Nov. 5, 1957 A. F. BAUER 2,811,761

SPLIT DIES PROVIDED WITH COOLING MEANS

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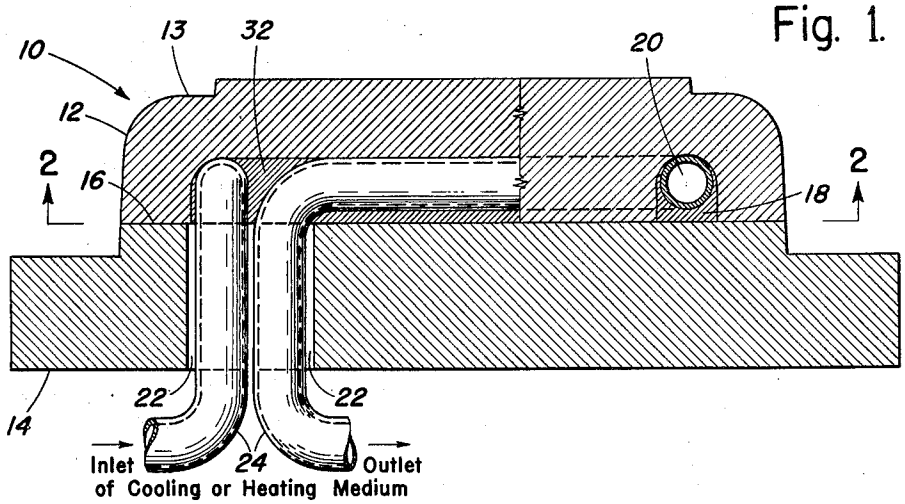
Fig. 1.



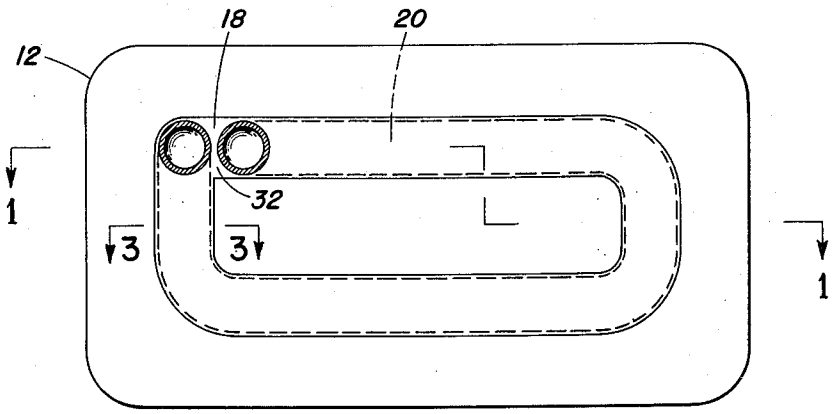


Fig. 2.

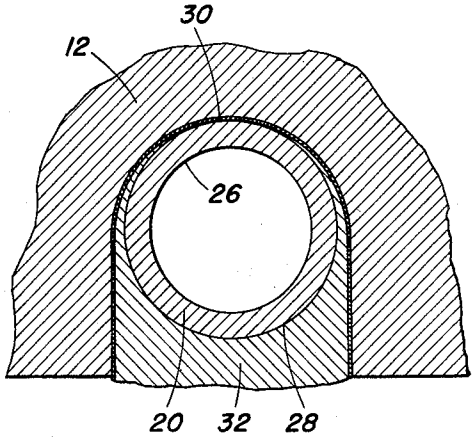


Fig. 3.

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SPLIT DIES PROVIDED WITH COOLING MEANS

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2 Claims. (Cl. 22—203)

This invention relates to means for cooling dies. More specifically, it relates to a novel construction for the indirect cooling of large die surfaces.

In the die casting art it is recognized that difficulties are likely to be encountered in removing heat from the dies used in the casting operation. In order to obtain efficient and economical operation of die casting apparatus it is necessary that the heat derived from the molten metal be carried away from the cast piece and also away from the die itself at a rapid rate. It is known to provide passages in the die bodies and to directly pass cooling fluids through said passages. The die steel, however, has been subject to shock caused by the direct contact of cooling fluids such as water. The effect of such shock is to create fatigue cracks and spalling which obviously greatly reduce the useful life of the die steel. Moreover, when a crack occurs which extends to the inside or casting surface of the die member, the die must be discarded since leakage of the cooling fluid into the interior of the die section obviously would make the casting operation impossible.

An object of the instant invention, therefore, is to provide a novel die construction which provides for indirect cooling of the die steel. Another object is to provide a die construction having means for conducting cooling fluids therethrough. Another object is to provide a die construction which will give long life and which will permit utilization of the die even though cracks do occur in the casting surface of the die itself. These and other objects will become apparent from the following more complete description of the invention and from the drawings.

Broadly, this invention is directed to a die construction comprising a die member having an inner face which possesses configuration of the article to be cast, and an outer surface, a passage cut through said outer surface, a conducting member positioned in said passage, at least part of the external shape of said conducting member possessing similar configuration to said passage and being directly bonded thereto, and a filler member portion present in that part of the passage not occupied by said conducting member.

Fig. 1, Fig. 2 and Fig. 3 are presented in order to more clearly show the details of construction of the instant invention. Fig. 1 is a schematic representation of a typical die construction according to this invention.

Fig. 2 is a cut-away portion of the upper section of a typical split die construction along line 2—2 of Fig. 1, and shows in greater detail the central elements of the conducting portion of the die construction.

Fig. 3 shows that section along lines 3—3 of Fig. 2.

Considering now Fig. 1, there is shown a typical die construction **10**. According to this invention the die itself is split into two sections **12** and **14** and is generally split along line **16**. The face **13** of the die **10** possesses at least part of the configuration of the article to be cast. Obviously at least one other die would be necessary to form the complete die. A passage **18** is provided in

section **12** and opens generally along the splitting line **16**. A conducting member **20** is positioned in passage **18** and generally makes contact with the wall surface of the passage. This construction is shown in more detail in Fig. 2. Outlet passage **22** is provided in the other section of the split die so as to permit an extension of the conducting member **20** to pass therethrough and permit inlet and outlet means such as shown generally at **24**.

In Fig. 3 the conducting member **20** is shown having an inner face **26** and an outer surface **28**. The generally hollow construction of the conducting member permits the transfer and flow of fluid media whereby cooling of the die member may be accomplished. Obviously the instant construction could also be employed to heat the die construction if such were desirable. The outer surface **28** of the conducting tube at least partially conforms to the contour **30** of the passage **18** and is positioned closely thereto. That portion of the passage which is not occupied by the conducting tube **20** is filled with appropriate filler metal **32**.

According to the instant invention a passage is cut into the die steel at the selected distance from the die surface. This groove can be regular or irregular in its plane view, but would by necessity have to approximate the shape of at least part of the cooling tube. The tube material may be of any suitable material of construction as commonly employed for conducting heat. Copper or various alloys could be used for this purpose.

The method of applying the tube is as follows: First, the groove is definitely patterned so that a channel can be milled or cut into the one die portion. This channel would be accurate in its cross section contour to accommodate the prescribed tube. After milling and polishing the channel, so cut in the steel die outer surface, the interior of the channel is tinned. This tinning can be done with any suitable alloy that will wet the surface. In the instant case a soft solder medium was suitably employed. Likewise, the external surface of the tube after it has been formed to fit into the cut channel is tinned with the same tinning medium as the steel. The tube is then positioned into the channel. This may conveniently be done with a hammer using a wood block to be sure that the contact between the two tinned surfaces is as complete as possible. Next the entire unit, both the die steel and the copper tube in its position, is heated. This heating actually melts the two tinned media and by capillary action the parts solder together. This bond is not considered complete. An alloy is poured into the void area around the tube so that the dies' channel is completely filled. The excess is machined off flush with the mating surfaces of the two die casting die portions. In one instance the filler used was a zinc alloy; however, it is conceivable that any heat conducting alloy could be used for this purpose.

Substantially any fluid having heat transfer properties may be employed as a cooling medium. Because it is readily available and easily handled, it is preferred to use water for this job. However, it is to be recognized that many other fluids could be satisfactorily employed.

There are likewise many bonding and filler materials which could be employed, according to the instant invention. It is necessary that the bonding material be compatible with the material of which the die is constructed and also the material of which the cooling tube is constructed. Obviously materials of construction should be employed which do not melt at the temperatures which the die members normally reach when in use.

By the foregoing description and drawings there has been described a novel die construction which can be successfully employed particularly in the production of large size castings. The life of dies constructed accord-

ing to the invention is substantially greater than those previously employed in the past and it has been found possible to continue using dies of this type for substantial periods of time even after cracks may have formed which extend to the casting surface itself.

While this invention has been described and illustrated by the foregoing description and drawings, it is not intended to be strictly limited thereto and other modifications and variations may be employed within the scope of the following claims.

I claim:

1. A split die of the class herein described comprising two members of substantial thickness, said members being united and in contact throughout their substantial entirety along a pair of matching interior faces and having casting faces possessing the general configuration of an article to be cast, the matching face of one section having a passage cut therethrough, a tubular member positioned in said passage, part of the external shape of said tubular member conforming to the contour of said passage and being directly bonded thereto, and a filler metal present in that part of the passage not occupied by said tubular member.

2. A split die of the class herein described comprising

two members of substantial thickness, an upper member and a lower member, said members being united and in contact throughout their substantial entirety along a pair of matching interior faces and having casting faces possessing the general configuration of an article to be cast, the matching face of said upper member having a passage cut therethrough, a tubular member positioned in said passage, part of the external shape of said tubular member conforming to the contour of said passage and being directly bonded thereto, a filler metal being present in that part of the passage not occupied by said tubular member, the lower member having a passage cut therethrough for the insertion of inlet and outlet tubes.

References Cited in the file of this patent

UNITED STATES PATENTS

141,442	Kingsford	Aug. 5, 1873
1,245,674	Bushnell	Nov. 6, 1917
1,473,827	Mills	Nov. 13, 1923
1,712,386	Harney	May 7, 1929
1,769,009	Adams	July 1, 1930
1,841,762	Samesreuther et al.	Jan. 19, 1932