Feb. 4, 1936. Q. BENT ET AL 2,029,286

PROCESS AND APPARATUS FOR RAIL HANDLING AND TREATMENT

Filed Jan. 21, 1932 8 Sheets-Sheet 1

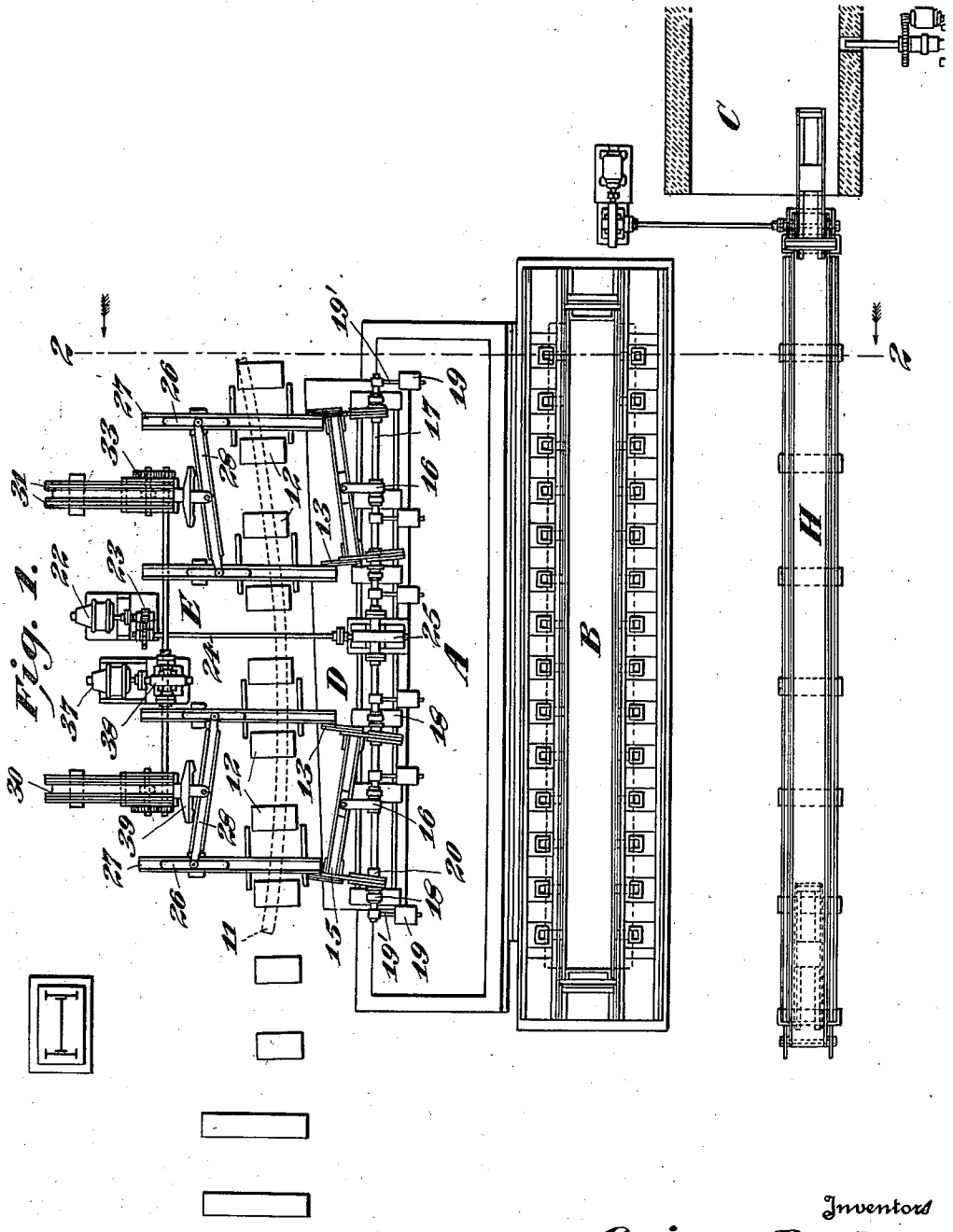


Fig. 1.

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PROCESS AND APPARATUS FOR RAIL HANDLING AND TREATMENT

Filed Jan. 21, 1932 8 Sheets-Sheet 2

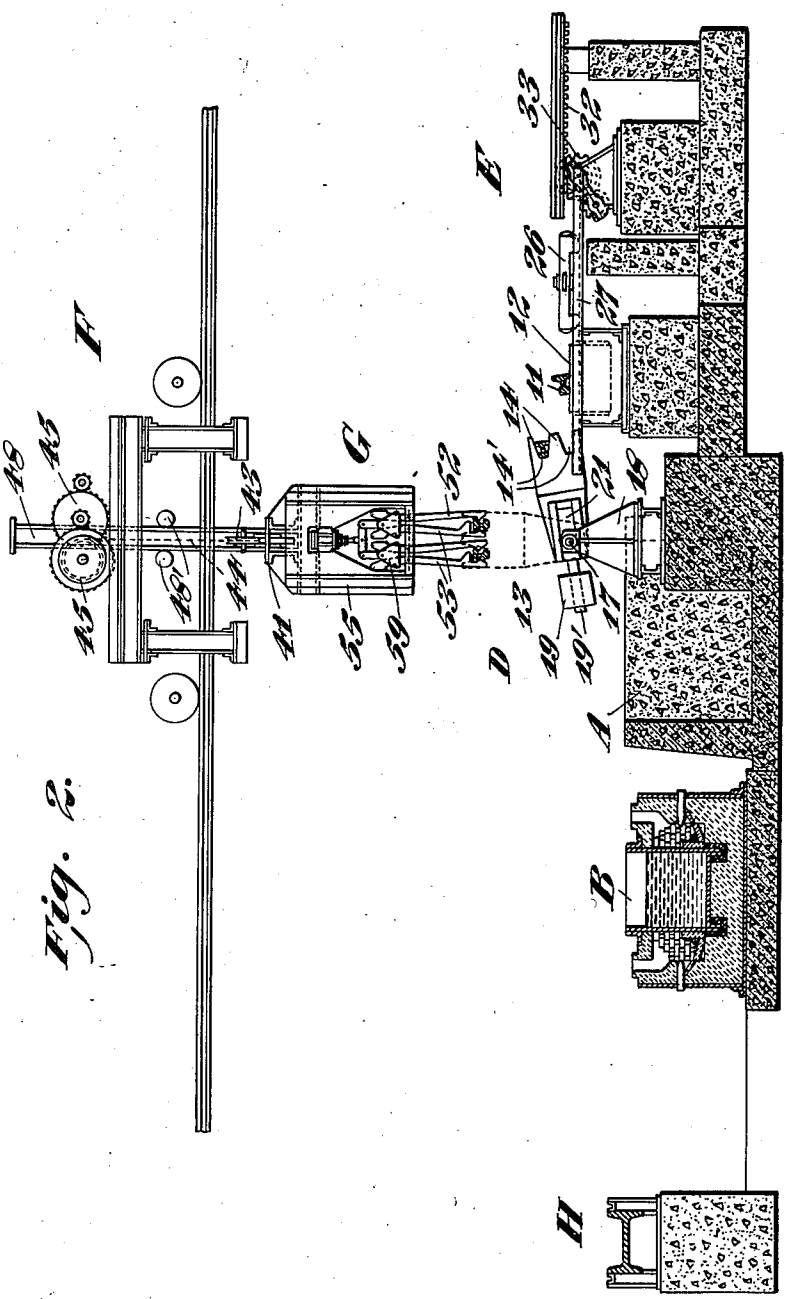


Fig. 2.

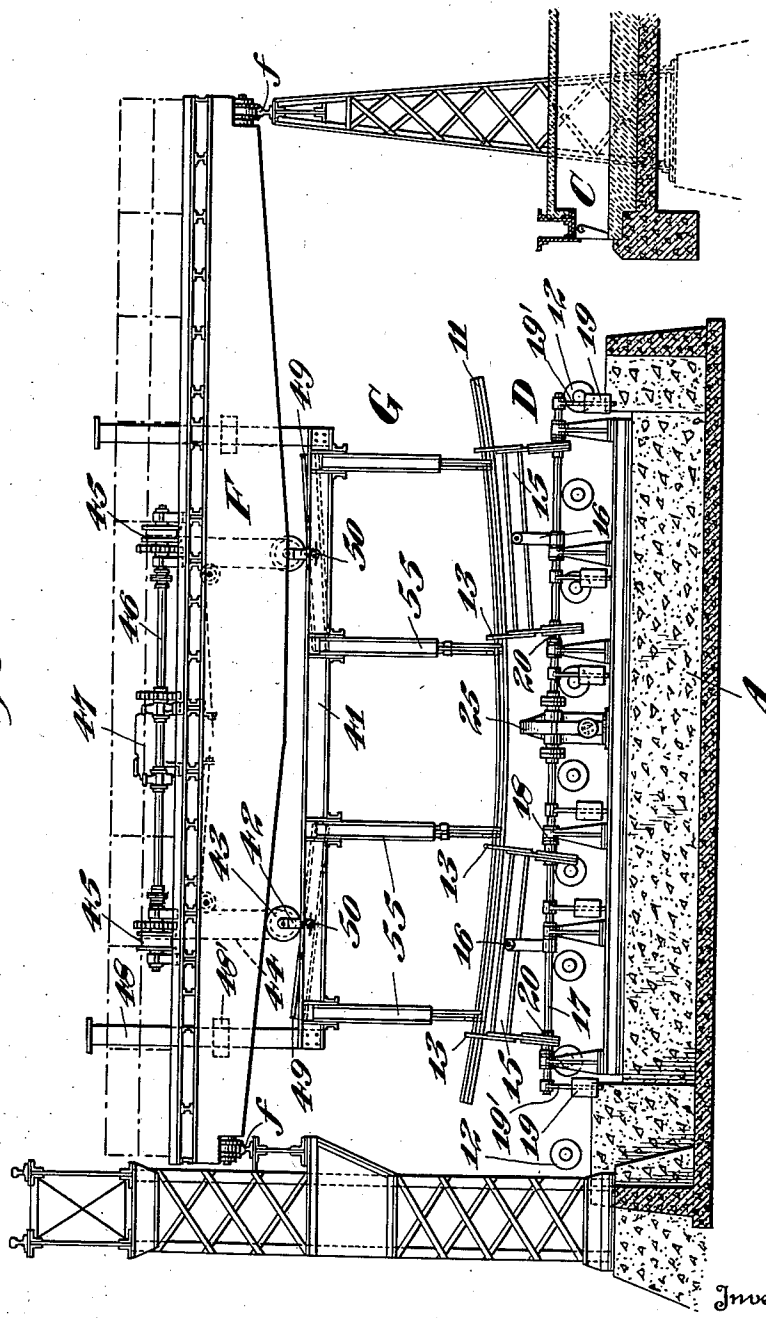
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PROCESS AND APPARATUS FOR RAIL HANDLING AND TREATMENT

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Fig. 3.



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PROCESS AND APPARATUS FOR RAIL HANDLING AND TREATMENT

Filed Jan. 21, 1932 8 Sheets-Sheet 4

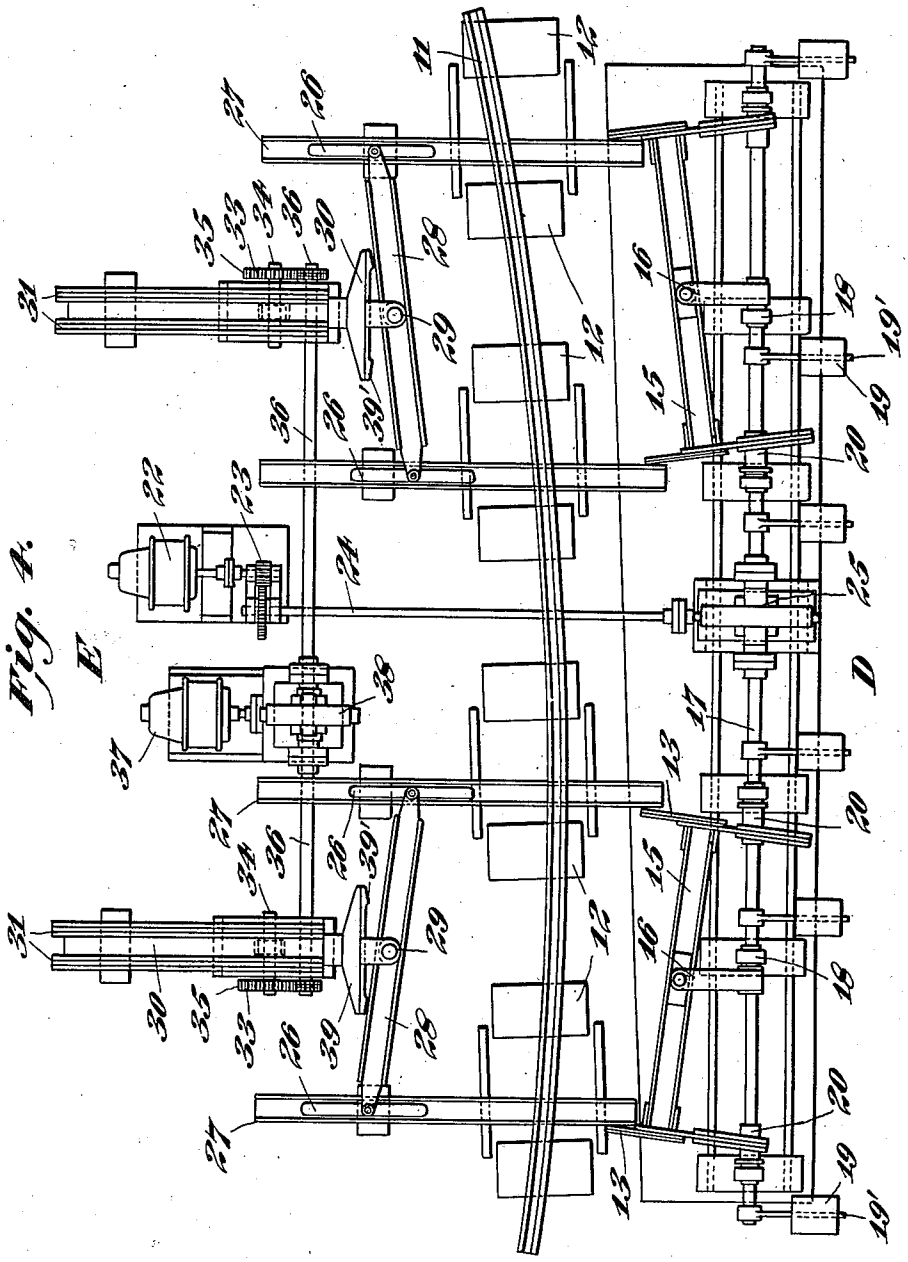


Fig. 4.

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PROCESS AND APPARATUS FOR RAIL HANDLING AND TREATMENT

Filed Jan. 21, 1932 8 Sheets-Sheet 5

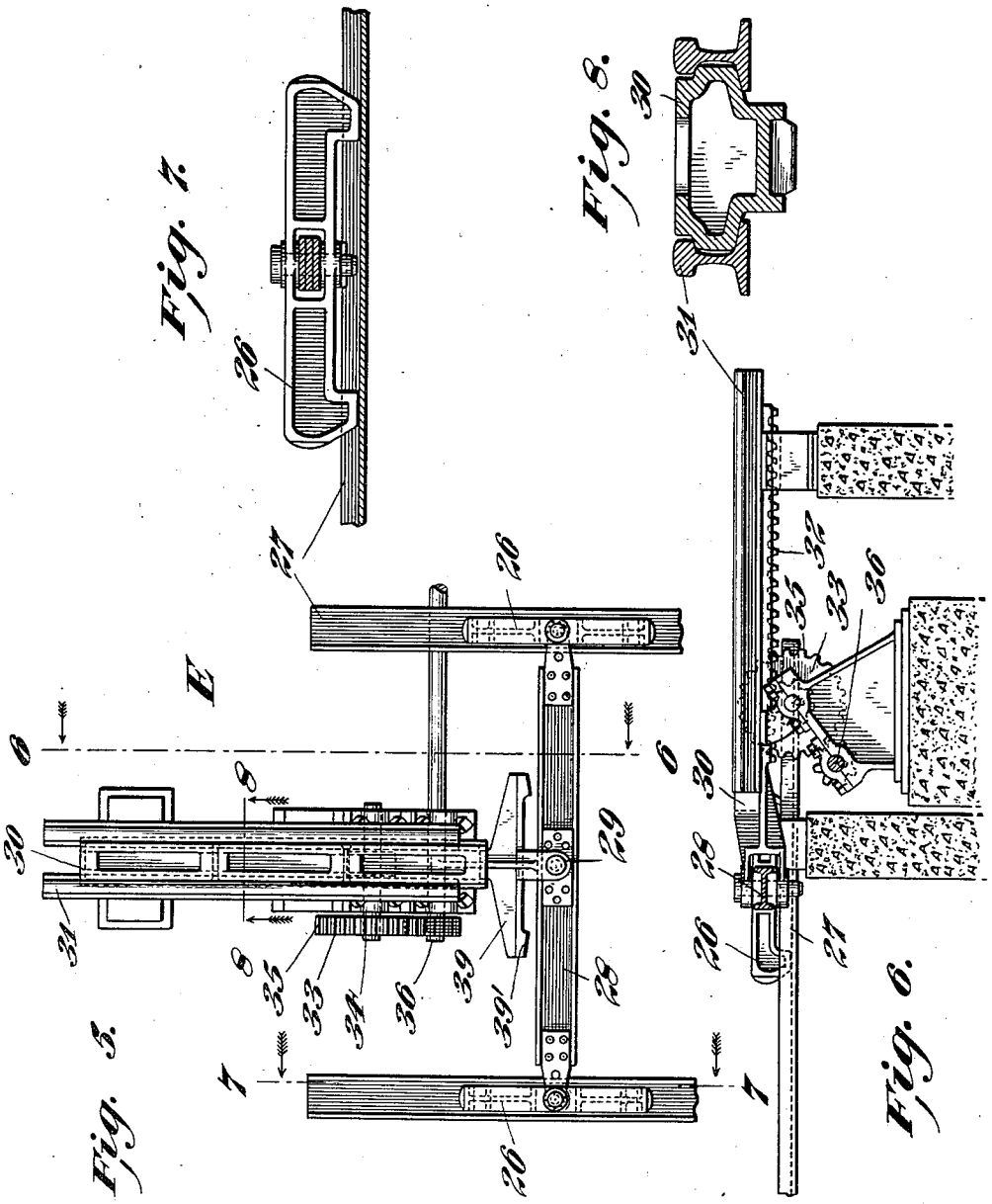


Fig. 7.

Fig. 8.

Fig. 5.

Fig. 6.

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PROCESS AND APPARATUS FOR RAIL HANDLING AND TREATMENT

Filed Jan. 21, 1932 8 Sheets-Sheet 6

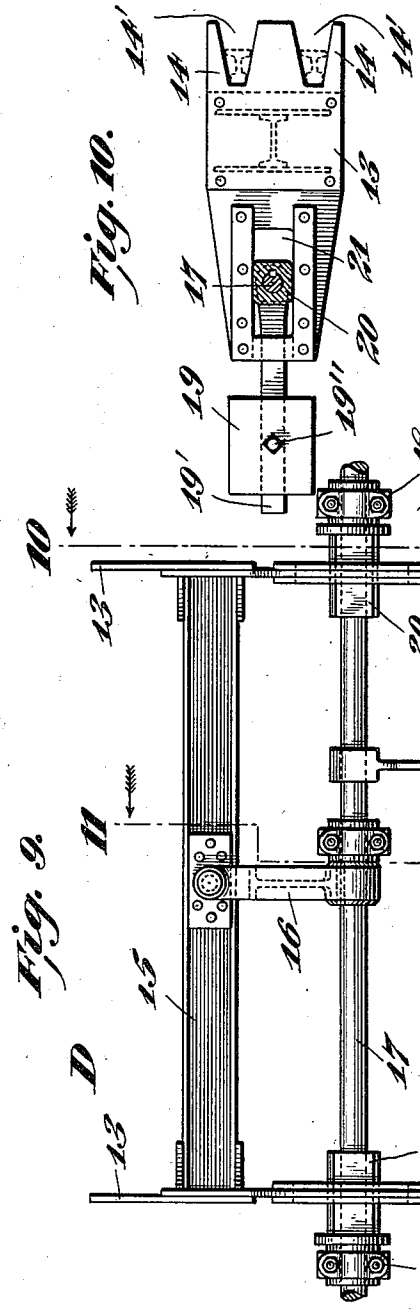


Fig. 10.

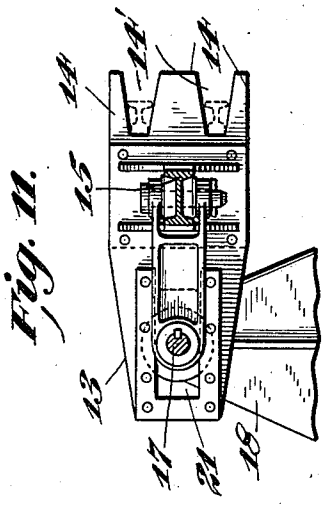


Fig. 11.

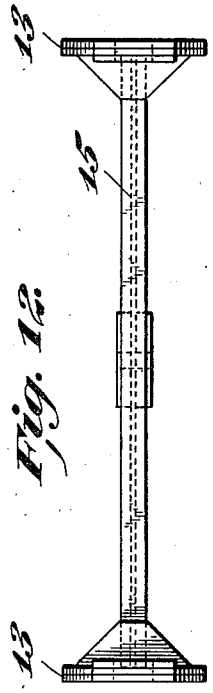


Fig. 12.

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PROCESS AND APPARATUS FOR RAIL HANDLING AND TREATMENT

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Fig. 15.

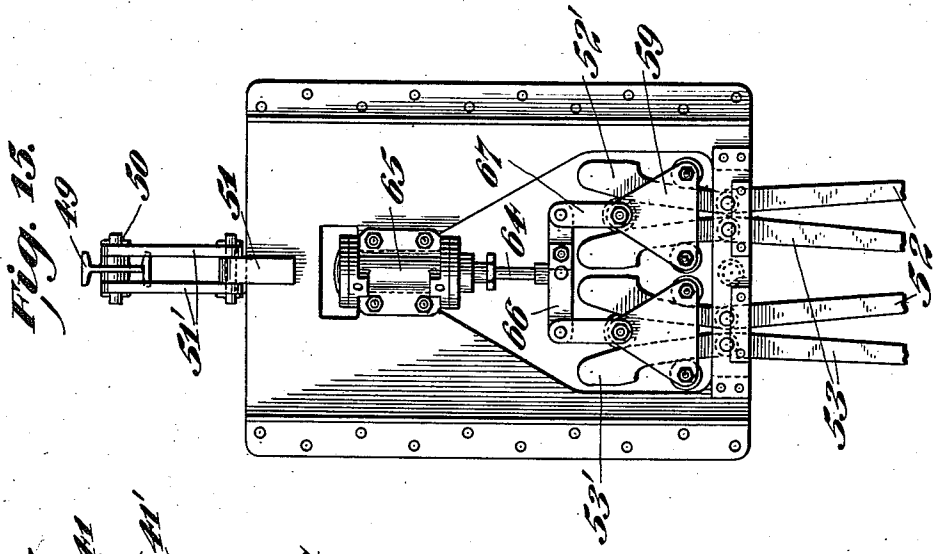


Fig. 13.

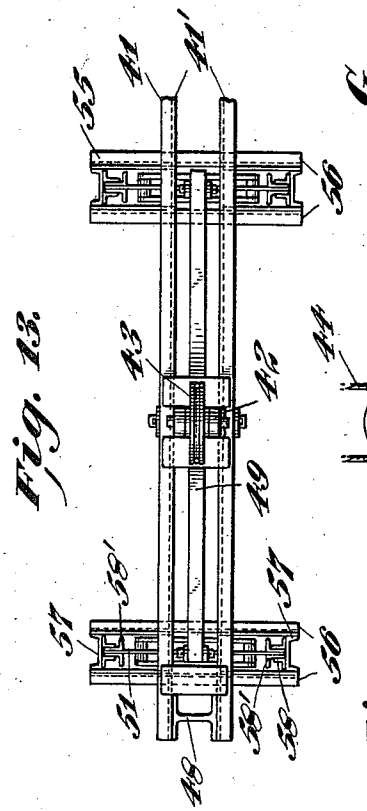
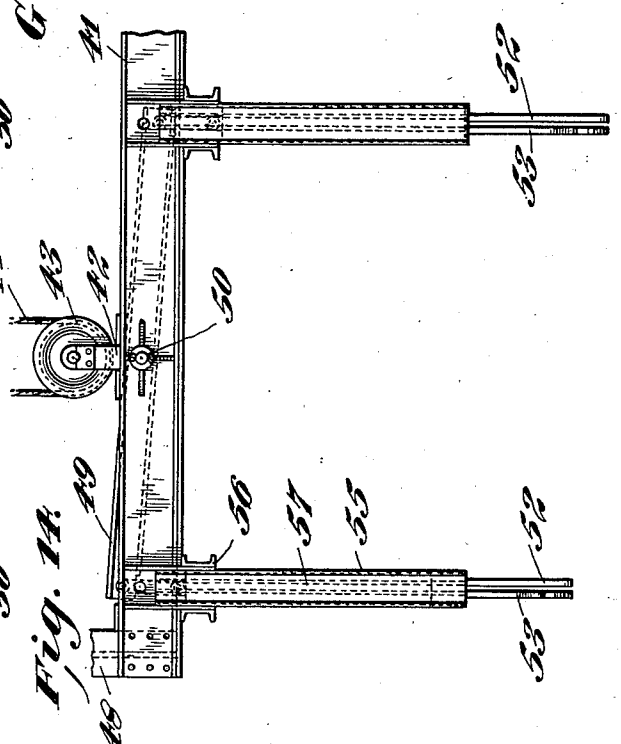


Fig. 14.



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PROCESS AND APPARATUS FOR RAIL HANDLING AND TREATMENT

Filed Jan. 21, 1932 8 Sheets-Sheet 8

Fig. 20.

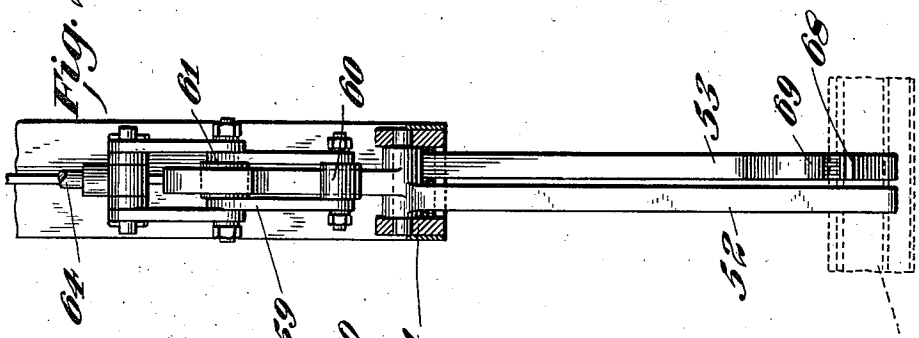


Fig. 19.

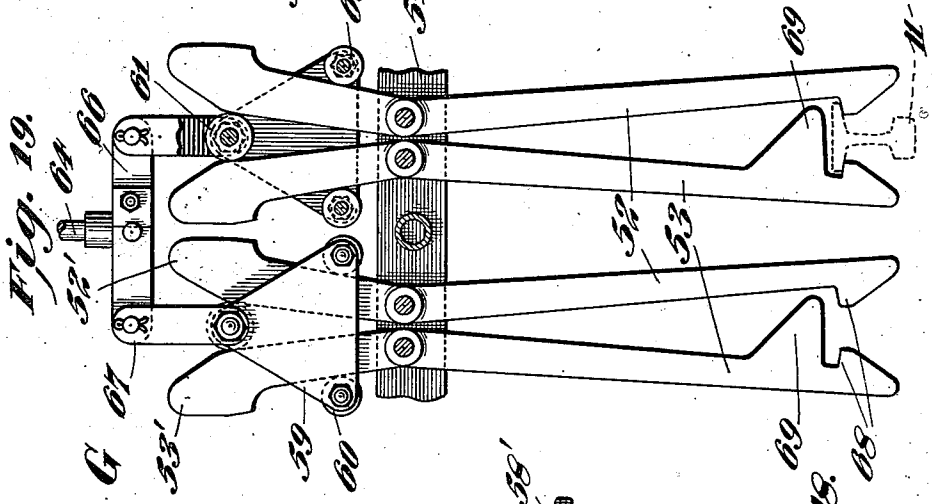


Fig. 16.

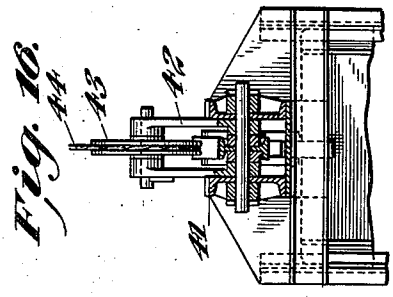


Fig. 17.

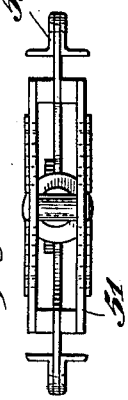
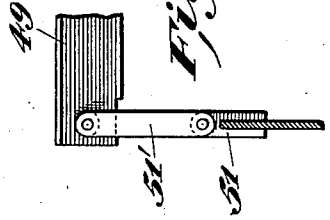


Fig. 18.



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Patented Feb. 4, 1936 2,029,286

UNITED STATES PATENT OFFICE

2,029,286

PROCESS AND APPARATUS FOR RAIL HANDLING AND TREATMENT

Quincy Bent, Friedensville, and Edward F. Kenney, Bethlehem, Pa., assignors to Bethlehem Steel Company, a corporation of Pennsylvania

Application January 21, 1932, Serial No. 587,860

16 Claims. (Cl. 148—21.5)

Our invention relates to processes and apparatuses for handling and treating rails.

Our invention is directed to processes for quenching rails particularly to those operations which include a temperature equalizing step following the quenching treatment. The invention is also directed to the handling of hot rails, whether or not heat treatment operations are involved, but it is particularly directed to rail handling incidental to such heat treatment operations.

Our invention is also directed to apparatus for carrying out such heat treatment and handling processes.

An important object of our invention is to handle hot rails under such conditions and in such manner as to reduce as far as possible the chances of strains or unrelieved stresses being developed in the rails, especially during quenching and other operations in the heat treatment of rails.

It is an object of our invention to so handle and support hot rails as to permit a relatively free alteration of shape incidental to changes in temperature; it being an object to so yieldingly support hot rails that they may change their shape without introducing undue stresses into the rail metal.

Another important object of our invention is to effect a direct and positive handling of the rail during heat treatment.

Another object is to so control the steps and condition of heat treatment as to minimize the dangers of subsequent straightening operations.

These objects, as well as others, together with the means and modes for realizing them, will be readily apparent after a more or less detailed exposition has been given of particular embodiments of our invention.

Before giving a description of a specific embodiment illustrative of the invention, it may be well to briefly outline the general operations.

In Kenney Patent #1,837,189, there is described a process for treating rails which comprises the steps of quenching the rails in a quenching bath such as water, to cool the rail rapidly through the critical range, removing the rail from the quenching bath while it still retains a great deal of heat and quickly equalizing in a molten bath of lead or other hot liquid medium; and then annealing or "drawing" in a furnace. The present invention is particularly adapted to be used in carrying out this Kenney process and the specific embodiment of our invention will be described as applied thereto. As will be obvious, however, the process and apparatus of the present disclosure, is not limited to the practice of the process set forth in the Kenney patent just mentioned.

The rail from the mill, its temperature still above the critical range, is brought into a generally horizontal position, its head down, with the web in a substantially vertical plane, and supported at a plurality of spaced points. The rail is so brought into this particular orientation and is so supported in order that the rail may alter its shape freely as its temperature changes. While thus supported the rail is lowered into a quenching bath, in which it remains for a predetermined time after which it is removed, without altering the same general orientation of the rail on its supports, and then immersed in a hot liquid bath, such as a bath of molten lead, where it is kept sufficiently long to substantially equalize its temperature. The rail is then placed in an annealing furnace.

Somewhat amplifying the outline of the invention given in the preceding paragraph: As the rail is received from the mill it lies upon its side on rollers, that is it rests upon the edge of one flange and the side of its head. Prior to quenching, the rail is brought into a substantially horizontal position with its head down, its web in substantially a vertical plane and supported at a plurality of points spaced along its length. To get the rail into this orientation the rail, lying upon its side on the rollers, is pushed transversely of its length into a device which I designate an elevator, comprising a plurality of spaced supports mounted upon a rocker shaft. This elevator device receives the rail while its supports are lowered into a receiving position and then the rocker shaft is turned to bring the rails into the desired orientation with the head down and the web in a substantially vertical plane. From this elevator device the rail is received by a transfer mechanism which possesses spaced supports or holders for the rails. This transfer mechanism carries the rail to juxtaposition first with the quenching bath and then with the equalizing bath, the rail being immersed first in the quenching medium and then in the equalizing medium without changing the conditions of support. An important features of each of the steps of handling are the means whereby the hot rail is always supported under conditions to prevent strains being introduced into the rail material because of alterations in shape of the rail as the rail's temperature changes. We effect this condition by means of equalizing systems for the rail supports.

In pushing the rail from its initial horizontal, side resting state into the elevator mechanism, the pushing elements engage the rail at spaced points along its length, the pushing elements being comprised in an equalizer system to permit of relative change of position of the pusher element as the shape of the rail varies with change of rail temperatures. Similarly in the elevator mechanism the spaced supports for the rails are arranged on the equalizer principle to permit relatively free change of shape of the rail. Likewise in the supports in the transfer apparatus the same equalizer principle prevails to permit of the desired free change of shape of rail. Thus it will be seen that we have provided a system for handling hot rails which will permit of relatively free change of shape of the rail incidental to its cooling or heating and thus avoid the introduction of serious unrelieved stresses into the rail metal.

Referring to the drawings:

Fig. 1 is a plan view of the general equipment for treating rails, omitting the crane and the associated rail transfer mechanism;

Fig. 2 is an elevation of the general equipment taken on lines 2—2 of Fig. 1, but including the crane and associated transferring mechanism;

Fig. 3 is an elevation of the elevating and transfer mechanism viewed at right angles to the showing of Fig. 2;

Fig. 4 is a plan view of the elevating mechanism and the mechanism for pushing the rail into the elevating mechanism;

Fig. 5 is a plan view of a portion of the rail pushing mechanism;

Fig. 6 is an elevation, partly in section, of the same taken on the line 6—6 of Fig. 5;

Fig. 7 is a longitudinal section of a pusher element and its associated guideway taken on the line 7—7 of Fig. 5;

Fig. 8 is a cross section through a portion of the pusher mechanism taken on line 8—8 of Fig. 5;

Fig. 9 is a side view of a portion of the elevator mechanism showing the rail supporting means mounted on an equalizer arrangement;

Fig. 10 is an elevation of the structure shown in Fig. 9 looking in the direction of the arrows at the ends of line 10—10 of Fig. 9 showing the elevator in a lowered position;

Fig. 11 is a similar elevation taken on the line 11—11 of Fig. 9 looking in the direction of the arrows part of the showing being in section;

Fig. 12 is a plan view of the structure shown in Fig. 9;

Fig. 13 is a plan view of a portion of the rail supporting and equalizer mechanism for supporting the rails during the quenching and equalizing treatments;

Fig. 14 is a side view of the same structure as shown in Fig. 13;

Fig. 15 is an end view of the structure shown in Figs. 13 and 14, looked at at right angles to Fig. 14;

Figs. 16, 17 and 18 are detail views of the same structure; and

Figs. 19 and 20 are side and end views of the rail hooks for holding rails in the mechanism shown in Figs. 13, 14 and 15.

The rail is quenched in a suitable quenching medium such as oil or water in the quenching chamber or tank A. It is then equalized in a suitable medium such as molten lead in the equalizer chamber or tank B and then transferred to the annealing furnace C. When the rail comes from the mill it is brought into a substantially horizontal position, head down and with its web in a vertical plane by means of what may be termed an elevator or positioning mechanism D, being pushed into this mechanism D by means of pusher mechanism E. The rail is transferred from mechanism D to carrier mechanism G in which it is supported in a substantially horizontal position head down with the web in a substantially vertical plane and in which it is carried to and immersed in the quenching bath of tank A and then immersed in the molten lead of equalizer B. The rail is then lowered onto furnace charger or conveyer H and conveyed into the annealing furnace C.

Now describing this embodiment of our invention in considerable detail: The elevator mechanism D comprises spaced rail supports 13 disposed in pairs along rocker shaft 17. These supports are provided with fingers 14 between which are grooves 14' adapted to receive the rails. These rail supports 13 are fixed at the ends of beams 15 which latter are pivotally connected to the outer ends of arms 16. These arms are keyed to rocker shaft 17 which is rotatably mounted in brackets 18. Counter weights 19 are secured to rocker shaft 17, these counter weights being mounted on arms 19' which are secured to rocker shaft 17 to rotate therewith, weights 19 being adjustably slidable on arms 19' and being fixed in position by means of set screws 19''. Bushings 20 are keyed at regular intervals on rocker shaft 17. These bushings are of squared cross section and are received in the guideways 21 on rail supports 13. The rocker shaft is adapted to be rocked by motor 22 which is operatively connected by gearing 23 to shaft 24 which, by gear mechanism 25, is operatively connected to rocker shaft 17.

The hot rail 11 is brought adjacent elevator mechanism D where it rests on rolls 12. The rail lies on its side in a substantially horizontal position. The rail is then pushed laterally into the spaces 14' of the rail supports 13 of the elevator mechanism D which latter is then in its depressed or lowered position for receiving the rails.

The lateral movement of the rail into mechanism D is effected by means of pusher mechanism E.

Pusher mechanism E comprises a plurality of spaced pusher elements 26, sliding in guideways 27 and pivotally mounted at the ends of beams 28. These beams are pivoted at their central points to lugs 29 projecting from pusher bodies 30. Pusher members or bodies 30 slide in guideways 31 and are provided with racks 32 which mesh with pinions 33 mounted on stub shaft 34 which is connected by gearing 35 to drive shaft 36, which, in turn, is driven by motor 37 connected thereto by means of gear mechanism 38. Pusher bodies 30 are provided with laterally projecting structure 39 having bearing portions 39' adapted to be engaged by portions of beams 28.

As will be evident, both the pusher and elevator mechanisms are provided with equalizer systems to enable the pushing elements of the pusher mechanism and the rail supports of the elevator mechanism to adapt themselves to the varying curvature of the rail as it alters in shape incidental to its changes in temperature.

Upon starting the motor 37 pusher bodies 30 are moved forward bringing the pusher elements into engagement with the base of rail 11 as it rests on its side on rolls 12. Because of the pivotal connection of beams 28 to the pusher bodies and the pivotal connection between beams 28 and pusher elements 26 these elements conform readily in position to the particular contour of the

rail. As the pusher bodies move forward the rail is moved transversely of its length toward elevator mechanism D at the end of which movement the rail is pushed into space 14' of rail supports 13. The rail having been positioned with its head lying toward the elevator mechanism when it is received in the recesses 14' the head will face the bottom of such recesses and the flanges will engage the sides thereof. Motor 37 is now reversed to withdraw the pusher elements.

Next the motor 22 is started to rock shaft 17 to bring the rail supports into their elevated position as indicated in dotted lines in Fig. 2. In this position it will be evident that the rail lies in a generally horizontal plane, head down and with its web in a substantially vertical plane. In the particular apparatus shown rail supports 13 are provided with two recesses 14' so that this particular apparatus is capable of handling two rails at a time. As with the pusher mechanism an equalizer arrangement provides for the altering curvature of the rail as it cools. Because of the pivotal connection between arms 16 and beams 15 the positions of rail supports 13 relative to each other and to the rocker shaft may vary and thus permit the rail to alter its shape without subjecting it to such stresses as would produce strains in the metal thereof.

The essential function of the elevator mechanism will be readily apparent. It is important that the rail be quenched while substantially horizontal with its head down and with the web in a substantially vertical plane. By means of the elevator mechanism the rail is brought into this position from which it is transferred to the carrier mechanism G which takes it to the quenching chamber A, temperature equalizing chamber B and to conveyer H, means being provided in this carrier mechanism for raising and lowering the rail into and out of the quenching equalizing chambers.

Now proceeding to a description of this carrier mechanism G: The carrier mechanism G comprises a crane F of ordinary construction adapted to travel on rails *f* in the usual way. Suspended from the crane is the beam structure 41 provided with guide members 48 sliding in guide rollers 48' on the crane structure. Beam structure 41 comprises spaced beams 41'. Mounted on this beam structure are pulley brackets 42 carrying pulley 43 over which passes cables 44 connected to winding drums 45 mounted upon the crane. These drums are operated by means of shaft 46 which is geared in a well known way to motor 47 on the crane. Levers 49 are pivoted at their middle points to the beam structure 41 at points 50. At each end of levers 49 is attached a carrier 51 for carrying the rail hooks 52 and 53 to be described later. These carriers are connected to levers 49 by means of links 51', links 51' being pivoted to both levers 49 and carriers 51.

Secured at regular intervals on beam structure 41 are guiding structures 55 for carriers 51. These structures 55 comprise spaced cross pieces 56, secured to beam structure 41, between which cross pieces are secured extended angle members 57 which are provided with guideways 58 to receive guide members 58' at the edges of carriers 51.

Rail hooks 52 and 53 are pivoted at intermediate points of their length to the lower portions of carriers 51. These rail hooks are brought together and separated by manipulating their upper arms 52' and 53' respectively. For this purpose we employ plates 59 provided with rollers 60 adapted to engage the outer faces of arms 52' and 53' and rollers 61 adapted to engage their inner faces. Upon upward movement of plates 59 rollers 60 bring the arms 52' and 53' together thereby separating rail hooks 52 and 53. Upon downward movement of plates 59 rollers 61 separate arms 52' and 53' bringing rail hooks 52 and 53 together. These plates are actuated by means of pistons 64 driven by the fluid actuated cylinder 65 and connected by means of the cross head 66 which is connected at its ends, by means of links 67, to plates 59.

Rail hooks 52 and 53 are provided with lugs 68 adapted to support the rail by its flanges. Rail hook 53 is provided with a finger 69 which extends outwardly a considerably greater distance than lugs 68 and is adapted to engage the base of the rail when the rail is being immersed in a molten fluid, such as lead, which has a greater specific gravity than the steel from which the rail is made, finger 69 serving to positively hold the rail down in the heavier liquid.

The mode of use of appartus G will now be briefly outlined. Two rails having been elevated in apparatus D as shown in dotted lines of Fig. 2 and in full lines in Fig. 3, the rails thus being in a generally horizontal position, heads down and with the webs in vertical planes, crane F is moved to bring apparatus G in proximity to apparatus D. Motor 47 is now operated to lower beam structure 41 with the associated carriers 51 to bring the rail hooks 52 and 53 into proximity with the rails in the rail support of apparatus D. Piston rods 64 are then actuated in a well known way to open up the rail hooks 52 and 53. After the hooks have been properly positioned on the rail flanges, the piston rod is reversed to "close" the hooks. The beam structure is then elevated and the crane brought into proximity with quenching tank A. The beam structure 41 with the associated carriers is then lowered to immerse the rail in oil, water or other suitable quenching medium in the quenching tank, the rail being left here a definite period of time after which the beam structure 41 and its associated carrier is elevated and the crane moved into juxtaposition with the equalizer chamber B after which it is lowered and the rails immersed in molten lead or equivalent highly heated liquid to equalize the temperature of the rail. Beam structure 41 is then elevated and the crane moved into juxtaposition with conveyer H toward which it is lowered, the rail hooks 52 and 53 being operated here in an obvious way to release the rails which are dropped onto the conveyer, which conveys them into the annealing furnace C.

In carrying out the process above described we have had very successful results when employing the quenching and equalizing conditions set forth in Kenney Patent #1,837,189, referred to above. For example, a section of the kind illustrated in that patent, weighing 130 lbs. per yard, is quenched in the water bath for 30 seconds and then equalized in a lead bath having a temperature of 1000° F., the rail being kept in this lead bath for a period of from 4 to 5 minutes. The annealing is carried out in furnace C which may be maintained at a uniform temperature of about 1000° F., where the rail is kept for a period of from about 1 to 1½ hours. It is to be understood that these conditions are merely illustrative so far as this particular application is concerned.

With our process and apparatus for rail handling it is possible to minimize the danger of

deleterious stresses and strains being introduced into rails. By means of our invention distortion of the rail is largely avoided and the rail is allowed the greatest possible degree of freedom during certain stages of the cooling. Furthermore, by means of our invention it is possible to obviate, or at least, largely minimize the introduction of stresses due to straightening of rails.

It will be appreciated how easily a hot rail can be subjected to forces during handling which may introduce undesirable stresses. As is well known, rails change their shapes considerably during cooling, the curvature of the rail in the plane of its web, the so-called rail camber, varying considerably as the rail cools. This liability is due to several conditions. A rail is very heavy; it is long, its length being very great in comparison with its cross sectional dimensions; and its cross section has markedly different dimensions involving radically different rates of cooling. In handling the highly heated rail it is very easy to distort it, particularly when the rail is at its higher temperatures, as for example when the rail is above the critical range. Distortion of the rail may necessitate a straightening of the rail when cold, thereby introducing serious stresses. Furthermore, if the rail in cooling, is not permitted to alter its curvature freely in the plane of the web various stresses which may seriously weaken the rail may be introduced. Particularly is this likely to happen during the rapid alterations of temperature which occurs during the quenching and equalizing stages.

Consider the action of pushing of the rail transversely of its length on rolls **12**, in Fig. 1. The great weight of the rail requires the exercise of forces of considerable magnitude. If the rail were to be moved without proper distribution of the forces along the rail there would be a marked tendency to distort or deform the highly heated rail and to indroduce stresses into the metal. In mechanism E the pushing elements **26** are distributed to engage the rail at regular intervals along its length. Furthermore, because of the provision of means to permit of relative movement between these pusher elements they all continue to exert force on the rail regardless of changes of curvature of the rail due to changes in temperature; the forces required for moving the rail being properly distributed along the rail length regardless of the varying curvature. Consequently the natural curve of the relatively soft metal is not deformed, whatever variation of shape which occurs being uniformly distributed along the rail length and in accordance with the "natural" curvature of the rail.

In the elevator mechanism D and in the carrier mechanism G similar means are provided for overcoming these inherent difficulties in handling rails. The rail supports **13** of apparatus D and the rail hooks **52** and **53** of apparatus G are so disposed as to support the rail at regular intervals along its length to equally distribute its weight and, because of these supports being movable relative to each other, the weight of the rail remains evenly distributed even with the varying contour of the rail as it alters in temperature. Especially important is this feature in the use of mechanism G. During the quenching and equalizing operations in chambers A and B, the shape of the rail varies greatly because of the rapid variations in its temperatures.

During these rapid changes of shape the rail supports move relatively to each other to accommodate themselves thereto. Looking at Fig. 3 it is evident that the rail is held by the rail hooks at four points. In the absence of this capacity for relative movement between the supporting structures it will be at once seen that any change of the curvature of the rail would mean a departure from the four point support to a two point support. Obviously with such a heavy and extended body as a rail, with its relatively small cross section, a two point support, whether furnished by the two intermediate supports, or by the two outer supports, would subject the rail to great stresses due to its weight.

In passing it may be noted that the mechanisms shown are designed to permit relatively free alteration of curvature in the plane of the web. This is so because the important variations in the curvature of the rail is in the vertical plane of the web due to the different rates of cooling of the thicker and thinner parts of the rail.

An important aspect of our invention is the carrying out of both the quench and temperature equalizing operations without altering the support of the rail. After quenching in chamber A the rail is carried without changing its support to chamber B in which it is equalized. By so proceeding there is much less chance of subjecting the rail to damaging stresses than would be the case if the transfer from one chamber to the other, and the operations therein, involved a change from one supporting means to another.

We have discovered that after a rail has been quenched through the critical range and then equalized in a liquid bath it then possesses substantially its ultimate shape. In other words, after the rail has been equalized, following the quenching operation, the rail does not substantially alter its camber or curvature in the remaining annealing and later cooling stages. If the rail is straight following the equalization it will be substantially straight when cooled to atmospheric temperature; if it has a particular camber or curvature following the equalization it will retain substantially that same camber when finally cooled. This fact has a significant bearing on our invention. Following the equalization step there is no necessity for a special support for the rail, such as is given to the rail prior to and during equalization, either in the annealing furnace or in the subsequent cooling, as the equalized rail has already attained substantially its finished shape. This is economically of considerable importance. The quenching and temperature equalizing operations require a relatively short period of time and therefore the capacity of the special supporting equipment is relatively great. The annealing and subsequent cooling stages of the treatment, however, involve considerable periods of time. Obviously it is very advantageous to be able to carry out these later operations in furnaces and other equipment which do not require special supporting means.

This discovery that the rail remains substantially unaltered in curvature or straightness following the equalization has a further important bearing upon our invention. As is evident from the preceding disclosure a primary purpose of our invention is to avoid excessive stresses being introduced into the rail whether as a result of the cooling or of the manipulation. In the ordinary manufacture of rails and in the manufacture of heat treated rails, frequently straightening of the finished, more or less completely, cooled rail has been necessary. During such straightening there is considerable danger of introducing

stresses into the rail metal which may more or less seriously weaken it. To avoid straightening of the finished, cold rail, or to reduce the amount of such straightening to a minimum, we so conduct our operation as to obtain a rail which is substantially straight when it comes out of the equalizing chamber. This we do by giving the rail when it leaves the mill just the amount of camber to produce substantial straightness of rail after it leaves the equalizing bath. Obviously the necessary camber will vary with rails of different sections, weights and compositions. In treating a particular batch of rails a certain number of them are given the degree of camber that is considered likely to give approximate straightness for the finished rails. These rails are quenched and then equalized. Following the equalization the degree of straightness or curvature is observed and the information thus furnished is utilized in the cambering of the remaining rails of the batch to correct possible departures of the rail from a condition of straightness. For example, the first rails treated may indicate that the camber was too little in which case the camber of the subsequent rails would be increased; if the information furnished showed that the camber had been too great the amount of cambering would be lessened.

It will be readily apparent that this practice has very substantial advantages. It enables the rail treater to obtain very readily a rail which requires very little if any straightening when cold. Furthermore a point of considerable importance is that the information as to the finished rail is very quickly obtained. The time required for quenching and equalizing is relatively short and the operator very quickly learns whether or not the camber should be modified and how much. Obviously the situation would be entirely different if it were necessary for one to wait until after the rails had been annealed and cooled. In such case a very substantial proportion of the entire heat would have been treated before the necessary information was available as to how to alter the camber to get straightness of rails.

There is another very substantial advantage in so proceeding as to obtain a substantially straight rail after equalizing. Straight rails are very much more easily handled than curved rails. For example, considerable difficulty would be involved in charging furnace C with rails which were substantially curved. Furthermore, curved rails would take up more space in the annealing furnace. This would be true particularly if the rails were of unequal degrees of curvature.

It is to be understood that in setting forth more or less specific embodiments of our invention we do not thereby intend to limit the protection sought in the broader phases of our invention.

For example, while we have disclosed our invention as being particularly adapted to processes involving heat treatment, we do not wish thereby to limit our protection on the broader phases of rail handling to operations which involve such heat treatment. We have shown methods and means for preventing stresses being introduced into the rail during alterations in temperature. These methods and means are of utility even where heat treatment is not involved, although not to the same degree. Means of the character exemplified in mechanisms D, E and G, can be used for handling rails and for supporting rails while cooling, to prevent stresses being introduced even in the handling of the ordinary rail, that is a rail equalized and annealed.

While the step of equalization is a very important one as regards several phases of our invention, it is to be understood that in certain of its broader aspects our invention is not to be limited to the use of the equalizing step and apparatus therefor. For example, as disclosed in Kenney Reissue Patent #17,240 it is possible to treat rails by quenching and then equalizing and annealing in the furnace. That process, as is obvious, omits the equalization in the liquid bath. As is evident, certain of the process steps and apparatus features above disclosed may be employed in carrying out such a process as that in the reissue patent mentioned.

Furthermore, even in the methods involving heat treatment, there may be considerable variations from the specific and illustrative embodiment which we have set forth. As an example, the annealing or drawing operation, following the equalizing treatment, may be effected in the equalizing bath, instead of in an annealing furnace, such as C in the method previously described. We do not believe that it is as practical to effect the complete anneal in the equalizing chamber as to employ the annealing furnace, but we merely mention this as indicative of a type of variation which may take place without in any way modifying the protection which we seek for the invention in its broader aspects.

Having thus described our invention what we claim as new and desire to secure by Letters Patent is:

1. In a process for treating rails, the steps of placing a hot rail in a position at a substantial angle to the vertical and yieldingly supporting the weight of the rail at a plurality of points spaced along the length of the rail to permit substantially free alteration of shape of the rail in the plane of the web, and cooling the rail while thus supported.

2. In a process for rail treatment, the steps of placing a hot rail in a position at a substantial angle to the vertical and yieldingly supporting the weight of the rail at a plurality of points spaced along the length of the rail to permit substantially free alteration of the shape of the rail in the plane of the web, and rapidly cooling the rail through the critical range while thus supported.

3. In a process for rail treatment, the steps of placing a hot rail in a position at a substantial angle to the vertical and yieldingly supporting the weight of the rail at a plurality of points spaced along the length of the rail to permit substantially free alteration of shape of the rail in the plane of the web, cooling the rail rapidly through the critical range while thus supported, and equalizing the rail while still hot and while still thus supported in a hot liquid bath.

4. In a process for rail treatment, the steps of placing a hot rail in a substantially horizontal inverted position, and yieldingly supporting the weight of the rail at a plurality of points spaced along the length of the rail, and then without substantially altering such supports immersing the rail in a quenching medium and then immersing it in a hot liquid bath.

5. In a process for the treatment of rails, the steps of moving a highly heated rail while lying on its side transversely of its length into a desired location by applying force at spaced intervals and while allowing substantial freedom of the rail to change its shape in the plane of its web, turning the rail into an inverted position with the web in substantially a vertical plane, yieldingly supporting the rail at a plurality of spaced points to permit substantial freedom of the rail to

change its shape in the plane of its web, and while thus supported rapidly cooling the rail and then equalizing the temperature thereof at an elevated temperature but below the critical range.

6. In a rail treatment apparatus, a quenching chamber, an equalizing chamber, spaced supporting members adapted to engage the rail at a plurality of points spaced along the length of the rail, a carrier for the supporting members which is movable from juxtaposition with one chamber to juxtaposition with another chamber, and means to lower and raise the supporting members into and out of said chambers, each of said supporting members being movable relative to the carrier and to each other during changes in shape of the rail to permit relatively free alteration of shape of the rail during change of temperature thereof.

7. In a rail treatment apparatus, a quenching chamber, an equalizing chamber, spaced supporting members adapted to engage the rail at a plurality of points spaced along the length of the rail to support the rail in a generally horizontal position with head down and with the web in a substantially vertical plane, a carrier for the supporting members which is movable from juxtaposition with one chamber to juxtaposition with another chamber, and means to lower and raise the supporting members into and out of said chambers, each of said supporting members being movable relative to the carrier and to each other during changes in shape of the rail to permit relatively free alteration of shape of the rail during change of temperature thereof.

8. In a rail handling mechanism, a rocker shaft, a plurality of rail supports disposed at intervals along the rocker shaft, means for connecting the rail supports in pairs, said connecting means being connected to the rocker shaft to turn therewith during a rocker movement of said shaft and pivotally connected to the rocker shaft to pivot in the longitudinal plane thereof, and means for rocking the rocker shaft.

9. In a rail handling mechanism, a rocker shaft, a plurality of relatively movable rail supports disposed at intervals along the rocker shaft, means connecting the rail supports and rocker shaft for effecting relative adjustive movements of the rail supports as the rail changes in shape, and means for rocking the rocker shaft.

10. In a rail handling mechanism, a plurality of spaced pusher members, an extended member pivoted at an intermediate point to each of said pusher members, rail engaging pusher elements pivotally connected to each of said extended members at points spaced to each side of the point of attachment of the pusher member, and means for moving the pusher bodies to move the rail in a direction transverse of its length.

11. In a process for the treatment of rails, the steps of moving a highly heated rail while lying on its side transversely of its length into a desired location by applying force at spaced intervals and while allowing substantial freedom of the rail to change its shape in the plane of its web, turning the rail into an inverted position with the web in substantially a vertical plane, and yieldingly supporting the rail at a plurality of spaced points to permit substantial freedom of the rail to change its shape in the plane of its web, and while thus supported cooling the rail.

12. In a rail treatment apparatus, a quenching chamber, spaced supporting members adapted to engage the rail at a plurality of points spaced along the length of the rail to support the rail in a generally horizontal position with head down and with the web in a substantially vertical plane, a carrier for the supporting members which is movable into juxtaposition with said chamber, and means to lower and raise the supporting members into and out of said chamber, each of said supporting members being movable relative to the carrier and to each other during changes in shape of the rail to permit relatively free alteration of shape of the rail during change of temperature thereof.

13. In a rail handling mechanism, a plurality of relatively movable pusher elements adapted to engage the rail at a plurality of points spaced along the length of the rail, means for maintaining the pressures equal on said pusher elements during change in shape of the rail, a plurality of relatively movable rail supports positioned to receive the rail from the pusher elements adapted to support the rail at a plurality of points spaced along the length of the rail, means for maintaining the weight of the rail equal on said rail supports, means for raising the rail supports to elevate the rail, a crane, a plurality of relatively movable rail holders borne by said crane, and means for maintaining the weight of the rail equal on said rail holders during change in shape of the rail.

14. In a rail handling apparatus, a plurality of pusher structures adapted to engage a rail at a plurality of points spaced along the length of the rail, driving mechanism adapted to move said pusher structures to push the rail transversely of its length, and means connecting said pusher structures for effecting adjustive, relative movements of the pusher structures as the rail changes in shape.

15. In a rail handling apparatus, a plurality of relatively movable rail engaging members adapted to engage a rail at a plurality of points spaced along the length of a rail, a structure for supporting said rail engaging members, and means connecting said rail engaging members for effecting adjustive, relative movement of the rail engaging members as the rail changes in shape.

16. In a rail handling apparatus, a plurality of relatively movable rail engaging members adapted to engage a rail at a plurality of points spaced along the length of the rail, a structure for carrying said rail engaging members, and means connecting said rail engaging members for transmitting motion from one rail engaging member to another as the rail changes in shape.

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