

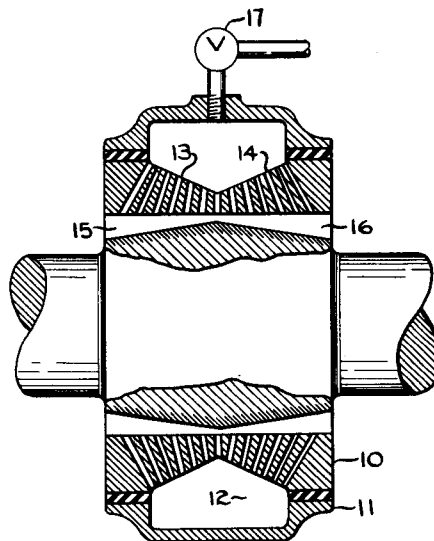
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APPARATUS FOR HARDENING TAPERED ARTICLES

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APPARATUS FOR HARDENING TAPERED ARTICLES

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1 Claim. (Cl. 266—4)

The present application as a continuation in part of our copending application Serial No. 54,388 filed December 14, 1935 and entitled "Heat treatment of shafts and the like," now Patent No. 2,202,759, issued May 28, 1940, is directed to apparatus for hardening surface zones of articles of various forms such as articles having conical, or spherical portions and is concerned mainly with such apparatus as can readily be used in connection with high frequency heating current. If a conical or spherical surface is heated by means of an inductor having the usual cylindrical form, a harmful amount of heating will be produced in the part lying closest to the inductor while other parts in which hardness is greatly desired will not be heated to critical temperature and thus will not be hardened. It is thus important and usually necessary that the inductor be so formed that a correct distribution of inducing current be obtained in the inductor so as to provide the correct distribution of heating current in the article. Also the correct amount and distribution of quenching is necessary to attain the desired degree of hardness.

In former instances the inner walls of cylindrical inductors have been cut away at their central parts to reduce the current carrying capacity of these parts and to increase the air gap existing in these regions. This is not always desirable since the remaining edge portions often interfere with the escape of the quenching fluid introduced thru orifices in the central parts of the inductor wall. To obtain proper distribution of current in the inductor to correspond with the heat distribution required in the surface zone of the article being hardened, the outer portion of the inductor can often be easily cut away at its center. This not only provides for correct current distribution but enhances the distribution of quenching fluid. Thus a single conical, double conical, spherical or other section of a shaft or similar article can be readily provided with a hardened surface zone of correct depth contour and hardness.

In view of the above stated conditions the chief object of this invention is to provide means for correctly distributing heating in an article of varying form. Another object is to provide means for distributing quenching after heating such article of varying form to attain the desired degree of hardness. A further object is to provide means for hardening an article of varying form which means is easily and economically produced.

With these and other objects in view said in-

vention then consists of the means hereinafter set forth. It will be understood that the phraseology employed is for the purpose of description and not for limitation and that the invention may appear in many embodiments differing in detail from the following disclosure but within the scope of the claims herein.

The annexed drawing and following description set forth in detail certain mechanism embodying the invention, such disclosed means, however, constituting but one of the various forms in which the principle of our invention may be used.

In said annexed drawing:

The sole figure is a longitudinal section thru an inductor adapted to harden a surface zone of a double conical portion of an article.

By employing our apparatus the surface zone of a double taper can be readily hardened as shown in the drawing. In this apparatus the inductor 10 has a cover 11 which serves as an insulated jacket, providing the quenching space 12. This inductor is tapered at 13 and 14 to provide for a concentration of current at the two sides opposite the air gaps 15 and 16, a concentration of current being required at the regions of wide air gaps to compensate for the reluctance at these points. In varying the form of the inductor by changing the slope of the walls at the quenching chamber side any distribution of current is provided to attain the desired depth of the surface zone.

It will be evident that providing such tapered areas with hard surface zones makes it possible to eliminate the usual separate cone for tapered roller and similar bearings by providing a surface on the shaft itself on which the rollers can successfully operate.

The term "taper" is used in a general way whether applied to the form of the hardened surface zone or to the inductor and is used to define forms other than true conical shapes, it being understood that the elements of the surfaces designated as "tapered" may be arcuate or of modified arcuate form as well as rectilinear.

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

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

In apparatus of the class described for hardening a surface zone of an article, the article being

adapted to be hardened by heating and quenching, an inductor element being adapted to encircle the surface zone of the article, the said element having a substantially cylindrical interior surface adapted to lie in current inducing relation with the surface zone of the article, an exterior surface of the element comprising two substantially conical surfaces intersecting substantially midway between the sides of the inductor to form a peripherally extending channel, a cover 10

for said channel, said channel and said cover forming an annular quenching fluid supply chamber, and a multiplicity of passages extending thru the inductor element to deliver quenching fluid from said chamber, said passages varying progressively in length from the central part to lateral parts of the inductor element.

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