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PROCESS FOR SECURING TWO MEMBERS ONE WITHIN THE OTHER.

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Fig. 1.

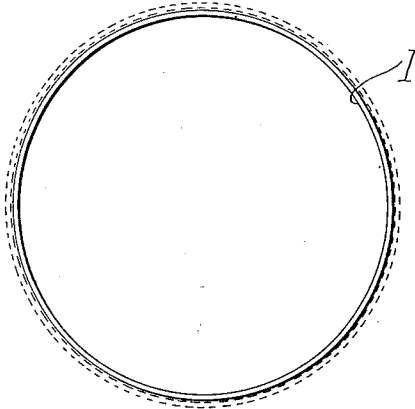


Fig. 2.

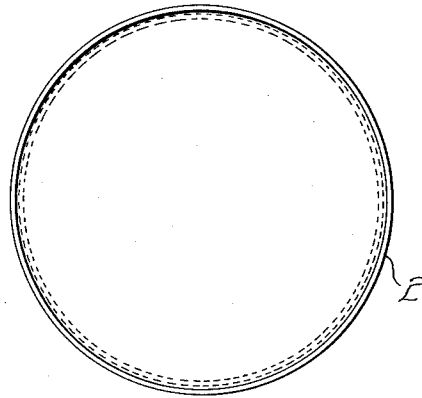


Fig. 3.

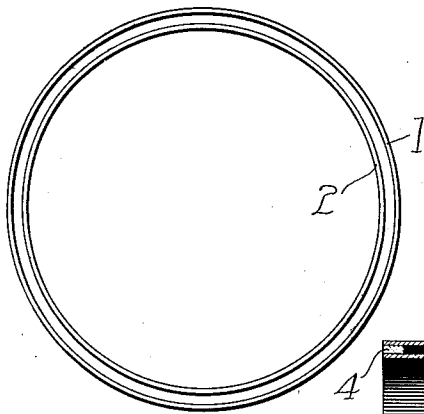


Fig. 4.

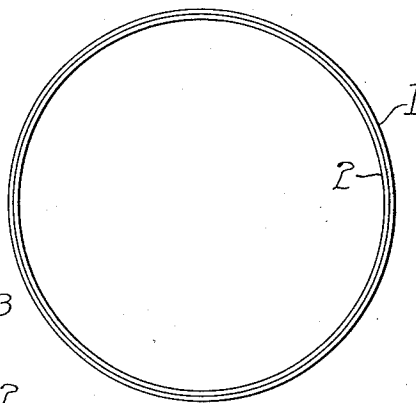
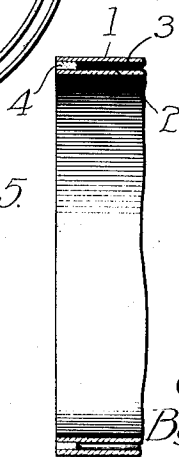


Fig. 5.



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PROCESS FOR SECURING TWO MEMBERS ONE WITHIN THE OTHER.

1,057,159.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, CHARLES P. MADSEN, a citizen of the United States of America, and a resident of Chicago, county of Cook, State of Illinois, have invented certain new and useful Improvements in Processes for Securing Two Members One Within the Other, of which the following is a specification.

For many purposes, it is desirable to firmly secure together in concentric relation two substantially cylindrical members, which will thereafter constitute a unit. Instances of this are the securing of two shells, one within the other, to have a space between them in which an electric heating element could be housed; securing a steel shell, to serve as a bearing, on a cast metal axle; securing a steel shell, to serve as a bearing, within a wheel; to secure the rim on a wheel, etc. Heretofore, this has been done either by expanding the one member by heat, and after placing the two members together, allowing the two members to become set through the contraction of the heated member as it cools, or taking the two members and forcing one upon the other. Either of these methods often possesses a serious objection, in that the joint of the two members is likely to be affected because of the members being always subject to temperature changes.

This invention has for its main object a new and improved method of firmly securing two substantially cylindrical members in concentric relation, so that the joint between them, after the members have once been set, will never become weakened or loosened through temperature changes in either or both of the members.

It is a well known physical law that the coefficients of expansion of the metals vary with their physical condition, being different for the same metal, according as it has been cast or hammered and rolled, hardened or annealed. It is also known that, as a general rule, operations which increase the density, increase also the rate of expansion, and operations which decrease the density, decrease also the rate of expansion.

I have found that if a piece of metal is

first subjected to a mechanical strain, and afterward heated, such mechanical strain will be relieved, and the metal will tend to substantially resume the condition which prevailed previous to receiving the mechanical strain. In carrying out my invention, I make use of these properties, and in the accompanying drawings are illustrated diagrammatically the various steps of my new and improved process, as applied to shells, although it will be readily understood that either of the members might be considerably thicker, or the inner member might be a solid.

Figure 1 shows in full and dotted outline the respective cross-sectional contours of the outer member before and after being mechanically expanded. Fig. 2 shows in full and dotted outline the respective cross-sectional contours of the inner member before and after being mechanically contracted. Fig. 3 shows the two members concentrically arranged after being mechanically reshaped. Fig. 4 shows the respective positions of the two members after heating, when it is intended to have them have a snug fit. Fig. 5 illustrates in transverse section the two members held apart by means of spacers.

In exemplifying this process, as shown in the drawings, two members, which are here shown as tubes or shells 1 and 2, are cut from the same steel tubing, or from steel tubing of slightly different sizes, but not sufficiently different to permit them to telescope. Before commencing the process, it may often be preferable to first take out all the mill strain from the members 1 and 2, which may be accomplished by annealing.

The shell or tube 1 which is to be the outer or larger member, is then operated upon for the purpose of altering its expansion characteristic. This is conveniently done by passing the member over a suitable sizing die, whereby its diameter is increased considerably (as indicated in Fig. 1), thereby placing upon the member an intense mechanical strain. The shell or tube 2, which is to serve as the inner or smaller member, is similarly treated, except that it is passed through a sizing die so as to decrease its size, as indicated in Fig. 2. These

two operations have the effect of respectively decreasing the density of one member and increasing the density of the other, and consequently altering the expansion coefficients of the members, as hereinbefore explained. The two members are then placed in concentric relation, and if they are to have an annular space 3 between them, as shown in Fig. 5, as for example, when they are to be used for such a purpose as the housing of an electric heating element, a spacer block 4 is placed between the members 1 and 2 at both ends. If the two members are to fit snugly together, as in Fig. 4, there is, of course, nothing placed between them.

With the members located in their concentric positions, as they are to be finally secured, heat is applied in any convenient and suitable manner, whereupon the mechanical strain of the two members is relieved. The density of the one member having been mechanically decreased, its rate of expansion is also decreased, and in fact, negated, since the member, upon being relieved of the mechanical strain by the application of heat, first tends to resume its normal shape and condition prior to its expansion. The density of the other member having been mechanically increased, the rate of expansion is greater than it would normally have been, and the member, when heated, tends to rapidly resume its initial shape and condition prior to contraction. It will thus be seen that the tendency of the two members is to act one against the other, whereby they become firmly set in their concentric positions, either against each other or against an intermediate member. By virtue of this concentric relation of these two members, which, prior to their treatment, were incapable of being telescoped, they can never actually resume their initial positions and conditions, but after having been relieved of the mechanical strain, will always act one against the other, in an attempt to approach their initial conditions, and reheating of the members will in no wise affect the joint nor can the members be separated without destroying either or both.

Although but one specific exemplification of this invention is herein shown and described, it will be readily understood that numerous other applications thereof may be made without departing from the spirit of this invention, as defined by the following claims.

I claim:—

1. The process of securing members one within the other, which consists in subjecting one of said members to mechanical strain so as to alter its physical condition, placing them one within the other, and heating the members so as to cause said

member to tend to resume its initial condition.

2. The process of securing members one within the other, which consists in mechanically altering their physical conditions, placing them one within the other, and heating the members so as to cause them to tend to resume their initial conditions.

3. The process of securing members one within the other which consists in straining said members mechanically, placing them one within the other, and relieving such strain by means of heat.

4. The process of securing members one within the other which consists in straining said members mechanically to respectively different extents, placing the members one within the other and relieving such strain by heat.

5. The process of securing members one within the other which consists in straining said members mechanically to respectively opposite extents, placing the members one within the other and relieving such strain by heat.

6. The process of securing members possessing substantially the same expansion characteristics one within the other, which consists in altering the expansion coefficients of said members, placing the members one within the other and heating them.

7. The process of securing members possessing substantially the same expansion characteristics one within the other, which consists in altering the expansion coefficients of said members to respectively different extents, placing the members one within the other and heating them.

8. The process of securing members having substantially the same normal density one within the other, which consists in mechanically altering the density of said members to respectively different extents, placing the members one within the other and heating them.

9. The process of securing a member on another, where the normal interior diameter of the one member is substantially less than the exterior diameter of the member upon which it is to be secured, which consists in mechanically expanding said one member, placing it upon said other member, and heating said one member.

10. The process of securing a member within another member, where the normal exterior diameter of the one member is substantially greater than the normal interior diameter of said other member, which consists in mechanically contracting said one member, placing it within said other member, and heating said one member.

11. The process of securing members normally incapable of being telescoped one within the other, which comprises mechani-

cally expanding one member and mechanically contracting the other, placing the members one within the other, and heating said members.

5 12. The process of securing members one within the other which consists in straining said members mechanically, placing them one within the other with spacing means

interposed at both ends, and relieving such strain by means of heat.

Signed at Chicago this 12th day of December 1911.

CHARLES P. MADSEN.

Witnesses:

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