

1

2,988,095

APPARATUS FOR OIL-QUENCHING END-CLOSED VESSELS

Robert C. Sherwood, Los Angeles, and Robert H. Lundquist, San Gabriel, Calif., assignors to California-Doran Heat Treating Co., Los Angeles, Calif., a corporation of California

Filed Mar. 4, 1957, Ser. No. 643,813

6 Claims. (Cl. 134-169)

This invention relates to apparatus for oil quenching end-closed vessels, the apparatus being adapted to carry out the quick-cooling step of a heat-treating process.

Elongated, end-closed vessels, such as the metal bodies of rockets, aero-jet missiles, etc. require that the quenching step of the heat treating thereof be performed in a manner to insure uniform cooling and, thereby, prevent variations in the texture of the metal walls thereof. Desired texture uniformity results in uniformity of stress conditions and elimination of weak spots or areas. The closed ends of such vessels present the greatest problem in that the metal thereof is not ordinarily quenched with the same degree of efficiency as the tubular walls of such vessels, primarily, because air and gases are trapped in the closed ends of such vessels, as the same are lowered into the quench bath. Thus, the quenching liquid, usually oil, cannot achieve contact with the inner face of the closed end of a vessel with the undesirable results as above indicated.

By providing the vessel with a snorkel-type tube that extends within the vessel from the closed end through the open end and then upwardly alongside the vessel, air and gases ordinarily trapped are forced out by the oil entering the inside of the vessel. This manner of solving the problem, while in universal use, is faulty in that the vessel must be provided with means of affixing the tube and, after quenching, the same requires to be removed—an uneconomical procedure—but, what is of greater importance, the heated air and gases that are discharged from such a tube are a great hazard and the same is known in the trade as a "flame thrower" for that reason.

An object of the present invention is to provide novel apparatus for safely and efficiently quenching end-closed vessels and to obviate the faults above set forth.

Another object of the invention is to provide quenching apparatus that removes the air and gases from within an end-closed vessel while the same is being lowered into an oil bath, in such manner as to insure proper immersion of the vessel, the apparatus safely exhausting heated air and gases and returning oil overflow to storage from which the bath is filled.

The invention also has for its objects to provide such means that are positive in operation, convenient in use, easily installed in a working position and easily disconnected therefrom, economical of manufacture, relatively simple, and of general superiority and serviceability.

The invention also comprises novel details of construction and novel combinations and arrangements of parts, which will more fully appear in the course of the following description. However, the drawing merely shows and the following description merely describes, one embodiment of the present invention, which is given by way of illustration or example only.

The figure is a semi-schematic view of apparatus according to the present invention.

The apparatus that is illustrated comprises, generally, a bath tank 5, an exhaust chest or chamber 6 disposed in the lower portion of tank 5, an air- and liquid-exhausting tube 7 disposed in upright position in said tank and discharging into chamber 6, means 8 to pump material from chamber 6, a gas exhaust tube 9 to conduct oil,

2

air and gases from the chest and to vent the air and gases from the oil to atmosphere, an oil storage tank 10, a discharge pipe 11 into said tank and connected to the outlet of the pump means 8, a connection 12 between the tanks 5 and 10 to supply the former from the latter, and valve means 13 to control flow from tank 10 to tank 5.

The above generally-described apparatus is so located with respect to a floor 14 that a vessel 15 may be conveniently lowered into tank 5, after the same has been heated in the initial steps of a heat-treating process, and as conveniently raised. The drawing shows a fixture 16 that, by means of hooks or rods 17, supports the vessel 15 in a depending position, and raising and lowering means 18 connected to the fixture and operable by overhead means. Also, the tank 5, near its upper end, is provided with fixture-engaging stop means 19 that limits the lower position of the fixture and of the vessel 15 carried thereby. The intent is to locate the vessel over tube 7 so that the closed end 20 of the vessel is spaced somewhat above the upper open end of said tube when the fixture is arrested by the stop means 19.

The chest or chamber 6 replaceably connects at 21 with the tube 7 so that the latter may be changed according to the diametral size of the vessel to be quenched, thereby, assuring desired rapidity of flow through said tube. Thus, should the vessel 15 be substantially smaller than the one shown, a commensurately smaller tube 7 may be connected to chest 6 by the quick-change coupling 21.

The means 8 is shown as a centrifugal pump 22 that is under continuous operation by means of a motor 23 to draw material from both chest 6 and exhaust tube 9 and to discharge the liquid pumped thereby back into storage tank 10, while permitting discharge of gases from the end 24 of the discharge pipe 11.

The tube 9 vents to atmosphere from its upper end 25, the same being preferably located above the level of floor 14.

The storage tank 10 is connected for gravity filling of bath tank 5 by means of connection 12, the valve means 13 controlling the same. Said means is here shown as a valve 26 in the bottom of tank 10, a valve actuator 27 that is shown in the form of an air-operated unit and capable of rapid action, and a connection 28 between valve 26 and unit 27.

Operation:

Assuming that the oil bath in tank 5 is at the level 29 slightly below the upper open end 30 of the tube 7: This level is approximately that of valve 26, when said valve is closed. An additional quantity of oil 31 is stored in tank 10 above valve 26.

With the apparatus in the above-described condition, a heated vessel 15 required to be quenched for proper hardening is lowered into the bath over the tube 7. Since the motor 23 is continuously driving the pump 22, air and such gases that are given off from the oil are drawn into open end 30 of tube 7 and into chest 6. Thus, the level of oil inside the vessel 15 may rise to the level in tank 5. Part of this gas may exit directly from the end 25 of the tube 9 and part will be drawn into pump 22 and be forced through tube 11 out of the end 24 of the latter. Any moisture there may be included in such gases will enter the top of tank 10; the gases will vent to atmosphere.

When the vessel has reached its lowermost position in the bath tank, the closed end 20 thereof will be above the bath level 29 and, therefore, not subject to the hardening phenomenon that results from a quick quench. At that instant, unit 27 is operated to dump the oil 31 through the open valve 26 and through connection 12 into tank 5. Thus, the oil bath is raised to the level 32, well above the

3

top of said closed end 20. Any time thereafter, the valve 26 may be again closed.

Since the pump 22 is operating, the level within the vessel 15 will rise until the oil therewithin rises above the end 30 of tube 7 and completely fills the interior of the vessel, thereby insuring complete and efficient quenching of all portions of the vessel. As a result of this rise of level within the vessel, the oil will overflow the top of tube 7 and enter the chest 6. Some of this oil will rise in tube 9 seeking the level in tank 5; the remainder will be pumped upwardly into tank 10. According to the capacity of pump 22, the level in tube 9 will be diminished by said pump and the same will be kept exhausted as the level 32 in tank 5 is being lowered back to the initial level 29.

During the above reduction of level of oil, a flow downwardly along the outside of the vessel and upwardly within the vessel is effected, further insuring that all portions of the walls of the vessel are uniformly treated by the oil as the heat therein is quenched.

When the level 29 is re-achieved, the apparatus is ready for another quenching operation, it being merely necessary to withdraw the quenched vessel and replace the same with one requiring quenching.

In other respects and with regard to time, temperatures of the bath, etc., usual quenching practice may be followed.

It will be understood that the apparatus is not dependent on use of oil in the bath, since water or other suitable liquids may serve as well.

While the foregoing has illustrated and described what is now contemplated to be the best mode of carrying out our invention, the construction is, of course, subject to modification without departing from the spirit and scope of the invention. It is, therefore, not desired to restrict the invention to the particular form of construction illustrated and described, but to cover all modifications that may fall within the scope of the appended claims.

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

1. Quenching apparatus comprising a bath tank having an upper end with upper and lower liquid levels near the upper end of the tank, the tank having a chamber formed in the lower end thereof, a vertically disposed tube within said tank extending upward from said chamber to a point between the said upper and lower liquid levels of the tank and adapted to receive an elongated hollow vessel to be quenched which is closed at its upper end and disposed over said tube with said closed end above and spaced from the open end of said tube, said tube being connected to said chamber at the lower end, means for supplying liquid to said tank for raising the level of the liquid from said lower level to said upper level, a vent extending from said tank chamber to a point above said tank upper level, and means for drawing liquid from the lower portion of said chamber and discharging the same in the upper end of the tank above the upper liquid level therein.

2. Quenching apparatus according to claim 1 in which supporting means is provided below the higher level of the liquid to so locate an end-closed vessel over the vertical tube that the closed end is uppermost below the higher level of the liquid and above both the upper end of said tube and the lower level of the liquid in the bath.

3. Quenching apparatus according to claim 1 in which supporting means is provided below the higher level of the

4

liquid to so locate an end-closed vessel over the vertical tube that the closed end is uppermost below the higher level of the liquid and above both the upper end of said tube and the lower level of the liquid in the bath, and the mentioned liquid supplying means holding the lower level of liquid in the bath tank below the upper end of the tube.

4. Quenching apparatus comprising a bath tank with a top opening adapted to receive an elongated hollow vessel to be quenched which is closed at the upper end, a vertically disposed tube secured within said tank and open at the upper end located above a lower level of the liquid in said tank, and spaced from the closed end of the elongated hollow vessel, means to evacuate liquid-gas material entering the upper end of the tube upon lowering the hollow vessel to be quenched to a position in which the closed upper end thereof is above the lower liquid level and over said tube into said bath tank, a storage tank connected to the bath tank and storing liquid to supply the same to the bath tank gravitationally, means to control such supply to fill the bath tank first to said lower level and then to a higher level covering the closed end of the hollow vessel, said evacuating means having an inlet at the lower end of the tube and an outlet discharging into the storage tank to replace into said latter tank the liquid phase of the material evacuated from the vertically disposed tube, and having a vent to release the gaseous phase of said material to atmosphere.

5. Quenching apparatus according to claim 4 in which the evacuating means includes a pump connected between said evacuating means inlet and outlet to draw material downwardly in the mentioned tube, force the liquid phase of said material into the storage tank, and drain the vent of liquid.

6. Quenching apparatus comprising: a bath tank for containing liquid at a first level, a storage tank connected to the bath tank, valve means operable to release liquid from the storage tank into the bath tank to raise the liquid therein to a second level higher than the first level, means supporting an elongated hollow vessel having a closed upper end, said vessel to be quenched in said bath tank with its closed end above the first level but below the second level of the liquid in said tank, a tube supported in the tank to extend upwardly into the closed end of the vessel to a point above the first liquid level and below the second liquid level in said bath tank, means to maintain a space between said closed end of the vessel and the upper opening of the tube, and means to effect withdrawal through said tube of gasses and liquids trapped above the upper end of said tube in the upper end of the vessel and vent the gases to atmosphere while the withdrawn liquid is returned to the said storage tank.

References Cited in the file of this patent

UNITED STATES PATENTS

1,645,356	Shurts	Oct. 11, 1927
1,730,658	Jensen	Oct. 8, 1929
2,101,312	Gerhardt	Dec. 7, 1937
2,233,852	Schmitt	Mar. 4, 1941
2,370,775	Capita	Mar. 6, 1945
2,537,215	Dunn	Jan. 9, 1951
2,547,053	Somes	Apr. 3, 1951

FOREIGN PATENTS

979,255	France	Dec. 6, 1960
---------	--------	--------------