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QUENCHING DEVICE

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Fig. 1.

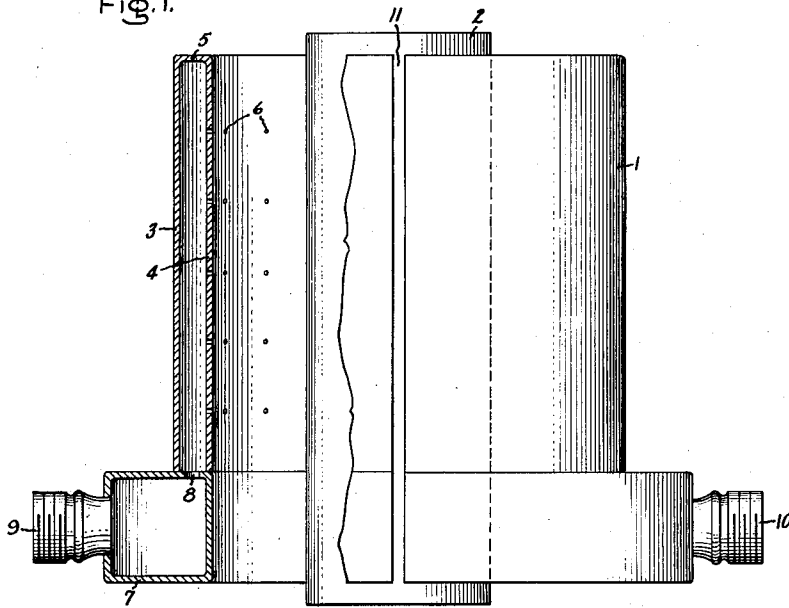
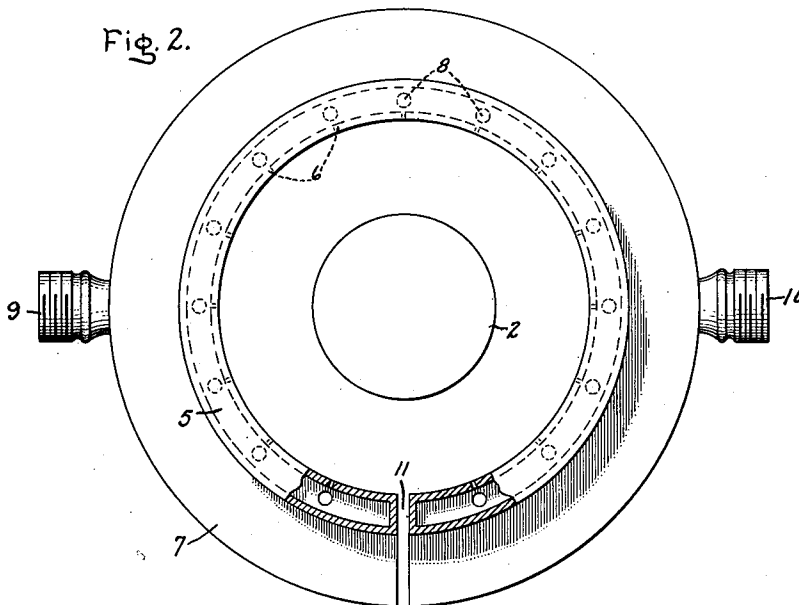


Fig. 2.



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QUENCHING DEVICE

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My invention relates to quenching devices, more particularly to devices for projecting a quenching fluid onto a heated article, and has for its object simple and reliable means for applying the cooling fluid uniformly over the area to be quenched.

More particularly, my invention relates to quenching devices of the type in which the quenching fluid is applied to the heated surface in the form of a plurality of jets, such as used in the quenching of steel articles for hardening purposes, and especially to quenching devices of annular or cylindrical form with apertures in an inner wall for directing jets of quenching fluid radially on the surface of a cylindrical heated object. In such devices when the quenching fluid is applied to a heated area of substantial size by means of a plurality of orifices I have found that nonuniform quenching may result because of differences in the pressure of the fluid at the various orifices caused by a drop in the pressure of the fluid in flowing to the orifices most remote from the point at which the fluid is supplied to the quenching device.

My invention therefore comprehends an improved construction for assuring an adequate supply of quenching fluid such as water to the quenching device with uniform pressure at the orifices. In one form of my invention I provide a cylindrical or annular header member to which the cooling fluid is supplied. Secured to this header member on one side is an annular quenching member having orifices in its inner wall and connected to the header by orifices in the wall separating the two. The water supplied to the header thus is fed into the quenching member at one end around the periphery of the quenching member and flows axially of the quenching member directly to the jet orifices. To assure a uniform pressure at all points in the quenching member, the total area of the feed orifices between the header and the quenching member is made substantially greater than the total area of the jet orifices.

For a more complete understanding of my invention reference should be had to the accompanying drawing, Fig. 1 of which is an elevation view partly in section of a cylindrical quenching device embodying my invention, while Fig. 2 is a plan view partly in section of the device shown in Fig. 1.

Referring to the drawing, I have shown my invention in one form as applied to a hollow cylindrical quenching member 1 for applying radially directed jets of quenching fluid to a cylindrical electrically conducting heated member 2, such as a steel pin to be hardened. It will be understood that the member or article 2 is suitably heated before being quenched, such as by means of a high frequency induction heating coil (not shown) and after being heated the article 2 is transferred quickly to the quenching member 1, as shown in the drawing. I contemplate also that the heating coil may be mounted

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inside the quenching portion 1 so the article 2 is quenched by jets of cooling fluid passing between the turns of the coil. The quenching device primarily is used for hardening purposes, although the quenching operation may be used for other purposes such as in the annealing of stainless steel.

The cylindrical quenching member 1 is provided with coaxial outer and inner walls 3 and 4 joined at the top by an end wall 5 forming a water receiving chamber, the inner wall 4 being provided with a plurality of orifices 6 through which water is directed in a radial direction with respect to the quenching member on the article 2. For the purpose of supplying cooling water to the member 1, I provide an annular header member 7 having an internal diameter substantially the same as the member 1 and secured to the lower end of the member 1 in concentric relation therewith, such as by brazing. A series of orifices 8 are provided in the upper wall of the header 7 separating the header from the member 1, through which orifices cooling water is fed into the water receiving chamber of member 1. Preferably, as shown, the orifices 6 in the member 1 are arranged in a plurality of vertical series of apertures as viewed in the drawing, these vertical series of orifices being equally spaced apart around the inner periphery of the member 1, and a feed orifice 9 is provided just below each vertical series of orifices 8 as shown in the drawing. Moreover, each feed orifice 9 has an area substantially greater, preferably about 50 per cent greater, than the combined areas of the vertical series of orifices 6 fed by it.

As shown, the header 7 is substantially square in cross-section so as to assure the supply of water at a uniform pressure to all points of it from the diametrically spaced apart water connections 9 and 10. Moreover, the cross-sectional area of the header is large as compared with the combined areas of the feed orifices 9. By means of this construction water is supplied at a substantially uniform pressure to all of the feed orifices 9 and in turn is supplied through the feed orifice at a substantially uniform pressure to the jet orifices 6.

It will be understood that the quantity of water which flows into the water receiving chamber of quenching member 1 is restricted by the orifices 9, with the result that the water flows in this chamber (which has a much greater cross section than the orifices) at a relatively low velocity as compared with the velocity of flow through the orifices. I have found that this slow rate of flow in the member 1, i. e., the upward flow when the member is upright as shown in the drawing, is essential for uniform formation of water jets through the quenching orifices 6. As the water rises in the member 1, some water trickles through the holes 6 but this water runs down the inside walls of said member and does not come in contact with the article 2. When the quenching member becomes filled with water, however,

the jets are formed simultaneously from the holes 6 and apply water simultaneously to all parts of the article 2 within the quenching zone. The simultaneous formation of the quenching jets is important because the quenching operation may be of extremely short duration, such as one-quarter second and, consequently, if the jets were not formed simultaneously, uneven quenching would result.

It will be understood that my invention is particularly useful in connection with intermittently used quenching devices, i. e., for quenching in rapid succession a plurality of articles 2 fed into the quenching device. In such case the water supply to the inlets 9 and 10 is shut off momentarily between quenching operations and then applied momentarily for the quenching which requires at the beginning of each quenching operation rapid movement of water to the most remote points of the device. With the device in the position shown in the drawing with its axis vertical, the upper orifices 5 are most remote from the water supply. I contemplate however that the device may be used in other positions, for example with its axis horizontal.

For the purpose of preventing the induction of heating currents in the quenching device itself, the device 1 and the header 7 are discontinuous, i. e., provided with a longitudinal slot 11 preferably positioned midway between the two water supply connections 9 and 10. I contemplate for example that the induction heating coil may be permanently located around the periphery of the portion 1, in which case the article 2 is heated and quenched in one position. The quenching device is made of a suitable material having high electrical conductivity, such as copper or brass.

While I have shown a particular embodiment of my invention it will be understood of course that I do not wish to be limited thereto since many modifications may be made and I therefore contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A quenching device comprising a member constructed of a plurality of walls forming a water receiving chamber, one of said walls being provided with a plurality of relatively small quenching orifices, a header member connected to said chamber member, at least one relatively large orifice having an area substantially greater than the combined area of said quenching orifices but substantially smaller than the cross-sectional area of said chamber providing for communication between said header and said chamber, and means for supplying a quenching fluid to said header member for the supply of quenching fluid through said relatively large orifice to said chamber, said relatively large orifice serving to restrict the quantity of fluid flowing into said chamber for producing a relatively low velocity of fluid flow in said chamber whereby when said chamber becomes filled jets of fluid are supplied from said quenching orifices substantially simultaneously for uniform quenching.

2. A quenching device comprising a hollow member constructed of a plurality of walls forming a water receiving chamber therearound, an inwardly disposed one of said walls being provided with a plurality of small quenching orifices, a header member secured to one end of said hollow member, said members being separated by a wall provided with a plurality of relatively

large orifices having a combined area substantially greater than the combined area of said quenching orifices but substantially smaller than the cross-sectional area of said chamber, and means for supplying a quenching fluid to said header member for the supply of quenching fluid through said relatively large orifices to said chamber, said relatively large orifices restricting the flow of fluid into said chamber for providing a relatively low velocity of fluid flow in said chamber whereby when said chamber becomes filled jets of fluid are supplied from said quenching orifices substantially simultaneously for uniform quenching of an article positioned within said hollow member.

3. A quenching device comprising a vertically disposed hollow cylindrical member constructed of walls forming an annular water receiving chamber including two coaxial walls, the inner of said two coaxial walls being provided with a plurality of relatively small quenching orifices arranged in a plurality of equally spaced vertical series, each of said series having the same number of equally spaced orifices, an annular header member secured to the lower end of said cylindrical member in concentric relation therewith, said members being separated by a wall provided with a number of relatively large orifices equal to the number of said series providing for the admission of water from said header to said chamber, the combined area of said large orifices being substantially greater than the combined area of said quenching orifices but substantially smaller than the cross-sectional area of said chamber, the combined area of said large orifices also being substantially smaller than the cross-sectional area of said header transversely to the direction of water flow therethrough, said large orifices being positioned respectively in alignment with said series of quenching orifices, and means for supplying a quenching fluid to said header member for the supply of quenching fluid through said relatively large orifices to said chamber, said relatively large orifices restricting the flow of fluid into said chamber for providing a decreased velocity of fluid flow in said chamber whereby when said chamber becomes filled jets of fluid are supplied from said quenching orifices substantially simultaneously for uniform quenching of an article positioned within said hollow member.

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