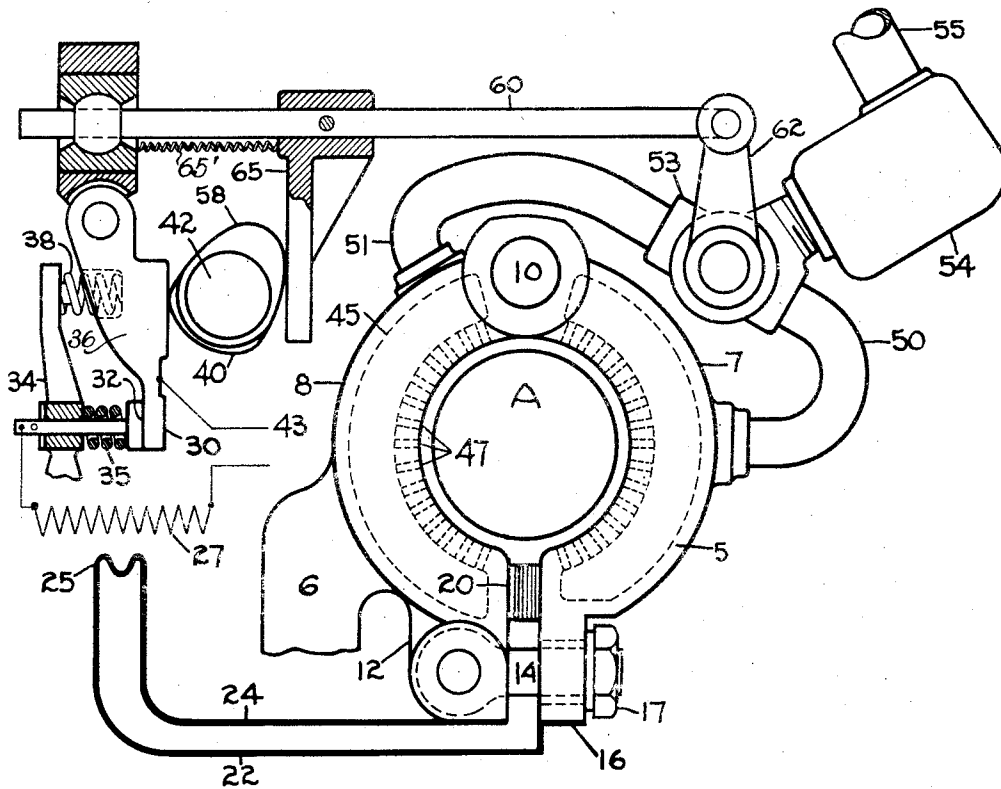


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HEATING AND QUENCHING APPARATUS

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HEATING AND QUENCHING APPARATUS

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3 Claims. (Cl. 266—4)

The present invention is a division of our co-pending application Serial No. 718,002, filed March 29, 1934, now Patent No. 2,180,038 issued November 14, 1939, and as such is directed to heat treating surface zones of articles. More particularly, the invention is concerned with apparatus for inductively heating a surface zone of an article or portion thereof for a predetermined period of time and applying quenching fluid to the heated surface in timed relation to the heating cycle.

With the apparatus of this invention it is possible to control the depth and hardness of the hardened zone and to insure a proper bond between the said zone and core or body portion of the article by substantially preventing the formation of free ferrite at the bonding region between the zone and the core.

The general object of the invention therefore has been to provide apparatus by which the above mentioned surface zone may be inductively heated to a temperature above the critical point for a period of time sufficient to so heat the zone to the required depth and thereafter actuate quenching apparatus which rapidly cools the heated zone and produces the desired metallurgical structure.

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 claims; the annexed drawing and the following description setting forth in detail certain means of carrying out the invention, such disclosed means illustrating, however, but one of various ways in which the principle of the invention may be used.

In said annexed drawing:

The single figure there appearing is a view of apparatus embodying this invention.

Referring to that figure, we provide a two-part inductor member 5 supported on a frame 6 and comprising arms 7 and 8 hinged together at 10 and curved so as to form an opening therebetween corresponding to the shape of the article A to be heated and quenched. The arms are so positioned with respect to the article A that the inductor member is adapted to lie in inductive heating relation with the article, suitable supporting means being provided.

The arms are clamped together and the clamping means is adjustable to receive a range of sizes. To this end a lug 12 is provided on the arm 8 and pivotally carried thereby is a locking bolt 14 positionable to pass through a lug 16 of the arm 7. The arms are maintained together

by a nut 17 clamping the arms against a series of insulating shims 20. By varying the number of shims employed the aforementioned variation in spacing between the arms 7 and 8 is maintained.

Periodically varying heating current is supplied to one of the arms, passes through the contacting faces of arms 7 and 8 and through pivot 10 into the other arm and returns to the supply source. Such connections comprise leads 22 and 24 connected to the arms 7 and 8, respectively, and leading to a secondary 25 of a transformer; the primary of the transformer being indicated at 27.

Current is supplied to the primary through a switch 30 which is opened and closed in a manner hereafter described. The switch comprises a pair of contact faces, indicated at 32, shiftable with respect to each other. The contact face connecting with the primary is slidably mounted in a bracket 34 and is normally urged against its coacting face by the spring 35. The coacting face, under the influence of spring 38 bearing against the bracket 34, tends to be rocked out of engagement to break the contact.

Contact is established by a cam 40 rotatably carried on shaft 42. As the shaft is rotated the aforesaid cam rocks the adjacent contact member 36 against the spring 38, allowing current to flow from lead 43 through the switch into the primary of the transformer. After the cam 40 has released the said contact member the spring 38 breaks the connection and cuts off the source of current fed to the inductor member 5.

After the heating interval has ended by travel of the cam 40 with respect to the switch, quench is rapidly applied to the heated surface of the article A. To this end the arms 7 and 8 are hollow, as indicated in dotted line at 45, and discharge through orifices 47 against the portion of the article heated. Quench is supplied to the members 7 and 8 by flexible delivery lines 50 and 51 respectively. These lines in turn are supplied through a valve 53, which in turn leads to a strainer 54 and thence to the main supply pipe 55. The valve 53 is operated by another cam 58 which like cam 40 is also attached to rotate with the camshaft 42. This is accomplished through a rod 60 secured at one end to a valve control lever 62 and to a tappet block 65 positioned to be engaged and moved by the aforementioned cam 58.

The cams 40 and 58 are so positioned with respect to each other that as the former permits the switch to break the supply of heating cur-

rent to the inductor the latter will shift the tappet block 65, since the spring 65' urges the rod 60 to the left thereby opening the valve 53 and, through the hollow chamber 45 and orifices 47 associated therewith, forcibly flooding the surface zone of the article A which has just been heated. Coolant is supplied with sufficient force to remove any incipient gas bubbles and prevent the formation of steam bubbles thereon which retard the cooling action and result in a spotty product.

It will be apparent that the duration of the heating and quenching cycles and the time relation of the sequence they follow can be varied by the form and position of the cams 40 and 58.

Other modes of applying the principle of our invention may be employed instead of the one explained, change being made as regards the means herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

We therefore particularly point out and distinctly claim as our invention:

1. The combination of an inductor member adapted to lie in inductive heating relation with an article to be heated, means including a switch for supplying periodically varying current to said member, a cam and cam follower for actuating said switch, a quenching member for quenching said article, means including a valve for supplying quench to said quenching member, a cam and cam follower for actuating said valve, and a common shaft for said cams, said cams being so positioned and conformed that said valve and

switch open substantially simultaneously to control the inductive heating effect in said article.

2. The combination of an inductor member adapted to lie in inductive heating relation with an article to be heated, means including a switch for supplying periodically varying current to said member, a cam and cam follower for actuating said switch, a quenching member for quenching said article, means including a valve for supplying quench to said quenching member, a cam and cam follower for actuating said valve, and a drive means interconnecting and actuating said cams, said cams being so positioned and conformed that said valve and switch open in pre-selected sequence to control the inductive heating effect in said article.

3. The combination of an inductor member adapted to lie in inductive heating relation with an article to be heated, means including a switch for supplying periodically varying current to said member, a quenching member for quenching said article, means including a valve for supplying quench to said quenching member and mechanism to operate said switch and said valve in pre-selected sequence including means to control the actuation of said switch and means to control the actuation of said valve and interconnected cam means including two elements adapted to engage said control means respectively in pre-determined sequence to control the inductive heating effect in said article.

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