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METHOD OF BONDING FERROUS AND NONFERROUS METALS

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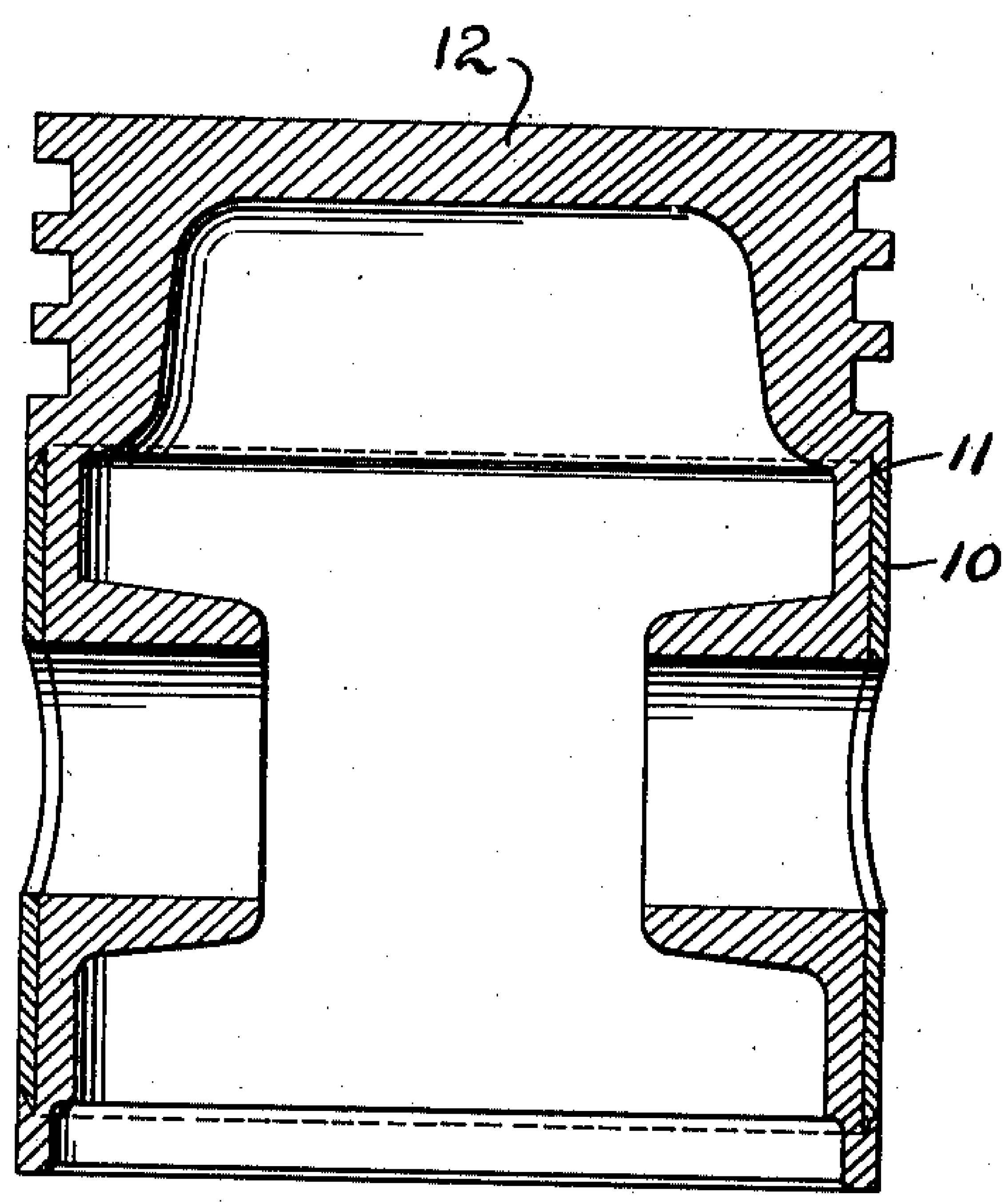

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METHOD OF BONDING FERROUS AND NON-FERROUS METALS

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3 Claims. (Cl. 22—204)

This invention relates to methods of bonding ferrous and non-ferrous metals, and more particularly to an improved process whereby a molecular bond and absolute union may be secured between aluminum, or an aluminum alloy, and iron or steel. While the invention is illustrated as applied to securing together a steel reinforcing sleeve and the body of an aluminum alloy piston, many other applications will be readily understood to exist. An important object of the invention, in addition to that inhering in the provision of such bonding process, resides in the provision of such an improved piston construction the ferrous and non-ferrous parts of which are so united, to form a rigid unit, that they cannot be loosened or separated, by subjection thereof to either physical abuse or wide changes of temperature.

Other objects and advantages will be apparent from the following description wherein reference is made to the accompanying drawing illustrating a preferred embodiment of my invention and wherein similar reference numerals designate similar parts throughout the several views.

In the drawing

The single figure represents in diametric cross section a trunk-type piston incorporating the principles of the invention.

Referring now to the drawing, and to the process in greater detail; the inside surface of the steel sleeve, as **10**, (or other ferrous surface with which the aluminum or aluminum alloy is to be bonded) may be left in unfinished condition, since the aluminum is poured, while molten, into engagement therewith, and takes the configuration of the ferrous surface. The exterior of the sleeve is of course machined or ground to the desired diameter, and its edges may be beveled, as at **11**, in order that they may project beneath a portion of the aluminum alloy piston body (**12**), after the parts are cast together, to provide a mechanical lock in the form of a dovetail joint. The sleeve is heated to approximately 850 degrees F., and then dipped in a bath of molten zinc, preferably of the variety sold commercially as Western Spelter, such bath being held at approximately 830 degrees F. The sleeve may or may not thereafter be allowed to cool, as desired, but in either event it is preferably preheated before insertion in the mold, to about 860 degrees F., such preheating being effected in a non-oxidizing oven to prevent oxidation of the zinc.

A permanent mold (unshown) is employed, the mold being preheated to approximately the same temperature as the iron or steel sleeve (860 degrees F.) and the molten aluminum alloy poured thereinto at a temperature of from 1280 to 1360 degrees F., depending upon its composition, after the sleeve is positioned in the mold.

A suitable alloy for pistons, and one which bonds exceedingly well, comprises

	Per cent
Al	78.
Cu	2.
Si	14.
Ni	2.20
Mg	1.60
Zn	1.20
Fe	1.
	100.00

Parts so bonded, and of physical proportions suitable for use, for example, in automobile engines, bond perfectly and cool sufficiently in from one to one and one-half minutes, although the cooling time must of course be somewhat increased if the work be more massive. The non-ferrous metal should be poured without allowing the sleeve to remain heated in normal or oxygen-containing atmosphere for a longer period than is necessary, in order that undue oxidation of the coated sleeve may be prevented.

I have found it to be important to employ a non-oxidizing or reducing oven in preheating the zinc-coated steel or iron, and such preheating is an important operation if reliable and uniform bonding is to be secured.

The Western Spelter employed contains as impurities approximately

Pb	1.60
Fe	.08
Cd	A trace

Although it has not been determined that the last element is necessary, equivalent results cannot be secured with pure zinc.

What I claim is:

1. The process of bonding a ferrous metal with a non-ferrous metal comprising at least partly aluminum, which comprises heating the ferrous metal to approximately 850 degrees F., dipping the ferrous metal in a molten bath comprising principally zinc but including small quantities of iron and lead, to coat the ferrous metal therewith, the bath being at a temperature of approximately 860 degrees F. while limiting access of oxygen thereto, and quickly thereafter pour-

ing the non-ferrous metal into engagement with the coated surface of the ferrous metal.

2. The process of bonding ferrous metal with a non-ferrous metal comprising at least partly aluminum, which comprises heating the ferrous metal to approximately 850 degrees F., coating the ferrous metal with a metal comprising principally zinc but including a small quantity of lead, heating the coated ferrous metal to a temperature of approximately 830 degrees F. while limiting access of oxygen to the coated surface, and quickly thereafter pouring the non-ferrous metal in molten condition into engagement with the ferrous metal.

3. The process of forming a composite piston of a ferrous metal and a non-ferrous metal comprising at least partly aluminum bonded thereto, which comprises heating a ferrous sleeve to approximately 850 degrees F. and dipping the same in molten metal comprising principally zinc but including a small quantity of iron, to provide a coating thereupon, heating the coated sleeve to approximately 860 degrees F. while restricting access of oxygen thereto, placing the sleeve in a mold heated to approximately the same temperature, and pouring the non-ferrous metal into the mold and sleeve to cast and bond such metal to the sleeve.

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