June 19, 1956 C. G. RAIBLE 2,750,641

CHILL

Filed Aug. 5, 1953

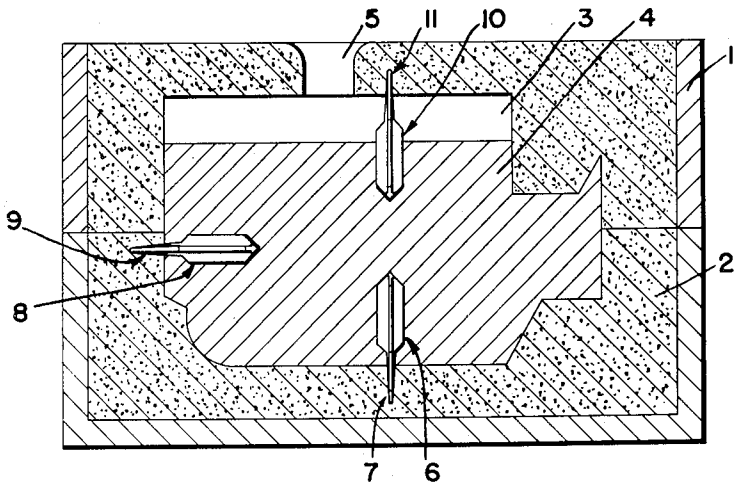


FIG. 1

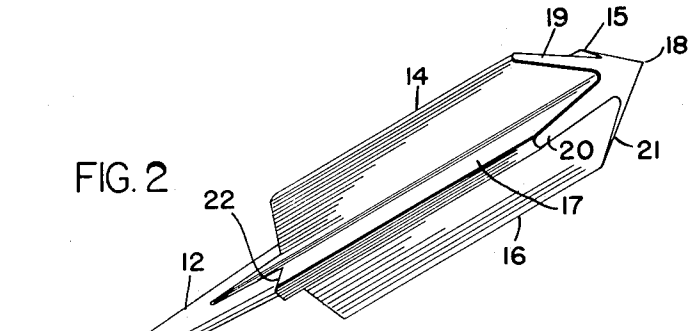


FIG. 2

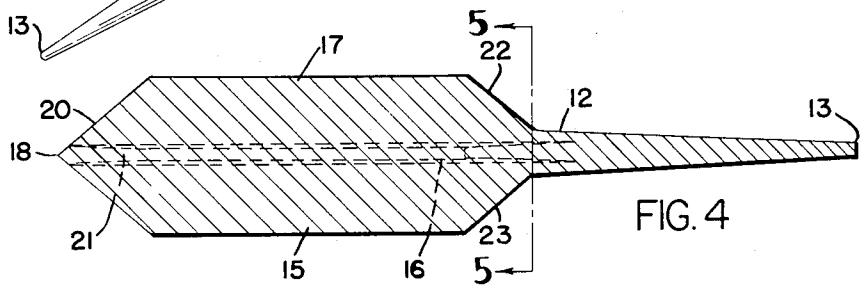


FIG. 4

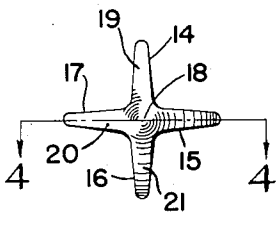


FIG. 3

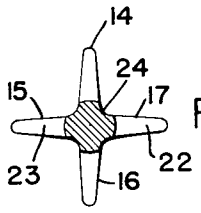


FIG. 5

INVENTOR.
CHARLES GREIF RAIBLE

BY

Frank H. Harmon

ATTY.

United States Patent Office 2,750,641 Patented June 19, 1956

2,750,641

CHILL

Charles Greif Raible, Chesterland, Ohio, assignor to Fanner Manufacturing Company, Cleveland, Ohio, a corporation of Ohio

Application August 5, 1953, Serial No. 372,509

6 Claims. (Cl. 22—174)

This invention relates to improvements in chills for use in producing metal castings from molten metal poured into a mold.

In producing metal castings in this manner, it is essential to provide means for maintaining the cooling rate uniform in the various portions of the casting in order to avoid resulting defects. These defects occur as the result of the fact that the center portion of heavy metal sections cools more slowly than the outer portions. As the hot metal cools, it shrinks, and the outer portions of the metal solidify first so as to fix the volume of the casting. During cooling, the metal tends to maintain uniform density of structure. Thus, as continued contraction progresses toward the center of the mass, eventually there is not enough metal to fill the outer volume with uniform density of structure.

In order to overcome such a problem, there have been proposed various forms of internal chills formed of masses of cold metals and so positioned in the molds so as to be fused in the molten metals, while a tail portion extends into the mold to facilitate the transfer of heat away from the internal structure of the casting, their purpose being to assist in making uniform the rate of cooling.

It is therefore one of the primary objects of my invention to provide an improved chill which, for a given amount of mass of metal, is so designed as to have the maximum surface area for contact with the molten metal of the casting in order to more efficiently act as a heat transfer agent from the interior of the molten metal casting through its outer surface into the mold.

With the foregoing and other objects in view, the invention resides in the combination of parts and in the details of construction hereinafter set forth in the following specification and appended claims, certain embodiments therefore being illustrated in the accompanying drawings, in which:

Figure 1 is a view in vertical section taken through a mold, showing the molten metal at a higher level and also showing a lower vertically disposed chill and a mid-level horizontally disposed chill, both submerged in molten metal, and an upper vertically disposed chill partially submerged in molten metal;

Figure 2 is an enlarged detail view in perspective of my improved chill;

Figure 3 is a view in front elevation of the nose portion of the chill;

Figure 4 is a view in section taken along line 4—4 of Figure 3; and

Figure 5 is a view in section taken along line 5—5 of Figure 4.

Referring more particularly to the drawings, Figure 1 schematically shows the environment in which my chill may be used, the showing including an outer frame work 1, filled with a mold of suitable material 2, such as sand, the mold being provided with a cavity 3 of desired size and contour to receive molten metal 4 which is poured through the opening 5 to assume the overall

shape and size determined by the cavity 3 in the mold. For mere purposes of illustration, I have shown a lower chill with the body portion 6 extending into the cavity to be surrounded by and fused with a molten metal of the casting 4, and a tail portion 7 extending into the mold 2. The same is true of the horizontally disposed chill with its body portion 8 and tail portion 9 and with the upper chill with its body portion 10 and its tail portion 11.

In Figures 2, 3, 4 and 5, I have illustrated my preferred form of chill in greater detail. Here, I have shown the chill to include a tail portion 12 that tapers in thickness to a point 13 at its rear end. The main body portion of the chill, forward of the tail portion 12, is preferably formed to be star-shaped, as shown in Figures 2, 3 and 5. In other words, instead of having the main body portion of the chill to be of a solid mass of rectangular or cylindrical form, or the like, I prefer to have it formed of four fins, or vanes, 14, 15, 16 and 17, whose radial planes intersect and whose radial length is far greater than the center mass, formed by the joining of the radial fins, in order to obtain the maximum surface area for the amount of metal employed throughout the length of the major portion of the chill. In addition, each of these vanes is preferably formed to taper to gradually decrease in thickness toward their radial outer extremities. In addition, I prefer to have the forward edges each inclined forwardly to merge into a conical nose 18. I have illustrated this in Figure 2 by designating such forward sloping edges 19, 20 and 21 of vanes 14, 17 and 16. Similarly, the rear portion of the vanes are inclined radially rearwardly inwardly at an angle to merge into the tail portion 12, Figure 4 showing such rearward inclined edges of vane 17 at 22 and vane 15 at 23.

Thus, with a chill of this design, as the molten metal is poured into the mold, and as its liquid level rises gradually within the mold, the lowermost chill, or chills, will be gradually enveloped, so that at no time will an entire surface be completely enveloped instantaneously. This is because the nature of the design of the chill is such that, regardless of its disposition within the mold, there is presented no top surface of any of the chills that will be horizontal. Thus, no gases will be trapped along any portion of the chill, but will escape along the inclined surfaces until the uppermost point of the upper chill has been reached by the liquid level of the molten metal.

I am aware of the fact that certain internal chills have been provided in which the main body portion is made of bar stock of square, conical, or cylindrical, cross-section. Such a chill has been found to be effective for chilling around a given restricted area. However, I have found, by actual practice, that the chilling of a steel casting, or the chilling of any other type of metal, is strictly a matter of heat transfer. By analogy, it is a phenomenon similar to the heat transfer of an ordinary radiator, whether of cast iron, copper, or the like, in which it is the surface area that is of importance in heat transfer. The same is true of chilling at any given point in a metallic casting. The greater surface area of an internal chill that can be brought into contact with the molten metal in the mold, the more readily efficient chilling of the casting may be accomplished without the addition of a large volume of cold metal. It is just as important not to over chill as it is to not under chill the molten metal of the casting at any given point. My design of chill makes it possible to present a greater surface area for transferring heat from any given point in the casting than by any heretofore known means.

In Figure 5 I have designated in section at 24 a cross-sectional area of the forward end of the tail portion 12 at

a point where it merges with the main body portion. The main body portion, as distinguished from being of square or circular cross-sectional area, is in reality of a size comparable to the cross-section area of the forward end of the tail portion, because it is just large enough to form a juncture point for the intersecting fins, or vanes. In attempting to clearly describe this cross-sectional configuration, I have referred to it as being star-shaped without any inference as to limitation as to the number of vanes, or fins, that I may desire to employ. My main point is to not merely add radiating fins, or vanes, to a square or cylindrical piece of bar stock, but on the contrary, to form the body portion of the chill as nearly completely of the vanes, or fins, as structurally expedient, with its transverse cross-sectional area 24 being as small as possible, the length of each vane being appreciably greater than the transverse cross-sectional dimension of the main body portion, as shown in Figures 2, 3 and 5 increased heat transferring radiating surface area and the reduction of the localized center mass represented at 24 to the minimum.

I claim:

1. In combination with a mold having a cavity for receiving molten metal, a chill having a tail portion of relatively small transverse cross section positioned to extend into the mold and a main body portion positioned to extend into the cavity to be surrounded by said molten metal and embedded therein for effecting the transfer of heat from said molten metal outwardly into said mold for the purpose of chilling the metal casting resulting from said molten metal, said chill being formed of metal in which said tail and body are integral, said body portion including a plurality of longitudinal radially extending vanes whose radial planes intersect, the radial length of each vane being appreciably greater than the transverse cross-sectional dimension of said body portion.

2. In combination with a mold having a cavity for receiving molten metal, a chill having a tail portion positioned to extend into the mold and a main body portion positioned to extend into the cavity to be surrounded by said molten metal and embedded therein for effecting the transfer of heat from said molten metal outwardly into said mold for the purpose of chilling the metal casting resulting from said molten metal, said chill being formed of metal in which said tail and body are integral, said tail being tapered from its forward portion where it merges with said body portion to decrease in thickness toward its rear end, said body portion being of appreciable length and being of such transverse cross-section as to include a plurality of longitudinal radially extending vanes whose radial planes intersect, the radial length of each vane being appreciably greater than the transverse cross-sectional dimension of said body portion.

3. In combination with a mold having a cavity for receiving molten metal, a chill having a tail portion positioned to extend into the mold and a main body portion positioned to extend into the cavity to be surrounded by said molten metal and embedded therein for effecting the transfer of heat from said molten metal outwardly into said mold for the purpose of chilling the metal casting resulting from said molten metal, said chill being formed of metal in which said tail and body are integral, said tail being tapered from its forward portion where it merges with said body portion to decrease in thickness toward its rear end, said body portion being of appreciable length and being of such transverse cross-section as to include a plurality of longitudinal radially extending vanes whose radial planes intersect, the radial length of each vane being appreciably greater than the cross-sectional dimension of said body portion, each of said vanes being tapered to decrease in wall thickness radially outwardly.

4. In combination with a mold having a cavity for receiving molten metal, a chill having a tail portion positioned to extend into the mold and a main body portion positioned to extend into the cavity to be surrounded by said molten metal and embedded therein for effecting the transfer of heat from said molten metal outwardly into said mold for the purpose of chilling the metal casting resulting from said molten metal, said chill being formed of metal in which said tail and body are integral, said tail being tapered from its forward portion where it merges with said body portion to decrease in thickness toward its rear end, said body portion being of appreciable length and being of such transverse cross-section as to include a plurality of longitudinal radially extending vanes whose radial planes intersect, the radial length of each vane being appreciably greater than the cross-sectional dimension of said body portion, each of said vanes being tapered to decrease in wall thickness radially outwardly, the edges of forward portions of said vanes being inclined forwardly to converge centrally into a conical forward nose.

5. In combination with a mold having a cavity for receiving molten metal, a chill having a tail portion positioned to extend into the mold and a main body portion positioned to extend into the cavity to be surrounded by said molten metal and embedded therein for effecting the transfer of heat from said molten metal outwardly into said mold for the purpose of chilling the metal casting resulting from said molten metal, said chill being formed of metal in which said tail and body are integral, said tail being tapered from its forward portion where it merges with said body portion to decrease in thickness toward its rear end, said body portion being of appreciable length and being of such transverse cross-section as to include a plurality of longitudinal radially extending vanes whose radial planes intersect, the radial length of each vane being appreciably greater than the cross-sectional dimension of said body portion, each of said vanes being tapered to decrease in wall thickness radially outwardly, the edges of forward portions of said vanes being inclined forwardly to converge centrally into a conical forward nose and the edges of rear portions of said vanes being inclined rearwardly to converge centrally to merge with the forward end of said tail portion.

6. In combination with a mold having a cavity for receiving molten metal, a chill having a tail portion positioned to extend into the mold and a main body portion positioned to extend into the cavity to be surrounded by said molten metal and embedded therein for effecting the transfer of heat from said molten metal outwardly into said mold for the purpose of chilling the metal casting resulting from said molten metal, said chill being formed of metal in which said tail and body are integral, said tail being tapered from its forward portion where it merges with said body portion to decrease in thickness toward its rear end, said body portion being of appreciable length and being of such transverse cross-section as to include a plurality of longitudinal radially extending vanes whose radial planes intersect to form a central portion of transverse cross-sectional areas substantially equal to that of the transverse cross-sectional area of the forward portion of said tail, the radial length of each vane being appreciably greater than the transverse cross-sectional dimension of said body portion, each of said vanes being tapered to decrease in wall thickness radially outwardly, the edges of forward portions of said vanes being inclined forwardly to converge centrally into a conical forward nose and the edges of rear portions of said vanes being inclined rearwardly to converge centrally to merge with the forward end of said tail portion.

References Cited in the file of this patent

UNITED STATES PATENTS

2,013,746	Ditty	Sept. 10, 1935
2,170,103	Westover	Aug. 22, 1939