Feb. 3, 1959 J. S. NELSON 2,871,535

PERMANENT MOLD AND METHOD FOR MAKING CAST CHAIN LINK

Filed Oct. 2, 1956 2 Sheets-Sheet 1

Fig. 1

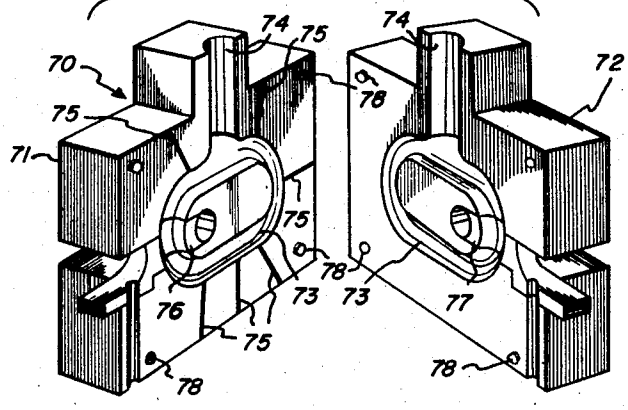


Fig. 2

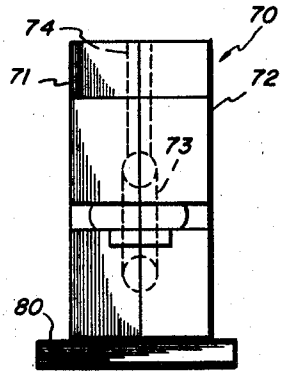


Fig. 3

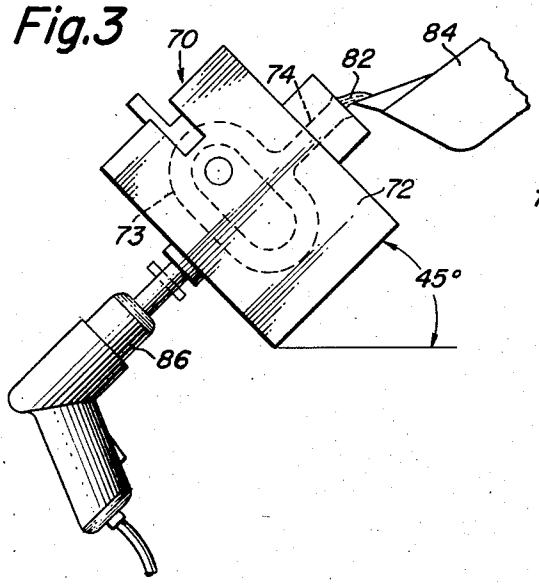
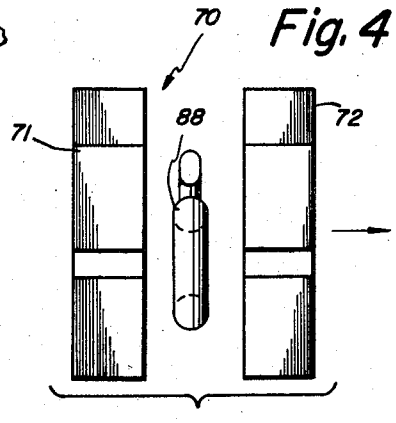


Fig. 4



INVENTOR

JOHN S. NELSON

BY Taubman & Taubman

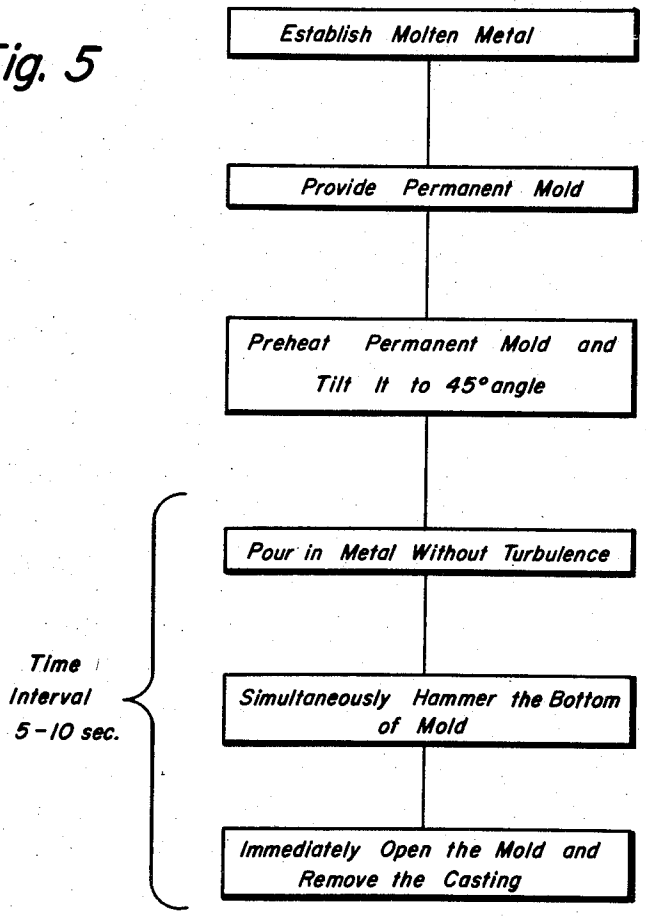
ATTORNEYS

Feb. 3, 1959 J. S. NELSON 2,871,535

PERMANENT MOLD AND METHOD FOR MAKING CAST CHAIN LINK

Filed Oct. 2, 1956 2 Sheets-Sheet 2

Fig. 5



INVENTOR
JOHN S. NELSON
BY Taulmin & Taulmin
ATTORNEYS

United States Patent Office 2,871,535 Patented Feb. 3, 1959

2,871,535

PERMANENT MOLD AND METHOD FOR MAKING CAST CHAIN LINK

John S. Nelson, Grand Island, N. Y.

Application October 2, 1956, Serial No. 613,412

1 Claim. (Cl. 22—216)

This invention relates to a permanent mold and a method for making cast link chain of aluminum or bronze. This application is a continuation-in-part of my prior application Serial No. 366,446 filed July 7, 1953 and now U. S. Patent No. 2,764,790.

Heretofore it has been customary to form the links for a chain from lengths of bar stock each of which is bent into a ring and then welding the opposing ends of the ring together. The use of such a method to form aluminum chain is not commercially feasible because of the difficulty and prohibitive cost of welding aluminum.

It is also known to cast links which are used in chains but this is usually done by forming the molds of sand which of course are destroyed in order to free the molded link. Such a method is also economically unfeasible and too slow for mass production.

While prior attempts have been made to employ permanent molds for casting chain links, these attempts have been singularly unsuccessful from a commercial standpoint so that cast aluminum or bronze chain is unavailable on the market today and unheard of although there is a great need therefor.

Aluminum or bronze chain is desirable for use where the conventional iron or steel chain rapidly corrodes and requires frequent maintenance. Further because of its lighter weight aluminum or bronze chain is highly suited for ornamental purposes where the heavier iron chain is now being used. Also, by using the proper aluminum or bronze alloys link chain having the desired strength properties can be produced.

It is therefore the principal object of the present invention to provide a permanent mold for making a cast aluminum or bronze chain link interconnected with previously cast links.

Another object is to provide such a mold which can be used to produce commercial quantities of aluminum or bronze chain in a practical and economically feasible manner.

Another object is to provide a multiple part mold which can be both rapidly assembled preparatory to the casting operation and also quickly disassembled to free the link after it has been cast, the whole procedure taking only a matter of seconds.

Another object is to provide such a mold which forms a chain link which requires little dressing up after being cast to make it commercially acceptable.

Still another object of the invention is to provide an improved method of making chains using permanent molds as aforementioned.

Other objects and advantages will be apparent from the following description and accompanying drawings in which:

Figure 1 is an exploded view in perspective illustrating a permanent mold for casting link type chain links, the complementary mold halves being shown in open position;

Figure 2 illustrates in side elevation a closed mold,

such as shown in Figure 1, which is preheated prior to the pouring thereinto of molten metal;

Figure 3 is a view in elevation and illustrating the angular position of the mold of Figure 2 during pouring of the molten metal into the mold, and illustrating diagrammatically a mold hammer for hammering the mold during filling of the same with metal, the pouring ladle for delivery of molten metal being shown partly broken away;

Figure 4 is an exploded view in side elevation illustrating the opening of the mold and removal of the cast chain link, the mold halves being shown in the position after being moved rectilinearly from each other and the cast link removed from the mold cavity; and

Figure 5 illustrates by a flow sheet the essential steps of casting chain links utilizing a permanent mold in accordance with this invention.

An important feature of the invention is the means which I provide for venting the mold cavity when the molten metal is poured into the cavity. Heretofore it has been general practice to provide circular vent holes but to provide adequate cross sectional area for the passage of air being displaced, in order to prevent defective castings, the circular vent holes were so large that metal would flow into them leaving risers or projections on the cast article which sometimes rendered it difficult to open the mold and always required additional time for removing the risers or projections. I have avoided all these difficulties by providing very shallow but broad vents.

In Figures 1 through 4, I illustrate diagrammatically how the casting of chain links is carried out using a permanent mold and such as utilized for making chain links. A permanent mold, as employed for casting links as shown, is more particularly described in my copending application Ser. No. 366,446 filed July 7, 1953, now U. S. Patent No. 2,786,248.

The essential steps of my process is further illustrated by the flow sheet in Figure 5, and comprises

(1) Establishing a source of molten metal from which the chain link castings are to be made;

(2) Providing a permanent mold having complementary mold cavities for forming the cast chain links, and which mold can be quickly opened for removal of the casting;

(3) The permanent mold is arranged with its pouring gate upward and the mold tilted at an angle of approximately 45° to the vertical, and preheated to a temperature of about ¾ that of the temperature of the molten metal to be poured thereinto;

(4) Molten metal is then poured into the mold while thus tilted to avoid turbulence, and the bottom of the mold is hammered to assist in removal of occluded air and gases from the mold cavities and cause discharge of same through the mold cavity vents;

(5) Immediately thereafter and within 3 to 5 seconds after pouring of the metal into the mold, the mold is opened and the cast chain link removed to prevent warping and sticking of the casting in the mold.

In casting chain links using permanent molds in accordance with this invention, it is important to carry out the pouring, solidifying and removal of the casting in the shortest time possible to produce sound castings and permit the continued use of the mold. If the castings are made in a mold which cannot be quickly opened within a few seconds after pouring and hammering of the mold, it has been found that the casting tends to stick and the mold cannot be opened without causing damage to the same.

In the casting of chain links as shown in Figures 1 through 4, the complementary mold **70**, as illustrated in Figure 1, comprises the complementary mold halves **71** and **72** which define a link chain mold cavity **73**. A pouring gate **74** is provided for communicating with the

chain link cavity as shown in Figure 1. Multiple vents 75 are provided around the mold cavity on the mold part 71 to provide for effective venting of air and occluded gases during casting. This use of multiple vents is very essential in order to produce sound chain link castings. Mold parts 71 and 72 are also provided with complementary mold inserts 76 and 77 and can be closed and opened by movement of the mold parts 71 and 72 apart rectilinearly, the respective mold parts being accurately positioned together by the dowel pins 78.

After closing of the mold preparatory to making the casting, the mold is heated as indicated, by the resistance heater 80, and the heated mold then tilted to an angle of 45° to the vertical as illustrated in Figure 3.

Molten metal 82 is then introduced into the gate 74 from a ladle 84 while simultaneously with the pouring the bottom of the mold is subjected to hammer blows to assist in the removal of all gases and thoroughly vent the same from all the mold cavities. This hammering of the mold may be provided for by conventional means such as an air hammer 86, as shown in Figure 3.

Within a few seconds after pouring of the metal in the mold and its solidification, the mold is opened as by holding mold part 71 stationary or fixed and drawing away mold part 72 in a straight line path as indicated by the arrow in Figure 4. The cast link 88 is then ejected from the mold cavity and the sprue portion removed to provide a finished chain link.

An important criterion of the method of casting chain links consists in carrying out the pouring and solidification of the casting in a very short period of time. This time interval, as illustrated in Figure 5, takes approximately 5–10 seconds to complete. Where the time is substantially increased, there is difficulty in removing the casting from the mold and the production of a sound casting.

Hammering of the mold while it is tilted and receives the molten metal is important to carry out simultaneously as the molten metal is poured into the mold. Otherwise there may be gaseous occlusions in the casting which would produce an unsatisfactory cast chain link. Further, it is necessary to preheat the mold to approximately ¾ of the temperature of the molten metal to be received in order to lengthen the life of the permanent mold and prevent it from warping or distorting during successive casting operations.

In the casting of stud chain links using permanent molds in accordance with my invention, tilting of the mold may be dispensed with inasmuch as, due to the divided mold cavity construction, spattering and turbulence of the molten metal during filling of the mold is generally not encountered. It is, however, preferred to tilt the mold along the longitudinal axis of the chain link mold cavity in order to allow the molten metal to "roll" into the mold from the ladle or pouring spout and thus avoid spattering and the setting up of a turbulent flow of molten metal which tends to entrap and hold gases. Furthermore, by pounding or striking the bottom of the mold during the pouring of the metal into the mold, air or other gases in the mold cavity which may tend to be trapped and held by the molten metal is caused to be discharged through the mold vents upon entry of the metal.

In casting the chain links the same may be made of various metals and particularly of the light metals such as aluminum, magnesium and alloys thereof. Such alloy aluminum-bronzes may contain from 10–15% aluminum and the remainder of copper. Other metals may consist of substantially all aluminum or magnesium with added alloy elements such as nickel, copper, beryllium and the like, the latter alloying elements may be present in about 5–10% and the remainder aluminum or magnesium. Also chain links made of lead may be cast. Also babbitt type castings may be made using alloys of copper and tin.

In accordance with this invention, castings may be made of aluminum or bronze or other metals in the production of chains and wherein permanent molds are used throughout the procedure. The casting of such chain links in permanent molds, and particularly where the casting is made in a very short time and wherein the permanent mold can be opened quickly following the reception of metal, provides an improved process of casting such products.

In this manner cast metal chain links can be produced in relatively large quantities and with sufficient speed and facility so that the manufacture of such chains commercially is now made practical. While the prior art indicates that castings can be made of chains it has not been possible heretofore to cast chain links in permanent molds and wherein the same is carried out efficiently and rapidly to produce castings which are sound and require substantially little machining to produce a finished chain.

What is claimed is:

A method of making cast link chains of aluminum metal which comprises the steps of providing a permanent mold having complementary mold parts forming a chain link mold cavity having a plurality of spaced vents communicating with said mold cavity and pouring gate for introducing molten metal thereinto, establishing a source of molten aluminum metal from which the chain link castings are to be made, positioning said mold to receive molten metal, preheating the mold, tilting the mold to an angle to the vertical and along the longitudinal axis of said chain link mold cavity, pouring molten aluminum metal into the mold in a quiet undisturbed stream while simultaneously vibrating the mold to assist the molten metal to enter the cavities of the mold and displace occluded gases, thereafter cooling the mold and immediately after solidification of the molten metal opening the mold and removing the casting.

References Cited in the file of this patent

UNITED STATES PATENTS

1,378,984	Soss	May 24, 1921
1,639,456	Johnson	Aug. 16, 1927
1,841,173	Egler	Jan. 12, 1932
1,956,910	Roth	May 1, 1934
2,116,630	Jones	May 10, 1938
2,540,199	Gorlinski	Feb. 6, 1951
2,748,433	Preston et al.	June 5, 1956
2,764,790	Nelson	Oct. 2, 1956

OTHER REFERENCES

Gravity Die-Casting Technique, by George W. Lowe. Preprint February 1946, Hutchinson's Scientific & Technical Publications, pages 93 and 94.

Die Castings, by H. H. Doehler, First Edition, 1951, McGraw-Hill Book Co., pages 143–147.