube 243 (Fig. II) and the connecting pipe 244, into the jacket 36 of the torch 31. After traversing the hollows of the torch jacket 36 (Fig. XXIII) the water leaves by way of the pipe 34 and flows through the connecting flexible tube 35 (Fig. III) into the upper tube 14 of the outrigger arm radiator 4, and thence through the devious passages of the radiator 4. After being cooled, the water finally leaves the lower pipes 12 and 13 of the radiator by way of the connecting pipes 246 and is discharged upwardly into the measuring receptacle 226 at the top of the housing 7 through the branch pipe 245. The excess of the cooled water passes from the receptacle 226 into the standpipe 230 and from thence is conducted by the pipes 233, 234 back into the tank 9 for recirculation. Incident to reciprocation of the rods 107 by the rotary spiral cam 98, the spring-pulled arm 126 (Fig. VI) is oscillated by reason of its engagement with the lateral projection 128 of the cross head 109 on said rods, with the result that the pawl 129 thereon imparts intermittent anti-clockwise rotation to the ratchet wheel 125. Through the clutch plates 139, 140, the movements so induced in the ratchet wheel 125 are communicated to the ratchet wheel 130, with attendant stretching and tensioning of the segmented spring 133 within the drum 120. This action is possible by reason of the fact that the drum 120 is restrained through the gear train of the clock mechanism 115 and interengaging escapement elements 152, 153. The timing means 115 is thereby constantly wound up during rotation of the crank handle 70, and the spring 133 tensioned to a limit prescribed by the resistance offered by the frictional reaction between the clutch disks 139, 140. In other words, after the spring 133 is tensioned to a certain degree, the clutch disks 139, 140 will yield to prevent injury to the timing mechanism 115, the point of yielding being determinable through adjustment of the disk compression spring 142 by the nut 145. Under the power thus stored in the spring 133 rotary motion is imparted to the disk 119, which latter is however held in check by the escapement elements of the timing means 115 so that a definite time period is prescribed for each rotation of said disk to determine the heat treating cycle of the apparatus. As the disk 119 nears the completion of its rotation in the indicated direction, the cross bar 158 of the slide 157, which up to this time rode the periphery of the disk, recedes upwardly into the notch 154 of said disk as far as permitted by the arm 170. The disk 119 is thereby locked against further rotation. At the same time, the link 112 is raised slightly by the spring

161 with the result that the flexible tongue 163 thereon is brought into position in readiness to engage the pendant tail of the dog 172 as shown in Fig. X. Accordingly, during the next movement of the link 112 to the right in Fig. X, the dog 172 will be dislodged from the fixed bar 173 and drawn upward by the spring 175 carrying with it the arm 170 and allowing the cross bar 158 of the slide 157 to be moved further up into the radial notch 154 of the disk 119 by the spring finger 159 as shown in Fig. XI. During the rise of the arm 170 the slotted link 178 is elevated from the position of Figs. VI and X to that of Fig. XI with attendant actuation of the lever 179 and disconnection of the clutch collar 90 on the vertical shaft section 91 from the clutch collar 89 on the vertical shaft section 87 and cessation in the rotation of the horizontal shaft 95 which carries the spiral cam 98. When this occurs the spring 101 (Fig. VIII) reacts upon the shaft 95 and turns it slightly in reverse direction as far as permitted by the slots 99 in the hub of the cam 98. This reverse shift of the shaft 95 is communicated, through the friction arms 249 and connecting rod 248, to the operating lever 247 of the valve 71 which latter is thereby closed to instantly stop flow of the oxygen and the acetylene gas to the torch 31. Moreover, as the arm 170 is raised as aforesaid, it strikes the laterally-directed end 213 of the arm 212 thereby moving the latter upward from the position shown in Fig. VI to that shown in Fig. XI, with the result that the rod 219 is pushed upwardly and the valve 227 opened to permit flow of the measured quantity of quench water from the receptacle 226 to the torch 31 by way of the tube 223 and the connecting pipe 41, see Figs. II and XI, the apparatus coming to rest with the roller 162 on the link 112 within the bottom of the guideway 156 for the slide 157 as shown in Fig. XI and hence with the torch 31 centralized over the crevice C of the rail joint J as shown in Fig. II. The quench water is thus released concurrently with shutting off of the gas supply and evenly discharged upon the rail ends at opposite sides of the crevice C. Exhaustion of the charge of quench water from the measuring receptacle 226 completes the cycle of operation of the apparatus, whereupon the clamping means is released by reverse actuation of the pedal 56 and the apparatus moved along the track to the next rail joint.

The moist fire clay F within the crevice C of the rail joint protects the vertical faces of the rail ends from the direct action of the oxy-acetylene flame and thereby prevents burning or fusion of the upper corners of the rail which is further insured against by the chamfering or beveling at E. The fire clay moreover distributes the heat, so that the affected portions of the rails are drawn to the desired hardness and toughness with attendant avoidance of brittleness at the upper rail corners. While the gas jet outlets 33 may be uniformly distributed across the width of the torch 31, I prefer to employ a lesser number of them at opposite sides of the torch as shown in Fig. XXII, so as to preclude excessive hardening of the sides of the rail heads which would be disadvantageous at curves and which would result in uneven wear under the thrust of car wheel flanges.

The proper hardening and toughening of the rail ends is dependent upon three factors; viz., first, the intensity of the heating flame; second, the duration of the treatment; and third, the application of a predetermined measured quantity of water uniformly upon the heated areas immediately after the heating. All three of these considerations are accurately predeterminable through my invention, the first by adjusting the stop 254 for the friction release extension 251 of the arm 249 by which the gas valve 71 is actuated; the second by use of gears 149 and 150 of different ratios in the timing means; and the third by adjusting the standpipe 230 in the quench water measuring receptacle 226.

I have obtained highly satisfactory results in practice by employing a flame of such intensity as will heat the rail ends to a temperature of approximately 1500 degrees Fahrenheit in a period somewhere between two and a half and three minutes, and quenching with just enough water to reduce the temperature of the rail to about 800 degrees Fahrenheit, which will leave ample heat in the rails to draw the heated surfaces to the desired hardness.

It is of course to be understood that I am not confined to the use of water as a quenching medium, since if desired or found more convenient in practice any other suitable fluid may be substituted. Also if desired or found more effective in practice, the rotary cam may be so designed as to impart variant motion to the torch 31 instead of uniform motion as hereinbefore set forth.

In the alternative embodiment of my invention shown in Figs. XXVI–XXXV, I employ a different type of torch ignition, and also a modified form of timing mechanism. Referring first to Fig. XXVII, it will be observed that the alternative form of ignition means includes an electric sparking element in the form of a rod 82*m* which is held by insulate bushings 270 in brackets 271 attached to one side of the torch 31*m* with its lower end or sparking point at the level of the bottom of said torch. By means of a conductor 272, the rod 82*m* is connected to one terminal of the secondary winding 273 of an induction coil 274, the other terminal of the winding being grounded as diagrammatically shown in the drawings. The primary winding 275 of the induction coil 274 has one of its terminals grounded, while the other terminal thereof is connected, by means of a conductor 276, with a finger spring contact 277 which is mounted on an insulate support 278 at the bottom of the housing 7*m*. Also mounted on the insulate support 278 is a second finger spring contact 279 which is grounded; and interposed in the conductor 276 is a battery 280 from which the primary circuit of the spark coil 274 is energized upon closing of the contacts 277, 279, which is accomplished by the tail of the latch 168*m* when the latter is tripped.

As in the first described embodiment of my invention, the modified timing mechanism 115*m* has a frame with spaced side plates 116*m* affording bearings 117*m* in which a transverse rotary sleeve 118*m* is journaled. Affixed to or forming part of the sleeve 118*m* is a disk 119*m* with the radial notch 154*m* adapted to receive the cross bar 158*m* of a vertical slide 157*m*. Axially disposed within and fastened to the sleeve 118*m* by a key or feather 281 so as to revolve therewith, is another sleeve 282 carrying a spur gear 283; and within the sleeve 282 is still another sleeve 284 whereto a spur gear 146*m* is secured by means of a set screw 285, see Fig. XXX. Within the sleeve 284 and fastened thereto in turn by a key 286 is a shaft 121*m*. Mounted

with capacity for independent rotation about a forwardly extending hub 287 on the gear wheel 146m is a ratchet wheel 130m which is formed with a hollow drum 120m wherein a flat coiled clock spring 133m is housed, one end of said spring being secured to said hub at 288 and the other end to the internal circumferential surface of said drum at 289. The drum 120m is held against axial displacement on the hub 287 of the gear wheel 146m by a keeper disk 290 which is backed by a nut 291 threadedly engaged with the shaft 121m whereof the outer end is journaled in a fixed bearing 292 carried by a fixed bracket 293 on the frame of the timing mechanism 115m. The actuating arm 126m and the timing means is in this instance formed as an extension of one component 294 of a split clutch collar which embraces the drum 120m, the other component of said collar being designated 295. A rod 296 passing transversely through the arm 126m and through a corresponding lug projection on the collar component 295 is surrounded by a helical spring 297 which serves to yieldingly urge the two components toward each other, the pressure of said spring being regulatable by a finger nut 298. As shown in Fig. XXVII, the arm 126m engages one side of the lateral pin projection 113m on the link 112m. Loosely engaged on the rod 296 in the interval between the arm 126m and the lug projection of the clutch collar component 295 is a supplemental depending arm 299 which engages the lateral stud projection 113m of the link 112m from the other side. The drum 120m will thus be positively rotated anti-clockwise during rightward movements of the link 112m; while when said link moves toward the left, the pressures on the clutch collar will be eased through the action of the stud projection 113m on the supplemental arm and shift freely on said drum. A detent 131m cooperates with the teeth of the ratchet wheel 130m to prevent retrograde or clockwise rotation of the drum 120m. Through the arrangement just described, it will be apparent that the spring 133m will be continuously wound up in a manner similar to that described in connection with the spring 133 of the first embodiment. It will also be understood that in the event that the spring 133m should become fully wound at any time, slippage of the clutch collar may take place to prevent injury to the mechanism 115m. By virtue of being connected to the hub 287 of the gear wheel 146m, the spring 133m in reacting, drives said gear wheel anti-clockwise or in the direction indicated by the arrow in Fig. XXVII. Keyed to the inner end of the shaft 121m of the timing mechanism is a spur pinion 300 which is enclosed in a housing 301 at the back of the frame of the timing mechanism 115m. As shown in Fig. XXVIII, the pinion 300 meshes with a spur gear 302 which is free to rotate about a stud 303 within the housing 301 and whereto is secured to a spur pinion 305 which, in turn, meshes with a gear wheel 306 keyed to the sleeve 118, see Fig. XXX. By this arrangement the motion of the shaft 121m under the influence of the motor spring 133m is communicated at reduced speed to the disk 119m. Referring to Figs. XXVII, XXX and XXXI, the gear wheel 146m serves to drive a pinion 147m at the outer end of a countershaft 148m which passes inward through the front side frame of the timing mechanism 115m and at the opposite side of said frame carries a gear wheel 307 (Fig. XXXI) which meshes with a pinion 308 on another countershaft 309 journaled in said frame. Also secured to the countershaft 309 is a worm wheel 310 which drives with a worm 311 on the shaft 312 of a fly ball governor 153m. The governor shaft 312, as shown in Fig. XXXI, has point ends which are rotatably supported by bearing screws 313 adjustable in the frame of the mechanism 115m. The sliding collar or sleeve 315 of the governer 153m carries a brake disk 316 which, during the operation of said governor engages a friction shoe 317 and in this way the speed or rotation of the notched disk 119m and the time period of the heating and quenching cycle of the apparatus is determined. In order that the cycle period may be varied when desired or required, I have provided means for adjusting the brake shoe 317. This means includes (see Figs. XXVI, XXVII, XXIX, XXXII) an adjusting knob 318 which is secured to the front end of a shaft 319 that extends forwardly into a dial casing 320 at the front side of the housing 7. At its inner end, the shaft 319 carries a worm 321 (Fig. XXIX) which meshes with a worm wheel nut 322 in engagement with threads at the outer end of a rod 323 which carries the friction shoe 317. As shown in Figs. XXIX and XXXII, the stem 323 is suitably guided for endwise movement in the frame of the mechanism 115m, and the worm wheel nut 322 held against axial movement between the spaced portions of a bearing bracket 325 attached to said frame. By rotating the knob 318 in one direction or the other, the friction shoe 317 will be correspondingly shifted toward or away from the disk 316 of the governor 153m, thereby to retard the rotation of said governor to a greater or lesser degree. Such adjustment of the shoe 317 is facilitated by a pointer 326 arranged for coordination with a small dial 327 within the dial casing 320. Referring again to Fig. XXX, it will be seen that the spur gear wheel 283 which rotates with the disk 119m, meshes (see Figs. XXVII and XXIX) with a similar gear wheel 328 on another transverse shaft 329 journaled in the frame of the mechanism 115m. The shaft 329 extends forwardly into the dial casing 320 and carries a pointer 330, see Fig. XXVI, arranged to coordinate with a large dial 331 within said casing. Affixed to the top of the housing 7m is a clock work 332 which may be of any suitable construction whereof the winding stem is shown at 333 in Fig. XXVI. The clock work 332 has an arbor 335 which extends forwardly into the dial casing 320 and which carries a pointer 336 arranged to coordinate with still another dial 337 in said casing, see Figs. XXVI and XXXIII, and having in practice, a three minute cycle period. Secured to the arbor 335 is a collar 338 (Fig. XXXIV) with a notch in its periphery normally engaged by a stud 339 on a lever 340 which is fulcrumed medially to swing about a stud projection 341 on the casing of the clockwork 332. The other end of the lever 340 overlies an extension of the pivot pin 342 forming the connection between the arm 199m and the link rod 200m. Accordingly when the rod 200m is pulled in initiating the operation of the apparatus, the lever 340 is actuated and its pin 339 withdrawn from the notch of the collar 338, as shown in Fig. XXXIV, so that the clockwork is released and permitted to operate. From Fig. XXXV it is to be noted that the cam projection 205m on the hub 206m of the actuated crank handle 70m is somewhat greater in circumferential extent so that the arm 340 is held retracted sufficiently long to insure passage of the

notch in the disk 338 beyond the pin 339 on said arm.

In order to prevent overrunning of the governor 153m at the completion of an operative cycle of the apparatus, I have provided the following means: Secured to the slide 157m is a stud 345 which is arranged to engage the horizontal arm of a bell crank lever 346 fulcrumed at 347 at the back of the frame of the mechanism 115m. The upright arm of the bell crank lever 346 is in turn arranged to be engaged by a roller 348 at the bottom end of a vertical lever 349 which is medially fulcrumed at 350 at the back of the frame of the mechanism 115m. The upper end of the lever 349 is longitudinally slotted to engage a pin 351 projecting laterally from a collar 352 on a slide rod 353 guided for endwise movement in fixed brackets 355, 356. At its outer end the rod 353 (see Fig. XXXI) carries a cross head 357 which engages behind a pair of nuts 358 adjustable on a parallel rod 359 which is guided for endwise movement in the frame of the mechanism 115m. The rod is yieldingly urged inward by a helical spring 360 which exerts its pressure against a head 361 at the inner end of the rod 359, said head carrying a friction shoe 362. Thus as the slide 157m (Fig. XXVIII) is depressed, motion is communicated through the bell crank lever 346 to the lever 349 so that the rod 359 is moved leftward in Fig. XXXI, and the spring 360 thereby permitted to force the shoe 362 inward to engage the disk 316 on the sleeve 315 of the ball governor.

Here, as in the first described embodiment of my invention, the heating cycle is determined by the time it takes for the notched disk 119m to make a complete revolution which period may be changed as desired or required through adjustment of the friction shoe controller 317 for the fly ball governor 153m of the timing mechanism. Since the gears 283 and 328 are identical in size, the pointer 330 for the dial 331 will make a complete turn in synchronism with the disk 119m of the timing mechanism 115m. Thus by observing the dial 331, the operator can tell at a glance at any time the extent to which the heating cycle has progressed.

Assuming the alternative form of apparatus to have been secured in position on the rails, its operation is as follows:

During the first revolution of the actuating crank 70m, the cam projection 205m thereon causes the arm 201m to be moved counterclockwise in Fig. XXVI with attendant impartation of an upward pull to the telescopic link 200m. As a consequence, the arm 170m is depressed by the latch link 168m, as shown in Fig. XXVI, and the bar 158m dislodged from the notch 154m in the timing disk, whereupon the latter immediately begins its rotation. As the arm 170m is depressed, the lever 212m drops with it and, through the rod 219m, closes the drain valve of the receptacle 226m for the quench water, this action being concurrent with actuation of the lever 179m which, as in the first described embodiment, causes clutching of the mechanism (Figs. IV and VII) for rotating the cam shaft 95m, to effect endwise reciprocation of the rods 107m. This reciprocating motion is transmitted through the link bar 112m, to the torch carriage (Figs. II and VI), said link bar having been coupled with the projection 113m on the rods during depression of the arm 170m as above explained. Upon initiation of the turning movement of the cam shaft 95m, the valve 71 (Fig. II) is opened to allow the combustible gas mixture to flow to the torch 31. By the upward pull of the link rod 200m, the detent 339m is withdrawn from the notch in the disk 338 on the arbor of the dial pointer 336 in the manner already understood, to permit the latter to revolve under the drive of the clock mechanism 332, which in practice is designed to effect a single excursion of said pointer around the dial 337, the latter being preferably graduated in seconds. Due to the engagement of the clamp arms 126m and 299 with the projection 113m on the link bar 112m, said arms are vibrated and the coil spring 133m is wound up in the manner previously explained to drive the timing disk, the brake shoe 362 (Fig. XXXI) having been retracted from the disk 316 of the fly-ball governor 153m through actuation of the lever 349 (Fig. XXVIII) by the bell crank 346 incident to depression of the slide 156m. Through the gears 283 and 328, the checking pointer 330 of the dial 331 is caused to travel about said dial. In its first movement rightward, the end of the link bar 112m engages the latch 168m to disconnect the latter from the projection 169m on the arm 170m, and through said latch member causes the spring contact 277 to be moved into engagement with the spring contact 279 (Fig. XXVI), thereby closing the circuit 272 (Fig. XXVII) through the spark plug 82m. During the succeeding leftward movement of the link bar 112m the circuit is broken through movement of the contact 277 away from the contact 279, with creation of a spark at the plug 82m (Fig. XXVII) by which the combustible gas mixture issuing from the torch 31m is ignited. The heating of the rail thereupon proceeds while the timing disk 119m turns through a complete revolution, when, by action of the spring 159m, a bar 158m of the slide 157m is thrust upward into the notch 154m in said disk to arrest further motion of the latter, thereby allowing the arm 170m to be raised by its spring 175m until it is re-locked in its normal elevated position by the latch 168m. In its upward movement, the arm 170m actuates the clutch arm 179m to stop rotation of the cam shaft 95m and cause shutting off of the gas supply to the burner, and at the same time lifts the arm 212m to open the drain valve of the quench water receptacle 226m. Also at the same time, the bell crank 346 (Fig. XXVIII) is actuated by the stud 345 on the slide 157m thereby moving the lever 349 and release of the brake shoe 362 as in Fig. XXXII to immediately arrest the motion of the governor 153m. Notwithstanding stoppage of the apparatus the clock 332 continues to operate until its end 336 is again locked in zero position by the stud 339 of detent lever 340. Thus, as in the first described embodiment, the heating of the rail ends is carried out for a definite time interval determined by the period of rotation of the disk 119m, at the end of which the quench water is instantly released to set the temper of the heated parts of the rails.

Having thus described my invention, I claim:

1. In apparatus for heat treating rails, a heating torch supported in proximity to the rails; means for conducting combustible fluid to the torch; a valve for governing flow of the combustible fluid; a main drive shaft; a secondary shaft with means thereon for moving the torch back and forth relative to the rail; clutch means through which the secondary shaft is driven from the main shaft; an operating arm frictionally engaging the secondary shaft whereby

the valve is kept open during the operative phase of the apparatus; timing means for disconnecting the clutch after a lapse of a predetermined time interval; and means whereby, after disconnection of the clutch, the secondary shaft is slightly moved reversely to its normal direction of rotation with attendant closing of the valve by the friction arm to interrupt flow of the combustible fluid to the torch.

2. In apparatus for heat treating rails, a heating torch supported in proximity to the rails; means for conducting combustible fluid to the torch; a valve for governing flow of the combustible fluid; a main drive shaft; a secondary shaft; clutch means through which the secondary shaft is driven from the main shaft; an operating arm for the valve frictionally engaging the secondary shaft; a rotary cam on the secondary shaft for moving the torch back and forth relative to the rail; a diametral key pin on the secondary shaft engaging a circumferential slot in the hub of the cam; a spring in tension between one end of the pin and an anchorage near the periphery of the cam; timing means for disconnecting the clutch after a lapse of a predetermined time interval with attendant cessation in the drive of the secondary shaft and slight movement of said shaft reversely to its normal direction of rotation under the action of the spring aforesaid to effect closure of the valve and interruption of the flow of the combustible fluid to the torch.

3. In apparatus for heat treating rails, a carriage with wheels for engaging one rail of a railway track; an outrigger arm extending laterally from the carriage and having a wheel for engaging the other rail of the track, said arm being constructed from tubing for the purpose of a radiator; a jacketed torch supported by the carriage in proximity to one of the rails with capacity for being horizontally reciprocated; means on the carriage for conducting combustible fluid to the torch; means on the carriage for moving the torch back and forth relative to the rail which is to be treated; means incorporated with said mechanism for circulating cooling water between the outrigger arm radiator and jacketing of the torch during the operation of the apparatus; and timing means on the carriage operated by said mechanism for automatically controlling the flow governing means to shut off the supply of the combustible fluid to the torch after the lapse of a predetermined time interval.

4. Apparatus according to claim 3, for heat treating rails, including a reservoir in circuit with the radiator and the torch jacketing having a standpipe for trapping a definite quantity of the cooled water; and means also controlled by the timing means for releasing the trapped water from the reservoir for discharge upon the treated rail portion concurrently with shutting off the supply of the combustible fluid to the torch.

5. In apparatus for heat treating rails at joints, a carriage shiftable on the rail; a heating torch supported by the carriage in proximity to the rail; and means on the carriage adapted to coact with the rail joint in automatically centering the torch relative to said joint as the carriage is shifted on the rail including a finder arm which is yieldingly urged toward the rail and which has a projection adapted to enter the interval between contiguous rail sections at the joint as the carriage is shifted on the rail.

6. In apparatus for heat treating rails at joints, a carriage shiftable on the rail; a heating torch supported by the carriage in proximity to the rail; and means on the carriage adapted to coact with the rail joint in automatically centering the torch relative to said joint as the carriage is shifted on the rail including a finder arm which is yieldingly urged toward the rail and which has a projection adapted to automatically enter the interval between contiguous rail sections as the carriage is shifted; and wherein means is provided for securing the carriage against movement on the rail during the treatment and for concurrently withdrawing the finder arm from the region of the joint after the torch is properly positioned.

7. In apparatus for heat treating rails at joints, a carriage shiftable on the rail; a heating torch supported by the carriage in proximity to the rail; and means on the carriage adapted to coact with the rail joint in automatically centering the torch relative to said joint as the carriage is shifted on the rail including a finder arm which is yieldingly urged toward the rail and which has a projection adapted to automatically enter the interval between contiguous rail sections at the joint as the carriage is shifted on the rail and wherein means is provided for securing the carriage to the rail; means for actuating the securing means; and connecting means whereby the finder is retracted laterally from the rail joint as the securing means is operated to secure the carriage.

8. In apparatus for heat treating rails at joints, a carriage shiftable on the rail; a heating torch supported by the carriage in proximity to the rail; and means on the carriage adapted to coact with the rail joint in automatically centering the torch relative to said joint as the carriage is shifted on the rail including a finder arm which is yieldingly urged toward the rail and which has a projection adapted to automatically enter the interval between contiguous rail sections at the joint as the carriage is shifted on the rail and wherein means is provided for securing the carriage to the rail; means for actuating the securing means, and connecting means whereby the finder is retracted laterally from the rail joint and moved longitudinally of the rail from the province of the torch as the securing means is operated to secure the carriage.

9. In apparatus for heat treating rails at joints, a carriage shiftable on the rail; a heating torch supported by the carriage in proximity to the rail; a finder arm on the carriage which is yieldingly urged toward the rail so that a lateral projection thereon automatically enters the interval between contiguous rail sections at the joint as the carriage is shifted, to center the torch relative to the joint; and a pilot burner on the finder arm for igniting the torch.

10. In apparatus for heat treating rails; a torch supported in proximity to the rail; driving means; means for reciprocating the torch; means automatically operated by the driving means at starting to connect the torch reciprocating means to the driving means; timing means; and means automatically operated by the timing means at the expiration of a predetermined time interval to disconnect the torch reciprocating means from the driving means.

11. Apparatus according to claim 10, for heat treating rails, including means whereby the timing means is actuated from the torch reciprocating means.

12. Apparatus according to claim 10, for heat treating rails, including a valve for controlling the supply of combustible fluid to the torch; and

means automatically operated upon disconnection of the torch reciprocating means from the driving means to close the valve.

13. Apparatus according to claim 10, for heat treating rails, including a valve for controlling the supply of combustible fluid to the torch; a spray nozzle associated with the torch; a reservoir for quench liquid; a valve for controlling the flow of the liquid from the reservoir to the nozzle; and means automatically operated upon disconnection of the torch reciprocating means from the driving means to close the combustible control valve and to concurrently open the quench liquid valve.

14. Apparatus according to claim 10, for heat treating rails, including a valve for controlling the supply of combustible fluid to the torch; a spray nozzle associated with the torch; a reservoir for quench liquid having regulatable means which permits overflow of excess quench liquid during filling; a valve for controlling the flow of the liquid from the reservoir to the nozzle; and means automatically operated upon disconnection of the torch reciprocating means from the driving means to close the combustible control valve and to concurrently open the quench liquid valve.

15. Apparatus for heat treating rails according to claim 10, in which the torch is jacketed, and including a radiator; conduit connections forming a closed circulatory cooling system between the torch jacket and the radiator; and means actuated from the drive means for circulating cooling medium through the system.

16. Apparatus for heat treating rails according to claim 10, in which the torch is jacketed, and including a radiator; conduit connections forming a closed circulatory system with the torch jacket and the radiator; means actuated from the drive means for circulating cooling liquid through the system; a reservoir interposed in the cooling system with means for trapping a predetermined quantity of the circulating cooling medium; a spray nozzle in association with the torch and in communication with the reservoir; a valve for controlling flow of the liquid from the reservoir to the nozzle; and means automatically operated upon disconnection of the torch reciprocating means from the driving means to open the valve for release of the trapped quantity of the cooling liquid from the reservoir for discharge upon the rail concurrently with closing of the combustible supply valve.

17. Apparatus according to claim 10 for heat treating rails, including a valve for controlling the supply of combustible fluid to the torch; ignition means comprising a sparking element in association with the torch and a control switch in circuit therewith; means automatically operated upon starting of the torch reciprocating means to open the valve and to momentarily close the switch aforesaid; and means automatically operated upon disconnection of the torch reciprocating means from the driving means to close the valve.

18. Apparatus according to claim 1, for heat treating rails, including a spray nozzle in association with the torch; a reservoir for quench liquid; a valve for controlling flow of the liquid from the reservoir to the nozzle; and means controlled by the timing means and actuated by the torch reciprocating means concurrently with disconnection of the clutch to open the quench liquid valve and effect release of the liquid from the reservoir for dispersion upon the rail by the nozzle.

19. Apparatus according to claim 1, for heat treating rails, including means whereby the clutch is automatically connected upon initiation of turning movement of the main shaft.

20. Apparatus according to claim 1, for heat treating rails, wherein the timing means is driven through motion derived from the secondary shaft.

21. Apparatus according to claim 1, for heat treating rails, wherein the timing mechanism includes a rotary control member, a spring motor for rotating the rotary member, and racking means for the spring motor deriving movement from the secondary shaft.

22. In apparatus for heat treating rails, a carriage shiftable on the rail; a torch; a movable support on the carriage for the torch; driving means; means for reciprocating the torch on the carriage; means automatically operated at starting of the driving means to connect the torch reciprocating means to the driving means; a valve for controlling supply of fluid combustible to the torch; means automatically operative upon starting and stopping of the torch reciprocating means to respectively open and close the valve; timing mechanism including a disc cam, a spring motor to rotate the disc cam, and racking means actuated from the torch reciprocating means to wind the spring motor during the operation of the apparatus; and means controlled by the disc cam and operative after the expiration of a predetermined time interval to disconnect the torch reciprocating means from the driving means.

23. In apparatus for heat treating rails, a carriage shiftable on the rail; a torch; a movable support on the carriage for the torch; driving means; means for reciprocating the torch on the carriage; means automatically operated at starting of the driving means to connect the torch reciprocating means to the driving means; a valve for controlling supply of fluid combustible to the torch; means automatically operative upon starting and stopping of the torch reciprocating means to respectively open and close the valve; timing mechanism including a disc cam with a notch in its periphery and a slip clutch drive motor for rotating the cam, a stop with means for yieldingly maintaining it in engagement with the notch in the cam normally; means operated concurrently with opening of the valve to withdraw the stop from the cam notch to permit turning thereof by the motor; means automatically operated, upon reentry of the stop into the cam notch after the completion of a rotation of the cam to effect disconnection of the torch reciprocating means from the driving means.

24. Apparatus according to claim 23, for heat treating rails, including a spray nozzle in association with the torch; a reservoir for quench liquid; a valve for controlling flow of the liquid from the receptacle to the nozzle; means operated by the stop to effect the quench liquid valve for release of the liquid from the receptacle concurrently with disconnection of the torch reciprocating means from the driving means.

25. In apparatus for heat treating rails, a torch supported in proximity to the rail; a valve for controlling the supply of fluid combustible to the torch; driving means; means for reciprocating the torch; timing means driven by the driving means; automatic means operative at starting of the driving means to connect the torch reciprocating means to the driving means; means automatically operated by the torch reciprocating means upon starting and stopping to respectively open and close the combustible supply

valve; timing mechanism actuated from the torch reciprocating means; means automatically operated by the timing mechanism after the expiration of a predteermined time interval for the heating cycle to effect disconnection of the torch reciprocating means from the driving means; a regulatable governor for the timing mechanism; an indicator with a dial and with a hand actuated from the timing mechanism to make a complete excursion around the dial irrespective of the setting of the governor; a normally quiescent clockwork with a dial and a rotating hand whereby the regulation of the governor may be checked; and stop means tripped by the driving means at the starting of each heating cycle to release the clock into action and operative to automatically stop the clock, said clock having a time period slightly in excess of the maximum required for rail heating.

26. In apparatus for heating the contiguous ends of adjoining sections of a track rail, a carriage shiftable on the rail; a torch supported on the carriage with capacity for being horizontally reciprocated in proximity to the rail; a valve for controlling flow of combustible fluid to the torch; means for positioning the carriage so that the torch in its reciprocation moves to equal distances in opposite directions relative to the split between the rail sections; means for reciprocating the torch at a substantially uniform rate relative to the rails throughout the treatment; and timing means automatically operative after the expiration of a predetermined time interval, to concurrently effect stoppage of torch actuating means and closing of the valve.

27. In apparatus for heating the contiguous ends of adjoining sections of a track rail; a torch having a plurality of jets and supported on the carriage with capacity for being horizontally reciprocated in proximity to the rail; a nozzle associated with the torch and having a plurality of jets symmetrically distributed with respect to those of the torch; means for positioning the carriage so that the torch in its reciprocation moves to equal distances in opposite directions from the split between the rail sections, a valve for controlling flow of combustible fluid to the torch; a reservoir for quench liquid; a valve for controlling flow of the quench liquid from the reservoir to the nozzle; means for reciprocating the torch at a substantially uniform rate throughout the treatment; and timing means automatically operative after the expiration of a predetermined time interval, to concurrently effect stoppage of the torch reciprocating means with the torch positioned centrally of the rail split, close the combustible control valve, and open the quench liquid valve.

28. Apparatus according to claim 10 for heat treating rails including an electric sparking element and a switch in circuit therewith; and means automatically operated from the torch reciprocating means at starting to momentarily close the circuit.

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