

Feb. 20, 1951

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2,542,237

QUENCHING APPARATUS FOR HEAT-TREATED WORKPIECES

Filed Nov. 13, 1944

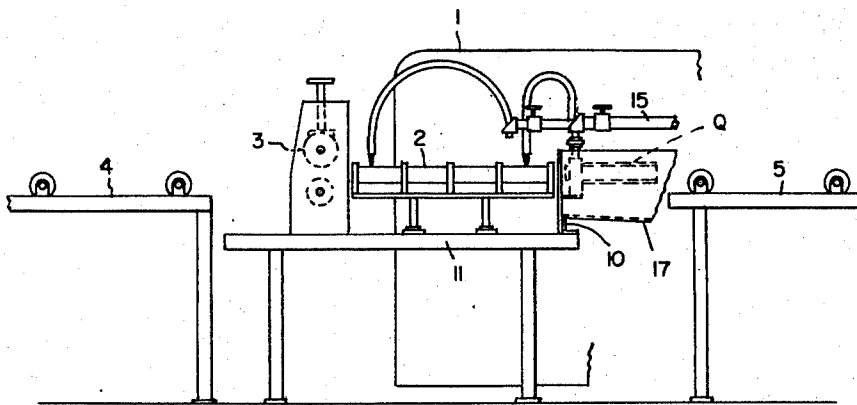


Fig. 1

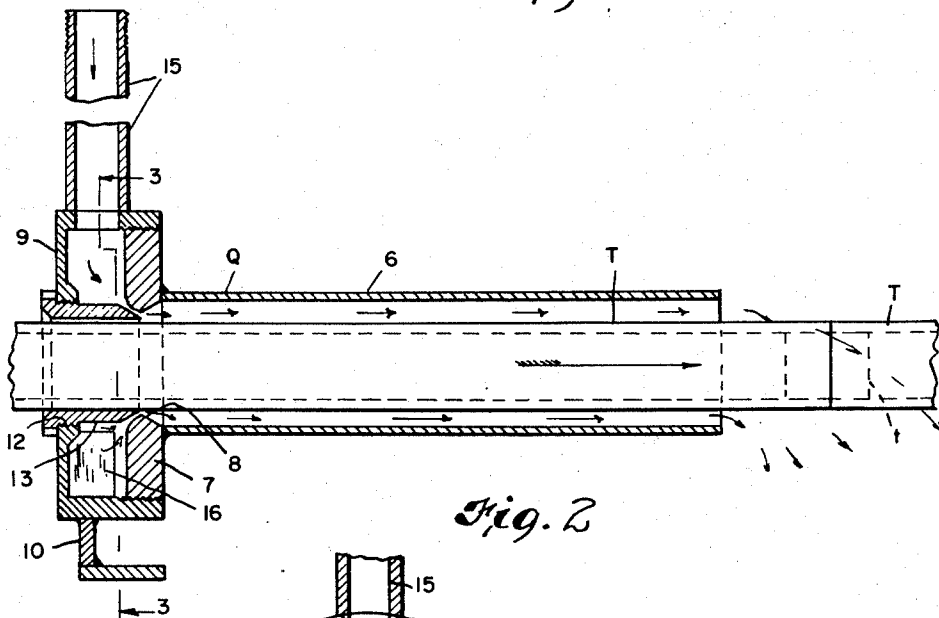


Fig. 2

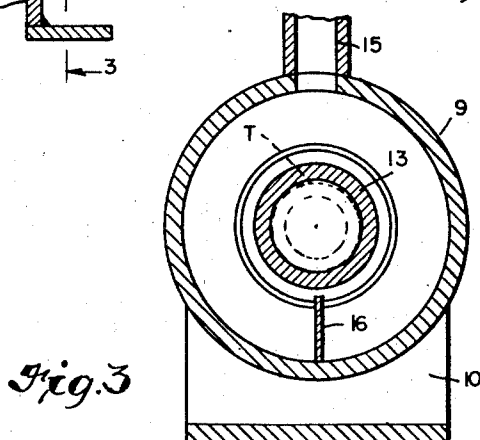


Fig. 3

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2,542,237

QUENCHING APPARATUS FOR HEAT-TREATED WORKPIECES

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Application November 13, 1944, Serial No. 563,211

1 Claim. (Cl. 134-122)

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The present invention, relating as indicated to quenching apparatus, has more particular regard to apparatus for quenching a longitudinally extending work-piece following heat treatment thereto so as suddenly to cool the latter from an elevated to a much lower temperature.

For this purpose, disregarding the familiar method of quenching by immersion in a liquid bath, it has been the customary practice to discharge a spray of water or other coolant onto the work-piece as it moves from the heating to the cooling stage. However, by such method of quenching it is difficult to control accurately the temperature to which the work-piece is lowered as well as to insure uniform cooling action throughout or around the work-piece as is not only desirable but necessary, particularly in the treatment of pieces made from stainless and other alloy steels, for example.

Accordingly, one principal object of the present invention is to provide an improved apparatus where not only a uniform cooling effect may be secured but where such cooling may be carried to exactly the degree desired throughout the work-piece that is being treated. A further object is to provide for regulation of such cooling effect so that the degree to which the work-piece is cooled may be readily varied as required. Still another object is to provide an apparatus which will be simple in construction, not likely to get out of order, and easily adjustable to secure the variation in the quenching action just referred to.

An equally important object with the foregoing, in case the coolant employed is oil or like inflammable material, is to confine such coolant after it has been applied to the work-piece so as to avoid spattering and danger of ignition due to contact where the work-piece has been heated to a relatively high temperature.

To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claim, the annexed drawing and the following description setting forth in detail certain means and one mode of carrying out the invention, such disclosed means and mode illustrating, however, but one of various ways in which the principle of the invention may be used.

In said annexed drawing:

Fig. 1 is a side elevation, more or less general in character, of a typical heat treating unit and my improved quenching apparatus in proper relation thereto;

Fig. 2 is a longitudinal vertical section of such apparatus; and

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Fig. 3 is a broken transverse section thereof taken on the plane indicated by the line 3-3, Fig. 2.

It will be understood that the particular method and apparatus employed for heat treatment of the work-piece is immaterial so far as concerns the operation of the present improved quenching apparatus. Thus, for example, the heating means employed may consist of any well known type of gas fired or electrically heated furnace. For the purpose of illustration (see Fig. 1), such heating means is of the electrical induction type, including the power unit 1 and a chamber 2 in the form of an induction heating coil through which the work-piece to be treated is passed and as it passes therethrough is heated to the desired temperature. Such illustrated mechanism or apparatus is designed specifically for handling longitudinally extending work-pieces such as tubes T (see Fig. 2) which are moved axially therethrough by means of feed rolls 3 in close end-to-end relation. To facilitate handling the tubes a feed table 4 and a delivery table 5 are provided and the juxtaposed ends of the tubes are held in alignment by means of a cylindrical plug or bushing t inserted therein.

The term "work-piece" as employed herein is intended to connote either a single tube T or a series thereof connected together, or any other form of longitudinally extending work-piece having a uniform cross section which may be axially fed through the chamber 2 or other type of heating equipment.

The quenching apparatus Q of present interest is suitably supported between such delivery table 5 and the end of the heating chamber 2 from which the work-piece emerges after being brought to desired elevated temperature. This apparatus, as illustrated in Fig. 2, comprises a cylindrical shell 6, so mounted as to lie substantially concentric with the work-piece as the latter passes therethrough from such heating chamber and provide an annular space around such work-piece. Said shell 6 is open at its outer end, the right hand end as viewed in Figs. 1 and 2, and for the purpose of being thus supported is attached at its inner end to a circular plate or disc 7 formed with a central bore 8 of less diameter than the interior diameter of the shell but of substantially larger diameter than the outside diameter of the work-piece. Said disc in turn forms one face of a cylindrical, or rather annular, chamber 9 which is supported by means of a bracket 10 on the main support 11. The latter also is conveniently used to support the heating chamber 2 and the stand which carries the feed rolls 3 so that the parts of

the apparatus in question, together with the quenching apparatus, may all be maintained in proper alignment.

Disc 7 has threaded engagement with the interior wall of chamber 9, and threadedly engaged with a central opening 12 in the flat wall of said chamber opposite said disc is a sleeve or bushing 13. The interior or right hand end of said sleeve 13 is chamfered or bevelled outwardly and the contiguous edge of the bore 8 in disc 7 is correspondingly bevelled so as to provide a circular slot which leads from the annular space within chamber 9 to the annular space within shell 6, such slot converging towards the axis of the shell, or in other words, of the work-piece when the latter is passing therethrough.

By rotating either disc 7 or sleeve 13, the transverse width of the circular slot thus provided may be adjusted within limits so that the coolant, whether liquid or gaseous, supplied to said chamber 9 under given pressure, may be discharged therefrom onto the work-piece passing through the bushing 13 and shell 6 at a corresponding rate.

Such coolant, which may be water, oil, or any other fluid for the particular quenching operation, is supplied to chamber 9 through a valve controlled duct 15 that, as shown, is connected with the upper end of the chamber. In order to prevent turbulence and insure an equable flow of coolant from the chamber through the previously described circular discharge orifice, one or more baffles 16 may be provided within the chamber, as best shown in Fig. 3. Said baffle 16 is preferably disposed radially of the chamber 9 and on the side thereof opposite the duct 15. After being discharged through the orifice in question the coolant is confined by the annular shell 6 so as to provide a flowing annular body of such coolant around the adjacent section of the work-piece. The rate of flow of the coolant, having regard to the cross-sectional area of the annular space is such that the coolant will substantially fill such space throughout the longitudinal extent of the shell. This result follows from the longitudinal disposition of the shell and the fact that its extent is a number of times greater than the diameter of the tube, which of course defines the interdiameter of such annular space. Upon finally escaping from the open end of shell 6 the coolant, where it is a liquid, is caught in a suitable trough 17, shown in part only in Fig. 1, following which it may be cooled to desired temperature and returned through duct 15 for use over again.

It is necessary of course to allow sufficient clearance between the work-piece and the opening in sleeve 13 so that such work-piece may readily move through the apparatus. For example, where the work-piece is a 2 inch pipe, a clearance of $\frac{1}{2}$ inch will ordinarily be desirable. Despite this there will be no tendency for the coolant discharged into shell 6 to escape through the clearance space thus left between the sleeve and work-piece, since, owing to the direction of discharge of the annular stream of coolant through the orifice provided between the inner end of said sleeve and the opening in disc 7, such stream has the effect of an inspirator and so creates a negative pressure in the space in question.

The operation of my improved apparatus has been sufficiently indicated in the course of the foregoing description of its construction. It

should, however, be noted that by discharging the coolant thus in the form of an annular stream onto the work-piece a uniform cooling effect around the entire circumference of the latter is assured, whereas with a spray such effect is extremely difficult of attainment. At the same time, by providing for the adjustment of the width of the annular discharge orifice, the flow of coolant may be accurately metered. Finally, by retaining an annular body of such coolant in contact with a section of the work-piece of predetermined length, not only is the full quenching action of the coolant secured, but such effect is obtained to a much greater amount by the more extended period allowed for heat interchange between coolant and work-piece.

The term "quenching" as applied to the operation of the apparatus is intended to connote any cooling step and not necessarily a rapid one. Thus, as previously indicated, the coolant need not necessarily be liquid, e. g. water or oil, but air may be used, and for some heat treating operations the coolant may have a temperature intermediate of ordinary room temperature and that to which the work-piece has been heated.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the means and the steps herein disclosed, provided those stated by the following claim or its equivalent be employed.

I therefore particularly point out and distinctly claim as my invention:

In apparatus for quenching an axially moving, longitudinally extending work-piece subsequent to heating thereof, the combination of a shell of larger diameter than such work-piece disposed to surround a section of the latter as it is thus moved, a coolant supply chamber similarly disposed and connected by means of an annular orifice with the end of said shell through which such work-piece enters, and baffle means in said chamber equalizing the flow of coolant to such orifice, said chamber being provided with a coolant supply duct on one side leading thereinto, and said baffle means being located on the side of said chamber opposite such duct and disposed radially of said chamber.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,139,086	Tidswell	May 11, 1915
1,143,700	Hamill	June 22, 1915
1,211,277	Bloom	Jan. 2, 1917
1,401,462	Circle	Dec. 27, 1921
1,643,330	Barord	Sept. 27, 1927
1,844,135	Morgan	Feb. 9, 1932
1,912,993	Murray	June 6, 1933
1,944,798	Mellor	Jan. 23, 1934
2,202,758	Denneen et al.	May 28, 1940
2,218,827	Mott et al.	Oct. 22, 1940
2,281,333	Somes	Apr. 28, 1942
2,295,272	Somes	Sept. 8, 1942
2,307,694	Malke	Jan. 5, 1943
2,310,384	Arnoldy	Feb. 9, 1943
2,321,431	Somes	June 8, 1943
2,412,802	DeCoriolis	Dec. 17, 1946