May 28, 1968 T. A. HOOK ETAL 3,385,466

MEANS FOR CLOSING CORE PIN HOLES

Original Filed Sept. 29, 1964

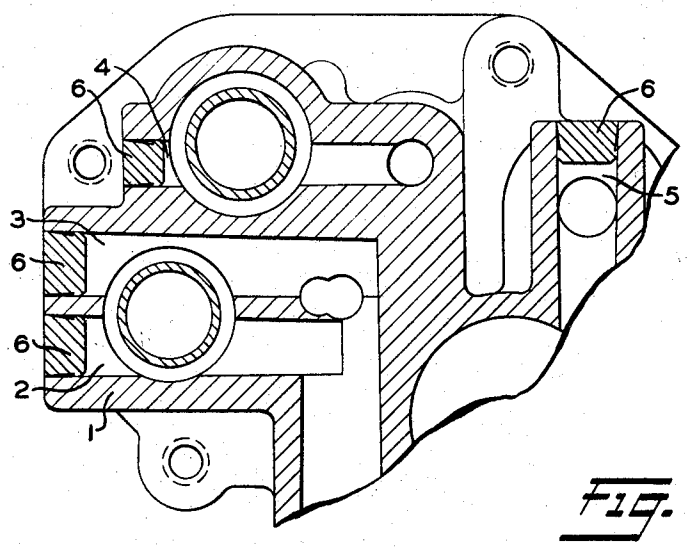


Fig. 1

Fig. 2

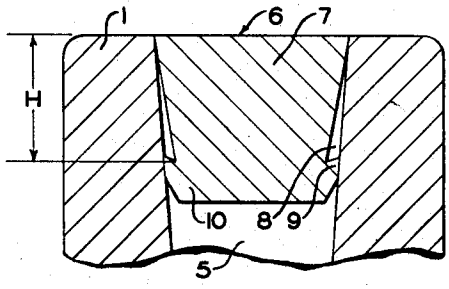


Fig. 3

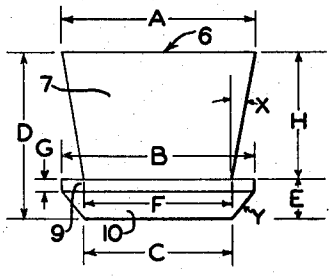
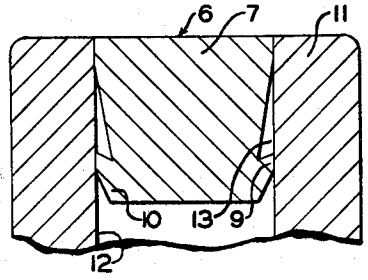


Fig. 4



INVENTOR.
THOMAS A. HOOK
DALE A. CHOVAN
A. A. Steinmeier
ATTORNEY

United States Patent Office 3,385,466 Patented May 28, 1968

3,385,466

MEANS FOR CLOSING CORE PIN HOLES

Thomas A. Hook, Silver Spring, Md., and Dale A. Chovan, Trafford, Pa., assignors to Westinghouse Air Brake Company, Wilmerding, Pa., a corporation of Pennsylvania

Original application Sept. 29, 1964, Ser. No. 400,050, now Patent No. 3,325,891, dated June 20, 1967. Divided and this application Dec. 19, 1966, Ser. No. 602,747

7 Claims. (Cl. 220—24)

ABSTRACT OF THE DISCLOSURE

A metallic plug, for closing a core pin hole in a die casting, having two truncated cone portions of unequal length which are integrally joined in tandem relationship with the larger diameter end of the shorter truncated cone portion adjacent the smaller diameter end of the longer truncated cone portion, the larger diameter of the two cone portions being substantially the same.

The present application is a division of our prior copending application, Ser. No. 400,050, filed Sept. 29, 1964, now Patent 3,325,891 issued June 20, 1967, and assigned to the assignee of the present application.

Die castings are made by forcing molten metal under pressure into molds, and often it is necessary that the casting be provided with internal passageways. In order to provide these internal passageways in a die casting, the mold, which is usually made in a plurality of sections, is provided with one or more tapered or uniform diameter core pins for each passageway. Each core pin is integral with and carried by a corresponding section of the mold. When the several sections comprising the mold are assembled, these core pins extend from the inside walls of the mold into the interior thereof to form in the die casting, when molten metal is forced under pressure into the mold, the desired passageways. Subsequent to the cooling and solidifying of the molten metal in the mold, the various sections of the mold may then be disassembled to remove the die casting from the mold. As each section is disassembled, the core pin or pins carried by the respective section are withdrawn from the corresponding core pin holes in the die casting.

The exterior end of each core pin hole in the die casting, subsequent to removal of the casting from its mold, must be closed in some suitable manner to prevent leakage of fluid under pressure from the corresponding passageway in the die casting to the exterior thereof, or if the interior of two intersecting core pin holes are to form two separate interior passageways in the die casting, some suitable means must be used to close communication between the two intersecting core pin holes.

Heretofore, one method used to close these core pin holes in a die casting has been to ream the core pin holes to a given diameter and depth, and thereafter drive a pin or cylindrical plug of uniform diameter into the reamed hole, the interior of which has been previously painted with red oxide paint, to close it with a tight fit provided by interference and thereby prevent leakage of fluid under pressure from the passageway within the die casting to the exterior thereof. While the plugging of core pin holes in this manner under some circumstances is satisfactory, the reaming operation is costly and time consuming.

Accordingly, it is the general purpose of this invention to provide a novel, simple and relatively inexpensive method and means of closing core pin holes in die castings, subsequent to removal of the casting from the mold

in which it was cast, without the necessity for costly reaming operations.

According to the present invention, there is provided a tapered malleable metallic plug having a truncated cone-shaped end which, when the plug is coated with anaerobic sealant and subsequently driven into a core pin hole, either tapered or of uniform diameter formed in a die casting, deforms, and in cooperation with the anaerobic sealant, when hardened in the microscopic depressions in the surfaces of the hole and plug, retains the plug in the hole against removal by vibrational or other forces and prevents leakage of fluid under pressure from the interior of the die casting to the exterior thereof.

In the accompanying drawings:

FIG. 1 is a horizontal cross-sectional view of a typical die casting having a plurality of core pin holes which are closed and sealed by tapered plugs embodying the present invention.

FIG. 2 is a cross-sectional view, on an enlarged scale, showing a fragment of the die casting shown in FIG. 1, in which a tapered plug is shown forced in place in a corresponding tapered core pin hole in the die casting.

FIG. 3 is an elevational view, on an enlarged scale, showing details of construction of the tapered plug used in the present invention.

FIG. 4 is a cross-sectional view, on an enlarged scale, showing a fragment of a die casting in which the tapered plug shown in FIG. 3 is shown forced in place in a corresponding core pin hole of uniform diameter in the die casting.

Description

FIG. 1 of the drawing shows a portion of a die casting **1** having therein four passageways **2**, **3**, **4** and **5**. These passageways are provided in the die casting **1** by means of tapered core pins. These core pins are removably held in the proper place in a mold into which molten metal is forced under pressure to form the die casting **1** and extend inward to the interior of the mold. The mold is usually made in two or more parts or sections which may be removed, one at a time, subsequent to the molten metal solidifying and cooling. The core pin or pins, which are integral with and extend inward from any section of the mold, are withdrawn from the corresponding core pin hole in the die casting **1** upon removal of the section of the mold from about the casting.

Subsequent to removal of the die casting **1** from the mold in which it was cast, it is necessary that the exterior end of the tapered core pin holes or passageways **2**, **3**, **4** and **5** be closed to prevent leakage of fluid under pressure from these passageways to the exterior of the die casting.

According to the invention, the exterior end of each of the four tapered core pin holes in the die casting **1**, shown in FIG. 1 of the drawing, is closed by a tapered plug **6**, constructed as shown in FIG. 3, of suitable malleable metal, such as aluminum or aluminum alloy. As shown in FIG. 3, the tapered plug **6** comprises a first inverted truncated cone-shaped portion **7**, the diameter of the larger end of which is indicated in FIG. 3 by the letter A, and the length of which is indicated by the letter H. This diameter A should be slightly less, for example, .003 inch, than the nominal diameter of the outer end of the corresponding tapered core pin hole, since the diameter of the outer end of the core pin hole may vary and be as much as .005 inch greater than or .005 inch less than the nominal diameter. The length H of the inverted cone-shaped portion **7** may vary, for example, from .250 inch to .300 inch.

The angle formed between the altitude and slant height

of the truncated cone portion **7** is small, and may vary, for example, from 2°54′ to 3°48′. This angle is indicated by the letter X in FIG. 3 and should be greater than the angle of taper of the corresponding core pin hole in order to provide, when the plug **6** is inserted into the tapered core pin hole, an annular chamber, indicated in FIG. 2 of the drawing by the numeral **8**, between the outside surface of the truncated portion **7** and the wall surface of the tapered core pin hole.

Formed integral with the lower end of the inverted cone-shaped portion **7** is a second inverted truncated cone portion **10**, having at its larger diameter end a short flat surface or cylindrical portion **9**, the diameter of which is indicated by the letter B in FIG. 3 and is only slightly, for example, from .001 inch to .003 inch, less than the diameter of the outer or larger end of the corresponding tapered core pin hole that is to be closed by the plug **6**. Furthermore the diameter of the short cylindrical portion **9** must be greater than the diameter of the corresponding tapered core pin hole at a distance from the top of the tapered core pin hole in the die casting equal to the height H of the first inverted cone-shaped portion **7** by, for example, .003 inch. The angle of taper formed between the length or altitude and slant height of the truncated cone portion **10** may be, for example, 20°. This angle is indicated in FIG. 3 by the letter Y.

In order to illustrate the proper dimensions of plugs for closing the open end of both tapered and uniform diameter core pin holes of different sizes, the following table is given by way of example, it being understood that the letters in the table refer to the corresponding letters in FIG. 3 of the drawings.

Uniform Diameter Core Pin Hole Size	Tapered Core Pin Hole Size (Outer End)	A	B	C	D	E	F	G	H	X°	Y°
.368″	.375″	.372″	.374″	.336″	.3125″	.0625″	.344″	.010″	.250″	3.8°	20°
.493″	.500″	.497″	.499″	.461″	.3125″	.0625″	.469″	.010″	.250″	3.5°	20°
.587″	.594″	.591″	.591″	.553″	.375″	.075″	.561″	.010″	.300″	2.9°	20°

When using a plug **6** to close the open end of a tapered core pin hole, a plug is selected from the above table, the dimensions of which correspond to the diameter of the outer end of the tapered core pin hole to be closed by the plug.

The selected plug is first coated with a suitable anaerobic sealant, available commercially.

Next, the inverted truncated cone portion **10** of the plug is inserted in the open outer end of the tapered core pin hole in the die casting **1** that is to be closed by the plug.

Thereafter, a force is applied to the upper end of the truncated portion **7** of the plug **6**, as by tapping with a hammer, to force the plug **6** downwardly until it occupies the position shown in FIG. 2 in which the upper end of the truncated cone portion **7** is flush with the top of the die casting **1**. Since the plug **6** is made of a malleable metal, the periphery of the short cylindrical portion **9** and the upper outer edge of the inverted truncated cone portion **10** of the plug **6** will be deformed or bent upward into the chamber **8** as the plug **6** is forced downward to the position shown in FIG. 2 due to the taper in the core pin hole. Furthermore, as the result of this upward bending, the remainder of the chamber **8** will be filled and compacted with the anaerobic sealant with which the outer surface of the plug **6** was coated prior to inserting the inverted truncated cone-shaped portion **10** into the open end of the tapered core pin hole.

The anaerobic sealant, which now fills the chamber **8**, has the characteristic of automatically hardening, when once confined between close-fitting metal parts where it lacks contact with the atmosphere, into a tough solid in a few hours at room temperature. The surface roughness of the metal parts, plug **6** and die casting **1**, provides anchors for the hardened anaerobic sealant. Thus, the plug **6** is "keyed" to the inside wall surface of the tapered core pin hole to prevent relative movement between the plug **6** and the die casting **1**. Consequently, after the anaerobic sealant in the chamber **8** has hardened, the plug **6** cannot be removed from the core pin hole into which it was previously driven. Furthermore, the hardened anaerobic sealant, together with the inwardly bent, short cylindrical portion **9** and inverted truncated cone-shaped portion **10**, prevents leakage of fluid under pressure from the corresponding passageway within the die casting **1** past the plug **6** to the exterior thereof. Thus, the plug **6** when coated with an anaerobic sealant and subsequently driven into the open end of a tapered core pin hole, provides a simple, low cost, and effective means of closing the open end of the core pin hole and preventing leakage of fluid under pressure from within a die casting to the exterior thereof.

FIG. 4 of the drawings shows a fragment of a die casting **11** having a core pin hole **12** of uniform diameter closed by a tapered plug, such as the tapered plug **6** shown in FIG. 3.

When using a plug **6** to close the open end of the core pin hole **12** of uniform diameter, a plug is selected from the hereinbefore-mentioned table, the dimension B of which plug must be .007 inch greater than the uniform diameter of the core pin hole to be closed by the plug selected in order that the short cylindrical portion **9** of this plug is deformed or bent upward when the plug is forced into the core pin hole of uniform diameter.

The selected plug is first coated with a suitable anaerobic sealant, available commercially.

Next, the inverted cone portion **10** of the plug is inserted in the open outer end of the core pin hole **12** of uniform diameter in the die casting **11**.

Thereafter, a force is applied to the upper end of the truncated cone portion **7** of the plug, as by tapping with a hammer, to force the plug downwardly until it occupies the position shown in FIG. 4, in which the upper end of the truncated cone portion **7** is flush with the top of the die casting **11**.

As hereinbefore explained, the periphery of the short cylindrical portion **9** and the upper outer edge of the inverted truncated cone portion **10** of the plug will be deformed or bent upwardly as the plug is forced downwardly, since it will be understood that the diameter of the larger diameter end of the inverted truncated cone portion **10** of the plug selected to close the core pin hole **12** is greater than the uniform diameter of this core pin hole.

Furthermore, it will be understood that a chamber **13**, which corresponds to the chamber **8** shown in FIG. 2, is likewise filled and compacted with the anaerobic sealant which hardens into a tough solid to "key" the plug to the inside wall surface of the core pin hole **12** to prevent relative movement between the plug and the die casting **11**. Consequently, after the anaerobic sealant in the chamber **13** has hardened, the plug cannot be removed from the core pin hole **12** of uniform diameter for the same reasons that the plug shown in FIG. 2 cannot be removed from its corresponding tapered core pin hole. Accordingly, it is apparent that the plug provided by the present invention is equally suitable for closing tapered core pin holes or core pin holes of uniform diameter.

Having now described the invention, what we claim as new and desire to secure by Letters Patent, is:

1. A plug comprising:

(a) a first truncated cone portion, and

(b) a second truncated cone portion,

(c) said first truncated cone portion and said second truncated cone portion being coaxially joined in

tandem relationship with the larger diameter end of said second truncated cone portion adjacent the smaller diameter end of said first truncated cone portion, and

(d) said second truncated cone portion having at its larger diameter a cylindrical surface which is relatively short in length as compared to the length of said second truncated cone portion.

2. A plug comprising:

(a) a first truncated cone portion, and

(b) a second truncated cone portion,

(c) said first truncated cone portion and said second truncated cone portion being integrally joined in tandem relationship with the larger diameter end of said second truncated cone portion adjacent the smaller diameter end of said first truncated cone portion, said cone portions being characterized in that for the larger diameter of the first truncated cone portion in the range of .372 inch to .591 inch, the angle of taper on said first truncated cone portion is in the range of 2°54′ to 3°48′, and in that the angle of taper on said second truncated cone portion is always 20°.

3. A plug comprising:

(a) a first truncated cone portion, and

(b) a second truncated cone portion,

(c) said first truncated cone portion and said second truncated cone portion being integrally joined in tandem relationship with the larger diameter end of said second truncated cone portion adjacent the smaller diameter end of said first truncated cone portion, said cone portions being characterized in that the larger diameter of said first truncated cone portion and the larger diameter of said second truncated cone portion are substantially identical, and in that the smaller diameter of said first truncated cone portion is approximately .008 inch greater than the smaller diameter of said second truncated cone portion.

4. A plug for closing a tapered core pin hole in a casting, said plug comprising:

(a) a first truncated cone portion, and

(b) a second truncated cone portion integrally joined in tandem relationship with the larger diameter end of said second truncated cone portion adjacent the smaller diameter end of said first truncated cone portion, characterized in that the larger diameter of said first truncated cone portion is of the order of .003 inch less than the diameter of the outer end of the tapered core pin hole and the larger diameter of said second truncated cone portion is of the order of .003 inch greater than the diameter of the tapered core pin hole at a depth substantially equal to the length of said first truncated cone portion.

5. A plug for closing a tapered core pin hole in a casting, said plug comprising:

(a) a first truncated cone portion, and

(b) a second truncated cone portion integrally joined in tandem relationship with the larger diameter end of said second truncated cone portion adjacent the smaller diameter end of said first truncated cone portion,

(c) said plug being characterized in that the larger diameter of said first truncated cone portion is of the order of .003 inch less than the diameter of the outer end of the tapered core pin hole and the larger diameter of said second truncated cone portion is of the order of .003 inch greater than the diameter of the tapered core pin hole at a depth substantially equal to eighty percent of the over-all length of said plug.

6. In combination:

(a) a casting having an inwardly tapered core pin hole, and

(b) a plug for closing said core pin hole, said plug comprising:

(i) a first truncated cone portion, and

(ii) a second truncated cone portion integrally joined in tandem relationship with the larger diameter end of said second truncated cone portion adjacent the smaller diameter end of said first truncated cone portion,

(c) said cone portions being characterized in that the larger diameter end of said first truncated cone portion is of the order of .003 inch less than the diameter of the outer end of the tapered core pin hole and the larger diameter end of said second truncated cone portion is of the order of .003 inch greater than the diameter of the tapered core pin hole at a depth substantially equal to the length of said first truncated cone portion.

7. A plug for closing a core pin hole of uniform diameter in a casting, said plug comprising:

(a) a first truncated cone portion, and

(b) a second truncated cone portion integrally joined in tandem relationship with the larger diameter end of said second truncated cone portion adjacent the smaller diameter end of said first truncated cone portion,

(c) said cone portions being characterized in that the larger diameter end of said first truncated cone portion is of the order of .004 inch larger than the diameter of the core pin hole, and in that the larger diameter end of said second truncated cone portion is at least .004 inch larger than the diameter of the core pin hole.

References Cited

UNITED STATES PATENTS

2,657,817 11/1953 Alvear ---------- 215—47

FOREIGN PATENTS

741,448 12/1955 Great Britain.

THERON E. CONDON, *Primary Examiner.*

JAMES B. MARBERT, *Examiner.*