June 6, 1950 R. E. SCHIEBER 2,510,718

METHOD OF HEAT-TREATING

Filed Sept. 10, 1947

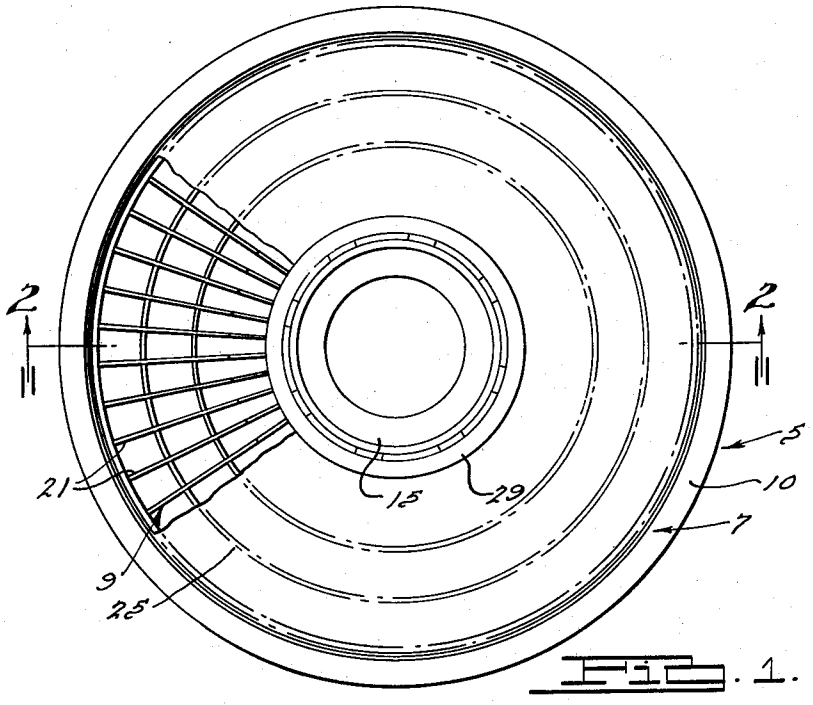


Fig. 1.

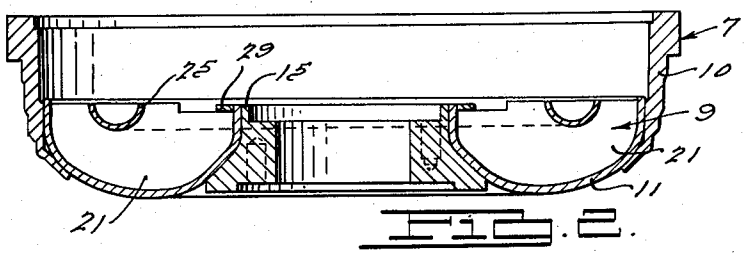


Fig. 2.

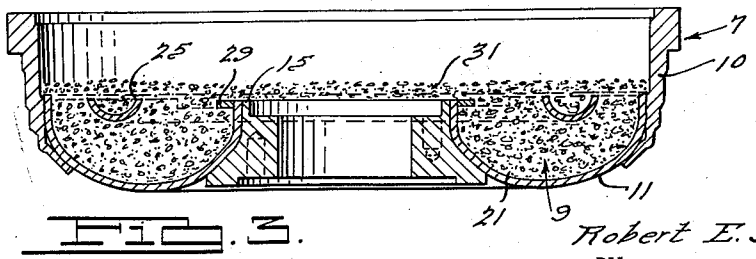


Fig. 3.

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Patented June 6, 1950 2,510,718

UNITED STATES PATENT OFFICE

2,510,718

METHOD OF HEAT-TREATING

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Application September 10, 1947, Serial No. 773,107

2 Claims. (Cl. 148—21.55)

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This invention relates to an improved method of heat treating a metal article and more particularly to a method of heat treating a metal article of the type having a relatively thin-sectioned member confined against expansion or contraction by a relatively heavy-sectioned member.

When a metal article of the type having a relatively thin-sectioned member confined against expansion or contraction by a relatively heavy-sectioned member is heat treated in the ordinary manner as, for instance, heated and quenched to harden it, the thin-sectioned member heats up more rapidly than the heavy-sectioned member and therefore expands ahead of the heavy-sectioned member, causing buckling of the thin-sectioned member. Likewise, when a metal article of the aforementioned type is quenched, the thin-sectioned member will be cooled more rapidly than the heavy-sectioned member and will break away and separate from the confining heavy-sectioned member. Therefore ordinary heat treating of such an article is not satisfactory and produces an unsatisfactory finished heat treated article.

The principal objects of this invention are to provide an improved method of heat treating a metal article of the type having a relatively thin-sectioned member confined against expansion or contraction by a relatively heavy-sectioned member so that both the thin-sectioned member and the heavy-sectioned member will have the same rate of expansion, that is, they will expand and contract substantially the same amount, at substantially the same time, so as to prevent any deforming of the thin-sectioned member or separating of the same from the heavy-sectioned member; to provide an improved method of heat treating a metal article of the aforementioned type in which the relatively thin-sectioned member is covered with particulated metal, during the heat treating operation, so that when it is heated and cooled it will expand and contract at the same time and rate as the confining heavy-sectioned member; to provide an improved heat treating method of the aforementioned type which may be used for any heat treating operation such as annealing, hardening, drawing, quenching or the like; to provide an improved heat treating method of the aforementioned type which is inexpensive, simple, and especially efficient in producing the aforementioned desired results.

These and other objects of this invention will become apparent from the following detailed description taken in conjunction with the accompanying drawing in which:

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Figure 1 is a top plan view of a fluid coupling member having a blade assembly of a relatively thin section confined within an outer annular housing of a relatively heavy section, the same being typical of the class of objects to which the present invention is particularly adapted;

Fig. 2 is an enlarged sectional view of the structure illustrated in Fig. 1 taken along the line 2—2 thereof; and

Fig. 3 is a sectional view similar to Fig. 2 illustrating the blade assembly covered with a particulated metal.

Referring now to the drawing, it will be seen that, for purposes of illustration, the improved heat treating method of this invention is illustrated in conjunction with a fluid coupling member generally indicated at 5, which comprises a relatively heavy-sectioned housing 7 and a relatively thin-sectioned blade assembly 9. The housing 7 includes an annular housing portion 10, of a relatively heavy section, having an annular, generally U-sectioned bottom wall 11 secured thereto. A central upwardly projecting boss 15, is disposed in the central aperture of the wall 11 and rigidly secured to the inner face thereof, such as by brazing or welding. These members thus constitute the relatively heavy-sectioned housing 7 of the coupling member 5.

Confined and secured within the U-sectioned wall 11 is the blade assembly 9, which comprises a plurality of radially projecting and circumferentially spaced blades 21. The blades 21 are brazed, welded or otherwise fixed to the housing 7 over the full line of contact between them, which comprises all edges of the blades except the upper edges thereof. An annular generally U-sectioned reinforcing element 25 of a relatively thin section, comprised of a plurality of relatively short pieces each interposed between an adjacent pair of blades 21, is brazed or otherwise suitably secured to the blades 21 so as to space, reinforce and interconnect the same. A ring 29 is secured to the upper inner surface of the U-sectioned wall 11 to positively hold the blade assembly in place. The blade assembly 9 is thus confined within the coupling housing 7, against both contraction and expansion.

When the member 5 is heat treated in the ordinary manner, that is, by placing the same while in the condition illustrated in Fig. 2 in a furnace held at the desired high temperature, the relatively thin-sectioned blade assembly 9 heats up more rapidly than the relatively heavy-sectioned housing 7 and therefore expands sooner and more rapidly than the housing. This often causes the blades 21 to buckle and break or damage the aforementioned brazed joints between the blades

and the housing, as well as the reinforcing U-shaped element 25. If the heat treating operation is one preliminary to a quenching operation to harden the assembly, then upon quenching of the heated member 5, the thin-sectioned blade assembly will contract sooner and more rapidly than the heavy-sectioned housing 7, and will thus tend and often does separate from the housing. This necessitates silver soldering, or otherwise resecuring the broken joints, and provides a generally unsatisfactory and costly coupling member.

In order to overcome this difficulty the improved heat treating method of this invention has been devised. With the method of this invention, the housing 7 is filled with particulated metal 31, as can be seen in Fig. 3. The particulated metal 31 may be either in powdered form or metal shavings, and is preferably a metal having approximately the same coefficient of conductivity as the metal of the housing 7 and blade assembly 9. In practice, it has been found that a metal such as cast iron may be used, so as to make the operation as inexpensive as possible. The housing 7 is preferably filled with the particulated metal 31 so as to completely embed blade assembly 9 therein and cover it with a layer of substantial thickness. In the particular case shown and assuming the coupling member to be about eight inches in diameter, it has been found that a covering layer of from ⅛" to ¼" is sufficient. However, it will be appreciated that the entire housing 7 may be filled with metal without affecting the operation. After the housing has been filled with the particulated metal, and while so filled, the member 5 is then subjected to the desired heat treating operation in a conventional manner.

By way of example, in order to illustrate a heat treating process of the type intended to harden the member 5, it will be assumed that the housing 7 and blade assembly 9 are made of annealed S. A. E. 4130 or S. A. E. 4140 steel, and it is desired to harden the same. The member 5 is placed in a furnace, after being filled with the particulated metal 31, and then heated to, for example, 1575° and held there for one half hour with the particulated metal covering the blade assembly 9 as described. The effect of the particulated metal is to blanket the blade assembly, and thereby provide, in effect, an integral member 5, all of the parts of which will expand and contract a like amount and simultaneously. That is, the tendency of the thin sections of the blade assembly to heat up and expand faster than the housing 7 will be retarded or compensated for by the particulated metal, which covers the same, so that during the heating, the blade assembly 9 and the housing 7 will be heated at approximately the same rate, so that the expansion of both blade assembly and the housing will take place at the same rate and at the same time. Therefore no separating of the blade assembly from the housing, or breakage of the blade assembly joints will occur.

If, after the heating operation, the member 5 is to be quenched, for example in oil, to harden it, in accordance with the present invention this is done while the particulated metal 31 is still covering the blade assembly. Here again the particulated metal will cause the thin-sectioned blade assembly and the heavy-sectioned housing 7 to cool at substantially the same rate so that the contraction of both the blade assembly and the housing will take place simultaneously and

at the same rate, so that no buckling, separating, or other injury will occur. After the member 5 has been quenched, and if it is desired, for example, to draw the hardness of the same, the particulated metal 31 which has been covered by the quenching liquid is removed from the housing and clean particulated metal is placed therein so as to again cover the blade assembly. The entire clutch member 5 can then be placed in a furnace and heated for an appropriate length of time at approximately 900° to 1000° F., for the particular metal specified by way of example, so as to draw the same, and the particulated metal will again form the same function as described above. After this drawing operation, and the ensuing cooling operation is completed, the particulated metal is removed.

The heat treating operation has thus been completed without deforming, cracking, separating, or otherwise injuring either the blade assembly or the housing 7. The heat treating operation is thus performed easily and efficiently and a finished heat treated metal article is produced which will not require reworking and which will not be distorted or otherwise injured.

It will thus be seen that a heat treating method has been devised which is simple, inexpensive and relatively efficient, and which will produce finished heat treated metal articles of the type described in a much more satisfactory and efficient manner than heretofore known in the art.

I claim:

1. In the heat treatment of a metal article including a relatively thin-sectioned member confined against expansion or contraction by a relatively heavy-sectioned member, the steps of covering the thin-sectioned member with metal particles of such a size and type that the members will expand and contract substantially simultaneously and substantially the same amount, heating the metal article to a predetermined temperature while so covered, cooling the article while so covered, and then removing the particulated metal from said article.

2. In the heat treatment of a metal article including a relatively thin-sectioned member confined against expansion or contraction by a relatively heavy-sectioned member, the steps of covering the thin-sectioned member with metal particles of such a size and type that the members will expand and contract substantially simultaneously and substantially the same amount, heating the metal article to a predetermined temperature with the particulated metal still covering the thin-sectioned member, quenching the metal article with the particulated metal still covering the thin-sectioned member, and then removing the particulated metal from said article.

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