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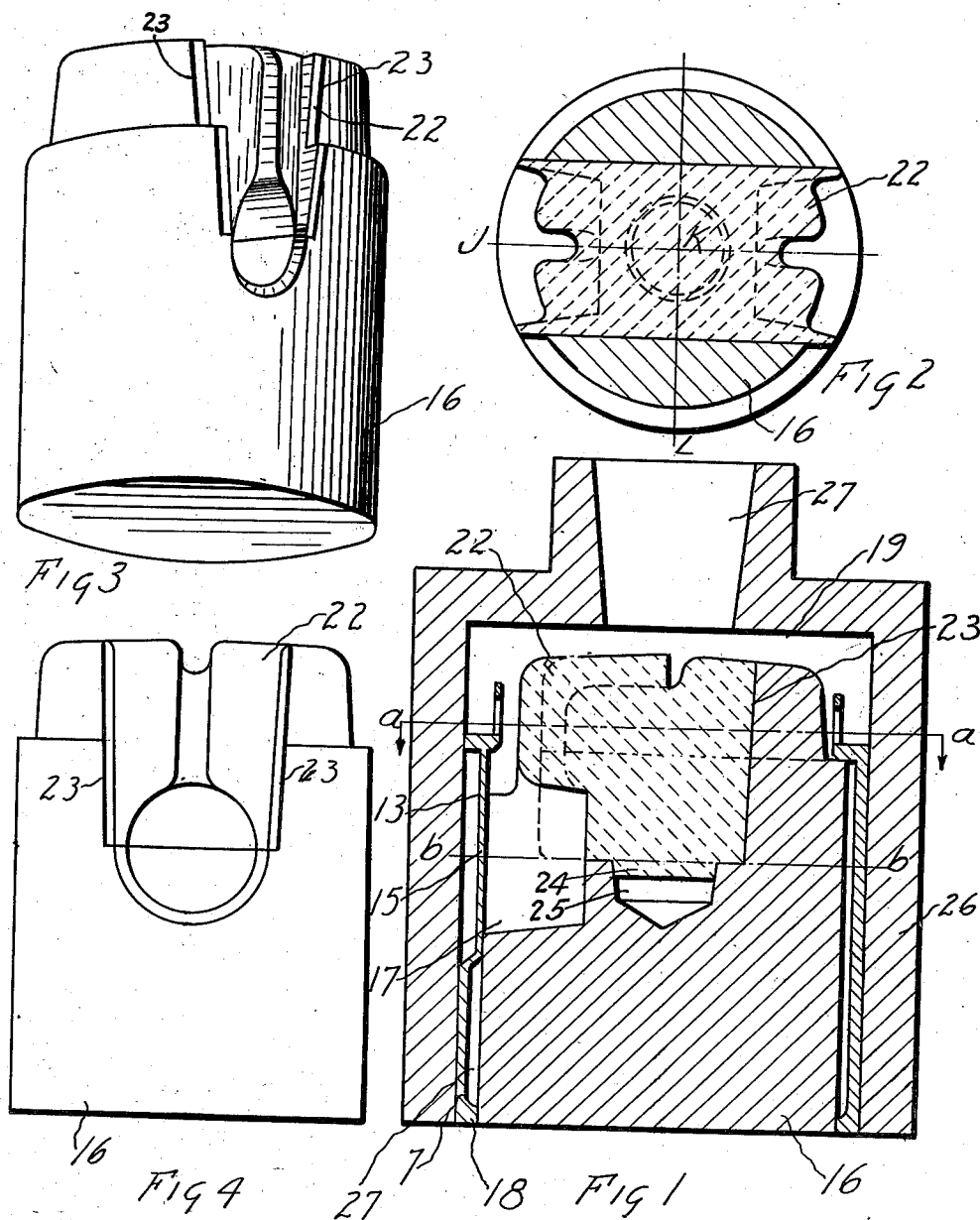
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2,076,971

PISTON MOLD

Filed May 26, 1930

2 Sheets-Sheet 1



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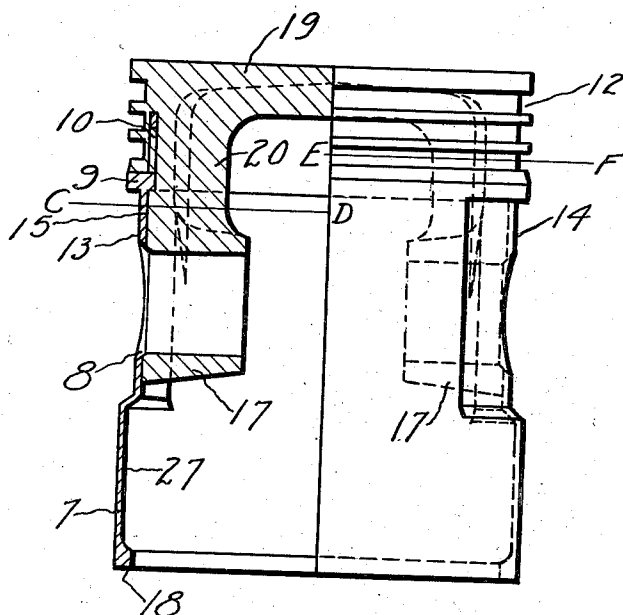


Fig 5

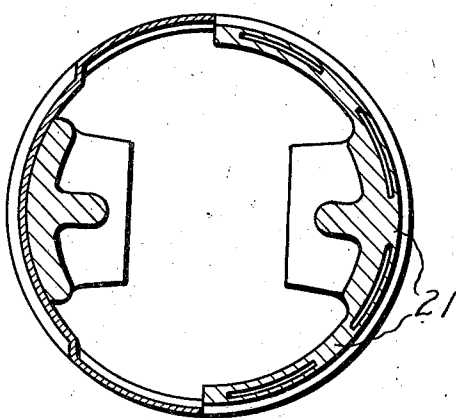


Fig 6

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2,076,971

PISTON MOLD

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4 Claims. (Cl. 22—126)

This invention relates generally to pistons for internal combustion engines, pumps and the like and is more particularly directed to methods and process of making bi-metallic pistons for same.

As examples of typical bi-metallic or so-called composite pistons, reference is made to the structures illustrated and described in Letters Patent Nos. 1,691,450 dated November 13, 1928 and 1,748,524 granted February 25, 1930, wherein, it will be observed, a skirt portion or shell is formed of a ferrous metal as cast iron, with a head having integral wrist pin bosses of an aluminum alloy cast thereon to complete the piston. These inventions disclose the head metal interlocked with the skirt or shell metal in such a way that separation of the two metals, even under the most severe operating conditions, is impossible. The permanent jointure of the light alloy and the ferrous metal is accomplished by embedding the upper part of the shell within the head-forming metal, the latter metal extending through the shell at a multiplicity of circumferential points, so that the two metals are mechanically tied as well as alloyed or united by fusion. The advantages of the employment of an aluminum alloy of a high degree of thermal conductivity for the formation of the head and wrist pin bosses, are self evident; also, those flowing from the use of a skirt which has the same coefficient of expansion as the metal constituting the wall of the cylinder upon which it bears and travels.

The present invention is directed to the provision of a simple, practical and economical method of producing bi-metallic pistons generally, especially such pistons falling within that category in which the head metal is cast upon a skirt of ferrous metal as referred to hereinbefore. It is well known that a piston composed of a combination of these two metals will embody characteristics which are inherent to each metal individually, the combination providing a structure which responds to the demands for a light weight piston which will resist the destructive rending and thermal forces to a degree whereby it will have a relatively long life.

It is also an object of this invention to provide a method of casting on the aluminum alloy head to the cast iron body through the use of a semi-permanent internal mold or core composed of a permanent portion such as might be formed of metal, and a portion of a plastic material such as might be formed of a core sand mixture. The advantages of this method of casting lie in forming a simple core easily inserted

and inexpensive which lends itself to the casting of any design of bi-metallic piston.

Other objects and advantages flowing from the utilization of our invention will doubtless present themselves as the description proceeds and we would have it clearly understood that we reserve unto ourselves all rights to the full range of equivalents, both in manner of practicing our method or process and in its use, to which we may be entitled under our invention, in its broadest aspect. For the purposes of the present disclosure, we have elected to describe certain preferred and alternative steps in the practicing of our method or process for making a bi-metallic piston of a particular form. However, as previously pointed out, this is not to be interpreted as a limitation of the scope of our invention, which may be followed with equal success in the manufacture of pistons of other designs to which it lends itself.

In the accompanying drawings, which are selected as illustrative of a type of piston which may be produced by the practicing of this invention:

Fig. 1 is a view in elevation, in section, taken along lines J—K—L of Fig. 2, of the shell of a piston of the type shown in the aforesaid Letters Patent No. 1,748,524 with the internal mold or core in place and the external mold in place.

Fig. 2 is a plan view, in section, taken on the line a—a of Fig. 1, of the internal mold.

Fig. 3 is a view in perspective, showing a plastic portion inserted in the permanent portion of the internal mold.

Fig. 4 is an elevation of the internal mold shown in Fig. 1.

Fig. 5 is a view in elevation, partly in section, of a type of piston which may be made by the practicing of this invention.

Fig. 6 is a plan in section taken at C—D—E—F on Fig. 5.

Referring now to the drawings in detail, in which like characters of reference are employed to designate similar parts in the several views used to illustrate the different steps or phases of our invention, the piston shown in Fig. 5 consists of cylindrical shell 7 diametrically apertured as at 8 to provide for the reception of the usual wrist pins. This shell may be of any suitable metal, preferably however, a ferrous metal and embodies a reduced or contracted portion at its upper end, which may be termed a shoulder, indicated at 9, which is perforated at 10, these openings being of any desired conformation. The head, which may be of any suitable

metal, preferably an aluminum alloy, is provided with the usual peripheral piston ring grooves 12.

The inset surfaces 13 and 14 have their inner 5 faces 15 contact the wall of internal mold 16 around wrist pin bosses 17, to form a seal to prevent the molten metal running into space 27 between the mold and the cylindrical shell 7.

Reinforcing ledge 18 serves as a guide for mold 10 16. Wrist pin bosses 17 dependent from and integral with the head 19, which are aligned with the shell openings 8, are connected by the diametrically disposed rib or web 20 which is integral with the head and bosses and serves as a reinforcement of the head structure as a whole. It 15 is understood that there may be one rib or multiple ribs, as the designer may prefer.

As will be manifest, the head forming metal is disposed upon the inner and outer surfaces of 20 the upper or shoulder end of the shell and fills the openings 10, which in the practicing of our invention provide one of the media through which the molten metal enters from the outside of the shell to the interior thereof for disposition as 25 stated. When the head metal sets, the metal within the openings 10 will conform to the contour of these openings and provide a plurality of radially disposed nubs or shanks connecting the inner and outer surfaces of the head metal, as 30 shown at 21 in Fig. 6.

From the foregoing it will be manifest that in order to obtain the advantages flowing from a bi-metallic piston of the general structure described, that is the interlocking, mechanically and 35 by fusion of the metals, as well as the lightness in weight, with the retention of the inherent characteristics of the two metals employed, a method or process of accomplishing a positive jointure of the two metals in approximately the form the 40 piston will take when completed, must be followed. Such a method, in addition to insuring uniform production, must be of a character whereby it may be economically practiced and one method that we have found that responds to 45 these requirements is through the use of a permanent mold with inserts composed of plastic material suitable for such cores.

For so-called permanent mold or die-casting, a metal mold 16 is provided and to allow it to 50 be withdrawn from the shell after the head section 19 is cast upon the shell, an insert of plastic material as for example a granular material like green sand or a gypsum material like plaster of Paris such as shown at 22 is provided, which will 55 in this instance core out under wrist pin bosses 17 and head section 19. In practice we have found that it is preferable to taper the sides as shown at 23. Pilot 24 on insert 22 is fitted into hole 25 of core 16 to centralize the insert with the core. 60 At 26 is indicated the outer mold proper such as might be formed of metal, with gate 27 to allow the molten metal to be poured into the mold and around the insert and upper end of the core section and into the wrist pin boss 65 recesses.

In the production of a piston, the shell is positioned within the female or outer mold, the sections of which are locked together, after which the internal mold with inserts in place, is positioned within the shell so that the wrist pin boss 70 recesses 17 are adjacent the inset surfaces 13 and 14; the surface of the core 16 contacting the inner side of inset surfaces at 15 and ledge 18. The

complete assembly is then ready for the conventional molding operation, the head metal entering through the outer mold at any suitable point or points, as in the head as shown at 27. As 5 hereinbefore mentioned, insert 22 may be made of a plurality of pieces or otherwise in place of the single piece construction shown. Preferably the shell is preheated to provide for a more uniform flow of the head metal. At such time after casting as the head metal has set to a solid state, 10 the core is withdrawn from the shell, and the outer mold is unclamped and removed. In removing the internal core, the insert 22 is retained in the head until such time as this insert is broken into pieces small enough for removal. It 15 is manifest therefore, that there will be a plastic or similar insert used for each piston produced. However, core 16 and mold 26 are used indefinitely.

Other methods of making die-cast or permanent 20 mold pistons disclose the use of multiple metal cores to enable the withdrawal of the cores from recesses after casting. This results in expensive mold costs and casting difficulties. Our construction of a combination core simplifies the making of the core and facilitates its location for 25 casting and its withdrawal after casting, the recessed surfaces in the head metal being formed by the use of the plastic inserts as described.

It is therefore manifest that the object of this 30 invention is to provide a semi-permanent mold combining a metal core and plastic inserts located at such parts of the interior of the piston which are recessed and which recesses could not be formed to allow the withdrawal of a one-piece 35 permanent mold.

We claim:

1. An internal mold for use in casting the head of a bi-metallic piston upon the shell thereof, comprising a permanent portion of metal having 40 a transversely disposed centrally located recess and a plastic material removably inserted between the spaced walls of said recess to complete said mold.

2. An internal mold for use in casting the head 45 and integral wrist pin bosses of a bi-metallic piston upon the shell thereof, comprising a permanent portion of metal having a diametrically disposed slot, the base of which is shaped to form the lower half of each of the opposite wrist 50 pin bosses of the piston and a plastic material insert mating with the defining surfaces of said slot and shaped to form the upper halves of the respective wrist pin bosses.

3. An internal mold for use in the casting of 55 the head and integral wrist pin bosses of a bi-metallic piston upon the shell thereof, comprising a permanent portion of metal having a bisecting slot extending from the head to the axis of the wrist pin bosses of the piston, and a plastic material insert mating with the defining surfaces of 60 said slot and shaped to form with the permanent portion the contour of the wrist pin bosses.

4. An internal mold for use in the casting of 65 the head and internal wrist pin bosses of a bi-metallic piston upon the shell thereof, comprising a permanent portion of metal having a cleaving recess extending from the head to the axis of the wrist pin bosses of the piston, and a plastic material removably inserted between the spaced walls 70 of said recess to complete said mold.

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