ABSTRACT

A continuous "furnace in-line" method of quenching steel articles wherein they are carried through a confined body of quenching fluid, such as water, and restrained during the movement therethrough to prevent warping, distortion and bending. Individual segments or portions of the metal articles are successively subjected to the quenching medium and it is possible, through the use of a quench fixture having a powered-roller bed, with an inlet having flapper-like elements normally closed to confine the quenching fluid, to introduce successive portions of the metal article into the quenching fluid in the completely submerged state. Fluid supply pipes running longitudinally of the axis of the quench fixture, positioned above and below the metal article being carried therethrough, provide means whereby the body of quenching fluid is maintained in an agitated state. Pressure differentials of the quenching medium emanating from the upper and lower conduits also provide means of controlling quench characteristics of the metal articles being treated.

11 Claims, 9 Drawing Figures
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1 QUENCHING METHOD AND APPARATUS

This application is a divisional application of Ser. No. 879,272, filed Nov. 24, 1969 for QUENCHING METHOD AND APPARATUS and now abandoned.

BACKGROUND OF THE INVENTION

This invention generally pertains to a method of treating metals and specifically relates to the fixture quenching of metal articles such as carbon steels and various alloys. With the advent of modern day technology giving rise to the need of special materials, especially metals of certain desirable characteristics, such as hardness, high tensile and yield strengths; and ductility, new techniques and apparatus have had to be developed to meet these needs. One of the well-known metal treatments comprises the heating of a metal article or the like to a certain temperature and then subjecting the thusly heated metal article to a quench treatment which imparts certain desirable characteristics to the article. Generally, the metal articles are heated and then hardened by subjecting them to uniform quenching. However, during this process the article oftentimes becomes distorted, bends and assumes a warped-like configuration which requires additional process steps such as straightening and the like. In other instances, cracking or other undesirable effects will result depending upon the severity of the treating process to which the metal article is subjected.

Most of the difficulties that arise with respect to the heating and subsequent quenching of metals and formed metal articles arise from the fact that many times the economics of the process dictate that the process be a continuous one, by which is meant that metal articles are carried through a quenching process as an “in-line” process step from the heating means or furnace through the quench fixture. More importantly, it is necessary that selected characteristics sought in the final, treated article will be readily obtained using the quenching process. By “in-line” is meant that the heated article is carried desirably, but not necessarily, by a planar conveyor, directly from the heating means into the quenching means without an undue hiatus caused by handling or otherwise.

The prior art in the past has suggested the complete submersion or immersion of a heated metal article in a quenching vat or tank containing water, oil, or other quenching media. This usually necessitates heating the article and then physically attaching some means to it whereby the article can be readily dipped into the quenching tank. In this process, however, there are formed relatively untreated areas of the article due to the formation of steam (where the quenching medium is water) or other gases which act as insulative barriers or layers thereby producing uneven quenching of the metallic article. The prior art, to some extent, has sought to alleviate this problem by agitating the quenching fluid so that the induced turbulence breaks up the blankets or layers of steam and the like to allow the quenching medium to contact all areas of the metallic article. Recognizing the fact that the aforementioned total submersion, batch metal-treating or quenching process has certain intrinsic limitations, the art has suggested the use of quench systems using various spray systems, while the metallic article is carried through a quench fixture and restrained in one fashion or another during the quenching process. Examples of such systems may be found in U. S. Patents to Safford et al., No. 3,420,083 and No. 3,423,254. Such systems and apparatus as disclosed in these patents have neither provided as efficient a system nor produced treated metallic articles of selected characteristics as might otherwise be desired. The herein disclosed system and apparatus overcomes many of the prior art shortcomings and provides a means whereby an in-line quenching system and apparatus may be used in a continuous manner to produce metallic articles of selected characteristics, while eliminating or keeping distortion, warping and other undesirable features to a minimum.

SUMMARY OF THE INVENTION

In an exemplary embodiment, the invention pertains to a method of treating metals wherein the temperature of the metal or metal article is first brought to a selected value. The thusly heated metal article is then introduced into a relatively confined and agitated body of quenching fluid so as to submerge or immerse successive integral segments of the article in a continuous manner such that a plurality of contiguous, relatively treated and untreated segments of the article are formed at the point of introduction of the metal article into the body of quenching fluid. During this period the metal article is confined on at least one side to inhibit warping, bending and other undesirable and uncontrolled movement. All of this is carried on while the body of quench fluid is agitated on each side of the metal article at least at the point of introduction of the metal article into the body of quenching fluid. A treated article, which has both selected surface and core characteristics and other desirable attributes is thusly obtainable which heretofore has not been possible. In another exemplary form, the invention pertains to an apparatus for the continuous fixture quenching of metals and metal articles which may be used in-line with a heating means or furnace. Generally the apparatus comprises a conveying means to convey the heated metal articles into and through a treating zone with means to confine a body of quenching fluid therein to thereby form an open-ended treating zone into which the articles are introduced in successive segments and in submerged or immersed fashion. Inlet means enclose one end of the treating zone and allow entry of the heated metal articles thereinto. At the other or outlet end, vertically adjustable outlet means enclose the treating zone and maintain a selected volume of quenching fluid therein. Conduit means are placed on either side of the conveying means and are used for introducing fluid streams of various, selected pressures into the treating zone while means are furnished to supply quenching fluid to the treating zone to complete the essential components of the apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic illustration of exemplary apparatus in accordance with this invention for carrying out the metal treating process;

FIG. 2 is a perspective view of a portion of the apparatus depicted in FIG. 1, specifically showing the treating zone;

FIG. 3 is a fragmentary view of a portion of the apparatus shown in FIG. 1, illustrating more detail;

FIG. 4 is a view taken along a line 4-4 of FIG. 3;

FIG. 5 is a fragmented, perspective view of the inlet of the apparatus depicted in FIGS. 1 and 2;
FIG. 6 is a cross-sectional, fragmented view showing how metal articles to be treated in accordance with the invention are carried through the apparatus; FIG. 7 is a partial plan view of the apparatus depicted in FIG. 1; FIG. 8 is a schematic illustration of the inlet of the treatment zone of the apparatus shown in FIG. 1; and FIG. 9 schematically illustrates an arrangement of the drive system for the apparatus depicted in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings wherein like numerals of reference designate like elements throughout and specifically referring to FIG. 1, the quench fixture or apparatus 2 of this invention is schematically illustrated. The fixture 2, as can be seen, is directly in line with a heating means, such as 4, which may be any of the prior art, conventional furnaces whether it be electrically or gas fuel operated, and employs a conveying means 6 onto which metallic articles are positioned when they are removed from furnace 4 so that they may be carried through the treating zone, generally designated 8, in apparatus 2. Treating zone 8 is formed by open, box-like member or container 10 having side wall panels and a bottom or floor panel with an inlet member at one end, as will be hereinafter described, and an adjustable outlet member at the opposite end so as to confine a body of quenching fluid at preselected levels within the treating zone in a manner which will hereinafter become apparent. Box-like member 10 is supported by means of support members, such as 12, over a reservoir member, such as 14, which is nothing more than a circumscribing and encompassing tank within which quenching fluid may be retained. Suction pumps such as 16 feed the quenching fluid from reservoir member 14 into header 18 and thence through valved manifolds 20 and 22, which in turn feed a plurality of spaced and apertured pipes or conduits positioned above and below the path of travel of the metallic articles being carried by conveyor 6. It will be noted that the drive for conveyor 6, as the metallic articles are being carried through treating zone 8, is obtained by means of motors and train gear system 24 and more directly by means of sprockets and drive chain 26. Conveyor 6 receives the heated metal articles from furnace 4 and carries them, in the direction of the arrows, through fixture 2 to deliver them to the opposite end thereof and to deposit the articles on an off-bearing conveyor 28 from which the thusly treated articles may be taken and stacked on pallets, not shown, and the like for subsequent processing.

Box-like member 10, used to confine the body of quenching fluid to thereby form treating zone 8, is fabricated of steel panels, or the like, having side walls 30 and 32 with the floor or bottom panel 34 being welded or otherwise secured to side panels 30 and 32 to form a substantially fluid-tight engagement along the abutting surfaces thereof. Disposed on the exterior surface of side panels 30 and 32 are spaced support and reinforcing I-beam members 36 also welded or otherwise secured to the side wall members. The length of supports 36 are such as to desirably support the power rollers within treating zone 8 at the approximate level of the furnace conveyor, not shown. Suitable cross members and other such structural supports are also provided but are presently omitted for purposes of clarity, it being understood that suitable reinforcement compatible with the volumes of quenching fluids being conveyed and the weights of the metal articles being treated are provided or added as will be necessary. Conveyor 6 is preferably of the split type and is independently controlled from that portion which conveys the work pieces through treating zone 8. Thus, this allows for a variance in the speed at which work pieces are conveyed through the inlet of the treating fixture 10 and also permits the work piece to be carried through the fixture at a different rate of speed than the speed it is carried to or from treating zone 8. In the exemplary embodiment shown, the conveying means 38, which carries the work pieces from the initial conveying member 6 through the treating zone 8, comprises a plurality of spaced, lower rolls, such as 40, suitably journaled in side wall panels 30 and 32 and having sprockets such as 42 adapted to be engaged by driving chain 44 suitably connected to a prime mover through suitable gears. At the inlet 46 of treating zone 8, a pair of upper rollers, such as 48, are suitably supported and journaled in rotative relationship in the framing of fixture 2 and have outwardly extending sprockets, such as 50, engageable with drive chain 44. This provides for positive drive of the work pieces into and through inlet 46. The work pieces 52 are here shown as lengths of plate having a somewhat arcuate configuration in cross-section. Inlet 46 of member 10 is provided with an inlet means 54 suitably secured to interior, extending channel members 56 and 58 welded or otherwise secured to the inside surfaces of side panels 30 and 32 which channels 56 and 58 also provide means of support for upper rolls such as 60 throughout the length of the treating zone 8 and the confines of the fixture 10. It will be noted that the upper rolls 60 are interposed between the lower power-driven rolls 40 and are so-called idler rolls being suitably journaled and supported in pillow block bearings in a vertically adjustable manner as hereinafter described. Suffice to say at present that the adjustability of the upper rolls 60 provide means of confining and restraining articles as 52 as they are carried through the fixture 2 and also allows for the handling of work pieces of various configurations. Upper rolls 60 are not powered and exert restraining forces on the work pieces being carried through treating zone 8 and insure that the work pieces remain in engagement with the lower, power-driven rolls 40 during the important initial part of the treating process. At the present time, it is theorized that this initial part of the process is primarily responsible for almost the total treatment results obtained in the overall process. In other words, most, if not all, of the quenching probably takes place almost at the time of total immersion or submersion of that portion of the metal article being introduced through the inlet and into the treating zone. Hence, for the present, the extreme turbulence of the treating medium is desirably induced at least within the initial portion of the treating zone and to insure proper completion of the treatment, agitation of the fluid is desirably had throughout the quench treating zone.

Inlet means 54 acts much like a flapper valve assembly, coacting with the outlet means to confine the body of quenching fluid within the treating zone 8 and only opens to permit entry of metal articles when they are present and then operate into the open position exerting a force against the fluid pressure of the quench-
ing fluid confined within treating zone 8, which fluid pressure normally tends to close the individual elements of inlet member 54, construction details of which will be later described. Disposed above the path of travel, through treating zone 8, are a plurality of spaced and apertured conduits or pipes such as 62 supported in longitudinal relationship with respect to the axis of fixture 2 in either stationary or adjustable fashion with respect to bottom rollers 40 and each conduit being provided with a pressure gauge 63 and valve 64 for regulating the flow of quenching fluid being pumped thereinto, supply of which is made available from individual headers or from a common header such as 18 having a manifold arrangement to permit pumps or the pump 16 to take suction from the reservoir fluid confined within the reservoir tank or member 14. While a single pump 16 is shown, it is contemplated and in some instances preferred, that each set of upper and lower conduits or pipes have its own fluid pump. A lower set of spaced and apertured pipes 66 are provided and these are secured in rigid relationship and extend the length of the treating zone 8 and may be secured to suitable support structure affixed to the bottom or floor panel 34 of fixture 10. The number of pipes 66 running in the same longitudinal direction as the pipes 62 are equivalent in number to the pipes 62 and likewise each conduit is provided with pressure gauge such as 68 and control the valve members such as 70. Again, as is the case with the upper set of conduits, the lower set of pipes or conduits may be fed from a single pump and connected to a common header in a manifold type of arrangement, but for better control of the fluid being introduced into the treating zone a separate pump from that feeding the upper pipes 62 is preferred. The reason for desiring control of each of the pipes 62 and 66 will become apparent when considering the fact that each of the conduits are provided with a plurality of spaced apertures or orifices. The orifices 72 provided in the upper pipes or conduits 62 are disposed along the bottom surface thereof to thereby emit jets or streams of fluid in a downward direction toward the conveyor rolls 40. In contra-fashion pipes or conduits 66 are provided with orifices 74 in the upper surface thereof to permit the emission of streams or jets of fluid toward the lower surface of the articles, for instance 52, being carried through treating zone 8. By independently controlling fluid flow through each of the pipes of conduits 62 and 66, either in unison or individually, pressure differentials of quenching fluid being emitted between the top set of pipes and the bottom set of pipes may be effected in order to impart specific desirable characteristics to the metallic articles being treated in fixture 2. Thus, in some instances, a pressure differential of from 5–60 psig and more may be desirable especially where undue warping or bending of the metal articles is encountered and the maintenance of the pressure differential will substantially inhibit or prevent this warping action. The end opposite the inlet 46, outlet 76, is formed by what can be considered a dam member such as 78 which is secured within the side panels 30 and 32 in vertically adjustable fashion so that the volume of quenching fluid retained within treating zone 8 may be selectively varied depending on the work pieces being treated. In other words, the adjustable outlet member 78 forms a weir-like arrangement and may, if desired, be positioned just above the level of lower conveyor rolls 40 to allow passage of the metal article therethrough so as to confine a substantial volume of the quenching fluid within treating zone 8. The lowermost edge of the adjustable member 78 may be configured the same as the cross-section of the metal article where same are being treated in a continual day-after-day manner so as to prevent undue spillage, leakage or flow of the quenching fluid between this lowermost edge of adjustable member 78 and the upper surface of the metal article being carried through fixture 2.

The inlet member 54 serves the important function of preventing the backflow of quenching fluid from treating zone 8 towards the in-feeding conveyor 6 and hence the hearth portion of the furnace member 4. The contacting of the high temperatured furnace with fluid of substantially lower temperature could produce disastrous results. Additionally, it, in cooperation with adjustable weir member 78, is responsible for maintaining a body of quenching fluid within the treating zone so that the metal articles may be immersed or submerged while passing through the treating zone. The metal articles being carried through treating zone 8 are carried through and introduced into the confined body of fluid in what may be considered successive, segment fashion such that a plurality of treated and relatively untreated portions of the article are created. This is meant that as the article enters the treating zone, there is a portion which is immediately subjected to the quenching fluid and to the turbulent action created by the jet and streams of quenching fluid emanating from the lower and upper series of pipes or conduits, while the contiguous segment of the article not yet introduced is relatively unscathed or untouched by the forces acting on the remainder of the article within the treating zone. This will be clearly seen by referring to FIG. 5 wherein it is clear that inlet member 54 is formed by a spanning plate 80 secured to side channels 56 and 58 allowing, by means of passageways 82, for the passage therethrough of upper conduits or pipes 62. The engagement of the pipe 62 with the interior surface of the passageways 82 should preferably be substantially fluid-tight since the body of quenching is generally maintained above this level during the quenching or metal treating operation. Secured to the bottom edge 84 of plate 80 are a plurality of flapper valve or valve members such as 86 and 88. The clearly depicted member 88 is of L-shaped configuration and is pivotally connected (as are the other elements such as 88) as by means of pin and hinge-plate arrangement 89 conventionally known, such that an inlet or opening into the treating zone, only as large as is necessary to allow introduction of the metal article to be treated, is formed. The reason for the L-shaped flapper members is because, in this particular instance, the lower feed rolls 40 are provided with disc-shaped, spacer members such as 90 which are provided to keep the metal articles 52 in proper alignment and out of contact with one another during the treating process. It will be noted that these members are adjustable to accommodate various widths of metal articles and may be removed entirely where wide metal articles are to be treated. The flapper element 86 positioned adjacent to member 88 may be of straight configuration not employing the L shape or may also, as is illustrated here, be of the same configuration as the element 88. Depending on the size and shape of the work pieces, the plurality of flapper elements indicated may be replaced by a single, pivotally hinged member where
desired, it only being important that an opening large enough to accommodate the incoming metal article be provided. So as to prevent the leakage of quenching fluid from the hinge-plate arrangement 89, a covering of rubber sheet such as 92 or the like may be provided. It is quite apparent the manner in which the upper rolls 60 cooperate with the lower intermediate rollers 40 to restrain and confine the metal articles 52, while being carried through the treating zone 8. The orifices 74 in the lower pipes 66 are also visible. It should be noted that the lower cross piece 92 secured to the bottom panel 34 cooperates with the upper panel 80 of inlet number 54 to provide the inlet opening of accommodating size for the metal articles 52. Likewise, the passageways 94 provided in the plate 92 meet the same limitations as those described for the passageways 82 allowing for the passage of the pipes 62. It is now apparent that because of the hinged structure, best seen in FIG. 8, that the fluid pressure of the quenching fluid confined within the treating zone 8 will keep the flapper elements of the inlet opening 54 in a closed position to thereby inhibit and prohibit the flow of fluid through towards the inlet conveyor and possibly the open hearth of the furnace which if allowed to reach the furnace could have dire consequences. As the approaching metal article enters the inlet area the fore portion abuts the individual flapper elements, opens them and acts against this fluid pressure which normally tends to keep the flapper elements closed. This action then permits entrance of the metal article into the treating zone and after passage past the inlet, the fluid pressure and gravity tends to close the flapper elements. It is apparent that the article segment within the zone is subjected to an agitated body of quenching fluid while the contiguous or adjacent segment of the same article not yet past the inlet opening is not subjected to the same forces.

FIG. 6 illustrates the manner in which upper rolls 60 are mounted in vertically adjustable relationship with respect to lower power-driven rolls 40. Channels 56 and 58, welded or otherwise secured to the walls and side panels 30 and 32 of the fixture 10 as indicated, are provided with spaced holes to receive through bolts such as 100 from which are hung pillow-block bearing assemblies 102 in which the shafts 104 of the upper rolls 60 are mounted. Because of the process involved, rolls 40 and 60 are preferably of high strength corrosion resistant metal. However, other materials may be used. Assemble 102 is spring biased by means of springs 106 acting against the bottom surface 108 of, for instance channel 58. The adjustment of the upper rolls 60 is obtained by loosening or tightening the nuts 110, secured to the opposite end of through bolts 100. Where desired, the cross members supporting the upper conduits 62 may also be adjustable but herein a spanning support member 112 is rigidly secured by means of welding or otherwise to the side channels 56 and 58 from which the conduits 62 are hung as by means of the conventionally found U-hangers 114. The lower pipes or conduits 66 are also rigidly secured to a cross span member such as 116 spanning the lower portion of the fixture 10 by means of U clamps 114. Where desired, however, the lower conduits may be made vertically adjustable to obtain varying degrees of pressure differentials of the fluid streams acting within the body of quenching fluid and hence upon the lower exposed surfaces of the metal articles being treated in the treating zone 8. The orifices 72 and 74 in upper and lower conduits 62 and 66 respectively may be randomly spaced. An askew alignment with respect to the pipe axis has been found to produce a high degree of agitation.

In practicing the invention, the valving of the individual upper and lower pipes is adjusted so as to permit fluid streams of selected flows and pressures to be emitted from the orifices therein. The quenching fluid for this purpose is made available in the reservoir surrounding the quenching fixture proper from which single or tandem pumps take suction. The speeds of the various conveyors are regulated depending upon the cross-section and overall configuration of the metal articles to be treated and also the type of quenching fluid being used. Generally speaking, in the type of fixture illustrated and for purposes of illustration, water will be the quenching fluid but other quenching fluids, particularly the non-inflammable types are also contemplated. Before the metal articles are introduced into the treating zone the various valving and the outlet member are arranged to provide a confined body of quenching fluid at least within the treating zone 8 to a selected level so as to permit at least complete submerging or immersing of the successive, integral metal article segments as the treatment progresses. The vertical position of the outlet member will generally dictate the level of quenching fluid maintained in treating zone 8. As the quenching fluid is taken from the reservoir tank, it is emitted through the orifices in the upper and lower pipes and is confined within the treating zone 8 until such time as the fluid level is such that the adjustable outlet member permits fluid to cascade thereover and thence back into the reservoir for recirculation. When this condition has been reached the quenching apparatus is then ready for use. As the heated metal articles are brought from the hearth of the furnace they are put in aligned relationship on the incoming conveyor and thence are conveyed in aligned relationship towards the inlet of the quench fixture. Upon reaching the inlet the fore or end portions of the article cause the inlet elements to open to allow entry of the metal articles into the treating zone. The orifices in the upper and lower pipes through which the jets or streams of quenching fluid are emitted are at least provided in the initial portion of the treating zone to create sufficient agitation of the quenching fluid to prevent steam buildup or other type of undesirable conditions which could prevent the contacting of the exposed surfaces of the metallic articles being treated with the quenching fluid. Preferably, so as to keep the fluid from passing through the inlet opening and toward the furnace, the initial orifices of the pipes are positioned at an angle with respect to the vertical inlet member to divert the stream of fluid into the body of quench fluid. During this time, the entire body of quenching fluid within the treating zone is maintained in a somewhat agitated and turbulent condition. The continuous introduction of the quenching fluid into the zone and the continual cascading or running over of the quenching fluid at the outlet end of the fixture provides a means whereby the quenching fluid runs back into the reservoir and is recirculated in the process just described. Because of the construction of the inlet member, a minimum of quenching fluid is allowed to flow back towards the open hearth of the heating furnace. Any fluid that escapes through this opening is minimal and does not create a dangerous condition. Makeup
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1. Quenching apparatus for quenching metal articles, comprising a substantially horizontally disposed container with a body of quenching fluid therein, said container having opposite side walls, opposite end walls and a bottom confining said body of quenching fluid and defining a treating zone, one of said end walls having an inlet opening therein for introduction of an article therethrough and into the container, the other of said end walls having an outlet opening therein through which said article is removed from said container, means for maintaining a predetermined level of quench fluid in the container, a plurality of longitudinally spaced, laterally extending, upper and lower articles engaging rollers in said container below the level of quench fluid therein for engaging an article on the top and bottom thereof, respectively, and supporting and continuously moving the article through the container and quench fluid to thus continuously submerge successive segments of said article in the quench fluid, a plurality of separate, laterally spaced, longitudinally extending, upper and lower quenching fluid spray means in said container above and below the article, respectively, for spraying quench fluid against upper and lower surfaces of said article along the length of the article to agitate the quench fluid in the container and thus insure proper quenching of the article, said article thus having a plurality of contiguous, relatively treated and untreated segments at the point of introduction of the article into the container, and valve means on said one end wall of the container at the inlet opening there-through to substantially preclude loss of quench fluid through the inlet opening and yet enable movement of the article through the inlet opening.

2. The apparatus in accordance with claim 1, wherein the other of said end walls comprises a vertically adjustable weir to maintain a predetermined level of quench fluid in said treating zone.

3. The apparatus in accordance with claim 8, wherein means is connected with said conduit means to obtain pressure differentials of the quenching fluid emanating from the upper and lower conduits to control quench characteristics of the article being treated.

4. The apparatus in accordance with claim 8, wherein said conduit means are apertured on the side thereof adjacent the article being treated for spraying quench fluid on the article, said apertures inclined with their outlets toward the direction of travel of said article so that quench fluid is sprayed angularly onto the article in the direction of travel of the article.

5. The apparatus in accordance with claim 1, wherein said rollers include a plurality of lower, powered rollers at the approximate level of the height of a heating furnace, each having a plurality of spaced means for keeping a plurality of separate, longitudinally extending articles to be treated in separated, aligned fashion.

6. The apparatus in accordance with claim 1, wherein said valve means comprises a plurality of flapper-like elements pivotally supported on support members spanning said treating zone and secured to said side walls, said flapper-like elements positioned in said inlet opening.

7. The apparatus in accordance with claim 6 wherein fluid pressure of said quenching fluid in said treating zone maintains said inlet valve means in the closed position thereby inhibiting the loss of fluid therefrom, and the introduction of metal articles to be treated opens at

The following example of a suitable quenching apparatus for treating metallic articles of irregular cross-section will now be described. This special steel section was approximately 6 inches wide and 84 inches long having a thickness of about five-eighths inch. The entire section weighed 76 pounds. The metallic article was removed from a heat treating furnace at a temperature of approximately 1,600° F. and was carried into a treating zone of quenching fluid comprising water which was maintained at a temperature within the range of about 70°-100° F. The treating zone formed by the quenching fixture contained 90 cubic feet of water which was maintained in the agitated and turbulent state by pumping 3,000 G.P.M. at 44 PSI through upper and lower set of pipes or conduits each set having five conduits of about 3 inch diameter with spaced apertures some at an angle and others not so angled with respect to the roller bed. The adjustable outlet member was positioned to maintain the height of the quenching fluid within the treating zone to a depth of about 12 inches over the bottom rolls making up the powered conveyor. The heated metal articles were introduced into the body of quenching fluid at a surface speed of about 60 feet per minute for a total distance of about 90 inches. Thereafter the treated articles were conveyed into the body of quenching fluid at a surface speed of about 12 feet per minute for a total distance of approximately 72 inches at which point it had entirely passed through the treating zone and the outlet member of the quenching fixture. The total volume of quenching fluid maintained in the reservoir was approximately 890 cubic feet with the temperature being controlled by a regulated flow of replacement or makeup water. The total depth of the water in the quench fixture was approximately 22 inches and the vertical distance between the upper and lower pipes or conduits was about 9 inches, while the longitudinal length of the pipes in the quench chamber was approximately 13 feet. It was found that such a described quench fixture and method used therewith produced metallic articles of highly desirable characteristics with a minimum of bending and warping such that further straightening operations were not needed.

It should be obvious that the relative size of the components of the quenching apparatus herein described will be dictated by the size and shape of the metallic articles to be treated. The foregoing example is by way of description only and it will be obvious to those of skill in this art that each of the elements making up the apparatus may be varied to meet the various limitations encountered in the myriad of possibilities encountered in the metal treating art. For example, the treating zone need not be positioned over a fluid reservoir since such an arrangement merely makes it possible to reuse quenching fluid in an efficient manner. Other such modifications not departing from the spirit of the disclosed invention will make themselves known to those of ordinary skill and all are intended to be covered by the appended claims.

The embodiments in which an exclusive property or privilege is claimed are defined as follows:
least a portion thereof to allow passage of articles thereinto.

8. The apparatus in accordance with claim 5, wherein said separate spray means each comprises a conduit means supported above and below the conveying path of said articles and extending longitudinally of said treating zone.

9. The apparatus in accordance with claim 8, wherein said conduit means comprises a plurality of laterally spaced pipes, at least the upper plurality of which are located above said rollers and are adjustably supported from said end walls in a vertically adjustable manner with respect to said lower rollers.

10. The apparatus in accordance with claim 9, wherein the upper rollers are vertically adjustable and are positioned in vertical alignment with points intermediate said lower rollers along the path of said articles in said treating zone.

11. The apparatus in accordance with claim 10, which additionally includes a reservoir means below said container in surrounding relationship thereto and adapted to hold a large volume of quenching fluid, and means for supplying quenching fluid to said treating zone, comprising suction pumps operatively connected with said reservoir means for pumping quenching fluid therefrom and discharging into said conduit means.