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METHOD OF MAKING A CASTING

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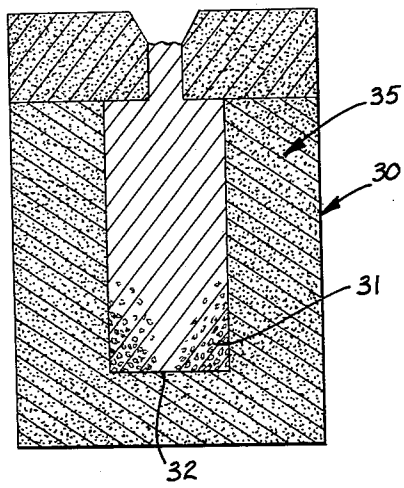


FIG. 1

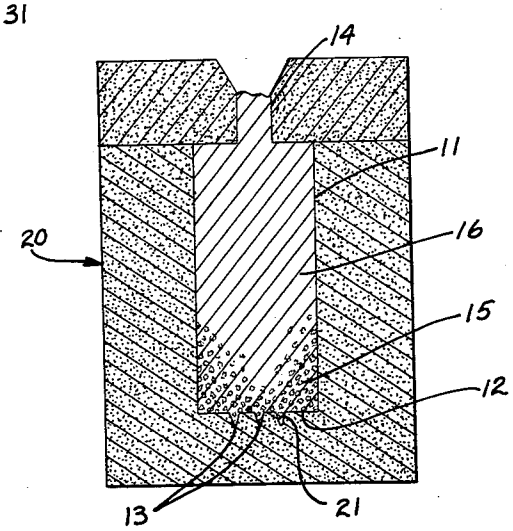


FIG. 2

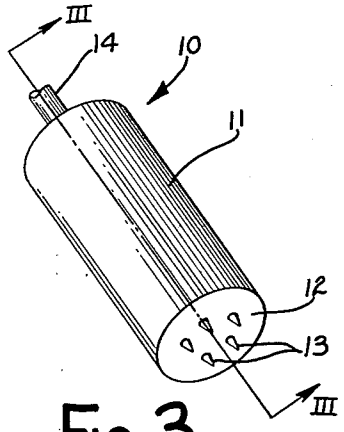


FIG. 3

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METHOD OF MAKING A CASTING

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This invention relates to a method of making a valve tappet, and more particularly to a specific method of casting a valve tappet.

For a long time valve tappets have been cast from a metal such as hardenable iron. In casting the valve tappets, the outer edge portion of the valve tappet foot becomes chilled before the central portion of the tappet foot. This is true since the heat from the molten metal is transferred into both the foot and side portion of the mold. Quick chilling brings about a desirable effect in the valve tappet in that a needle-shaped constituent, acicular carbide, is formed in the quick chilled area of the tappet. This form of carbide formation is desirable since it provides a hard wearing surface and has certain lubricous characteristics.

Since it is desirable to have the total surface area of the valve tappet foot contain acicular carbides, it is necessary to provide some means whereby the central portion of the valve tappet foot may be chilled as quickly as the edge portion. Applicant has solved this problem by providing the mold with pin forming depressions in the central area of the valve tappet foot mold. Thus, when the metal is poured it will flow into these depressions causing pins to be formed which project from the foot surface. This greatly increases the surface area from which heat may be radiated and provides a means whereby the center portion of the valve tappet foot surface may be chilled as rapidly as the outer edge. This results in a formation of acicular carbides throughout the entire surface area of the valve tappet foot.

The valve tappet formed in this manner can be readily machined before the heat treating process. A simple grinding operation removes the projecting pins from the foot of the valve tappet. The valve tappet produced by the method disclosed herein provides a tappet which is readily machinable but after heat treatment provides a foot surface which is extremely hard and resistant to wear.

It is an object of this invention to provide a method of casting a valve tappet wherein the total foot surface area is chilled.

Another object of this invention is to provide a method for casting valve tappets wherein the central portion of the foot surface is provided with projections or pins to increase the total surface cooling area.

A further object of this invention is to provide a valve tappet which has good machining properties and a foot area with good wear characteristics.

Still another object of this invention is to provide a method of making a valve tappet wherein the total foot surface area contains a formation of acicular carbide.

These and other objects and advantages in the practice of this invention will be more apparent in the illustrations and description of a working embodiment of the invention as hereinafter set forth.

In the drawings:

FIG. 1 is a cross section view of a valve tappet showing the formation of acicular carbide when a previous method of casting has been employed;

FIG. 2 is a cross sectional view taken along the section line III—III of FIG. 3 and showing the acicular carbide formation in a valve tappet following the method of casting of this invention.

FIG. 3 is a perspective view of the valve tappet of this invention shown as removed from the mold.

This invention relates basically to a method of casting a valve tappet.

This method is practiced by providing a foot surface of a conventional valve tappet mold, with pin forming depressions. Hardenable iron is heated to pouring temperature and poured into the mold. As the molten metal comes into contact with the surface areas of the mold, it is chilled or cooled rapidly in the lower portion of the mold or vicinity of the valve tappet foot surface. Rapid heat radiation takes place about the outer edge of the foot surface, since the bottom and side edges of both are exposed to the mold providing for radiation in both directions. The effective surface area of the central portion of the foot surface is increased by the projections formed thereon. The heat is transferred from the central portion of the foot surface to the projections and thus into the mold. The projections provide enough added heat transferring area so as to cause the central portion of the valve tappet foot area to cool at approximately the same rate as the outer edge, thereby forming the desirable acicular carbide formation over the entire valve tappet foot surface area.

Reference is now made to the drawings wherein the valve tappet of this invention is shown in FIG. 3 and designated generally as 10.

The valve tappet 10 as it comes from the mold subsequent to casting takes the shape as shown in FIG. 3. The valve tappet 10 has a cylindrical outer surface 11 and an end or foot surface 12. Projections or pins 13 extend from the central portion of the foot surface. The opposite end of the valve tappet has a stem 14 projecting therefrom formed during the casting process and later removed during the grinding operation.

The tappet 10 is cast in a conventional sand mold shown generally as 20 in FIG. 2. The sand mold 20 has pin forming depressions 21 in the foot surface thereof. Otherwise the mold is similar to the mold 30 previously used and shown in FIG. 1.

The valve tappet 10 as shown in FIG. 3, which forms the subject of this invention, and the valve tappet 35 as shown in FIG. 1, which shows a valve tappet previously in use, are both preferably manufactured from hardenable iron of approximately the following composition: carbon 3.0%–3.4%, silicon 2.10%–2.40%, manganese .70%–.90%, sulphur .10% maximum, phosphorus .20% maximum, nickel .40%–.70%, chromium .90%–1.25%, molybdenum .40%–.70% and the remainder iron. Hardenable iron as cast is composed of flake graphite pearlite and carbides, the latter appearing in acicular form at quick chilled points of the casting, and in cellular form where the cooling is gradual.

An acicular carbide formation is desirable in the foot surface area of the valve tappet. When the valve tappet is cast in a mold such as a mold 30, the acicular carbide formation takes place approximately as shown in FIG. 1. The acicular carbide 31 forms in the lower outer cylindrical surface and the outer edge of the foot surface of valve tappet 35. The central portion 32 of the valve tappet 35 foot surface does not contain acicular carbide but forms into a cellular carbide formation. The cellular carbide formation is not desirable for valve tappet foot surfaces, since upon heat treatment it does not produce the hard wearing surface as does acicular carbide.

In view of the fact that in previous casting methods the center portion of the valve tappet foot surface has cooled slower than the outer edges thereof, the present method has been devised. This new method produces a valve tappet foot surface which has an acicular carbide formation across the entire or total surface area of the

foot of the tappet. This is accomplished by providing the mold, such as 20, with pin forming depressions 21 in the foot surface area of the mold. The number of depressions necessarily vary with the diameter of the valve tappet. The larger the diameter the more projections or pins needed to convey the heat to the mold. By providing the foot surface area of the mold with the pin forming depressions the total surface area of the center portion of the tappet is increased considerably. By adding the chill pins 21 to the valve tappet 10, the surface area exposure of the center portion of the valve tappet foot is approximately the same as the outer cylindrical surface of the valve tappet in combination with the outer edge of the foot surface area. Thus, the entire foot surface area cools or is chilled at approximately the same rate. This provides an acicular carbide formation throughout the entire foot surface area. This is best shown in FIG. 2 by the particular carbide formation designated as 15. The degree of penetration of the acicular carbide formation into the body of the valve tappet depends upon the rate of chill and varies somewhat from mold to mold. However, a sufficient layer results so as to allow grinding off the pins or projections 13 and leaving a layer sufficiently thick to provide a hard wearing surface.

The valve tappet 10 as cast is composed of a grain structure of graphite, pearlite and carbide. The body portion 16 of the valve tappet has a cellular carbide formation, and the foot surface area 15 has an acicular carbide formation, these two carbides being interspersed with the graphite and pearlite in the respective areas. The pins 13 are ground from the foot surface while the valve tappet is in this form of grain structure. Other necessary machining is also done at this time.

After the tappet has been machined to the proper dimensions, it is heat treated. Heat treatment is accomplished by a conventional manner bringing the tappet to a temperature of approximately 1550 degrees Fahrenheit to 1570 degrees Fahrenheit. Upon completing the heat treatment, the pearlite grain structure is transformed to martensite. The graphite and carbide structures remain unchanged.

The above method produces a valve tappet which has a very hard foot surface. This hardness is approximately 55 to 61 Rockwell C. A wearing surface of at least this hardness is desirable for a valve tappet foot.

The tappet of this invention having an acicular carbide formation across the entire foot surface of the tappet is far superior to the tappet which has such a formation only around the outer edge thereof. Thus, where tappets previously had the tendency to wear in the center portion thereof, this tendency has been reduced to a minimum, since the same grain structure of the tappet is presented over the entire foot surface area.

These desirable features in the valve tappet have been accomplished by merely providing the conventional mold

with pin forming depressions located near the center portion of the tappet foot surface area. These depressions allow pins or projections to form on the surface of the tappet foot, providing means of quick heat transfer from the molten metal to the molds. The center portion of the valve tappet foot is cooled at approximately the same rate as the edges, providing for the formation of the desirable acicular carbide formation throughout the total foot surface area. The same grinding operation which previously ground a foot surface of a valve tappet such as 35 can be used to grind the foot surface of the valve tappet 10. Therefore, the pins 13 require no additional operation for removal. The pin forming depressions 21 can be formed in the mold by a pattern as easily as the previous type mold used. Thus, it can be seen that applicant's method produces a valve tappet which is far superior and yet can be manufactured at no added expense. Thus, applicant's method produces a valve tappet which is highly desirable commercially.

While a preferred embodiment of this invention has been described, it will be understood that modifications thereof may be made. Such of these modifications as incorporate the principles of this invention are to be considered as indicated in the hereinafter appended claim unless this claim by its language expressly states otherwise.

I claim:

The method of making a valve tappet comprising the steps of: forming a valve tappet mold having a cavity with one wall thereof comprising a foot forming surface; providing the foot forming surface with pin forming depressions intermediate the outer edge of said foot forming surface; heating hardenable iron to a pouring temperature, pouring and chilling said hardenable iron into said cavity thereby forming a casting with a foot surface having pins extending therefrom intermediate the outer edge, said pins providing means for dissipating heat from said intermediate section thereby increasing the cooling rate of said intermediate section to form an acicular grain structure; and machining said pins down flush with the foot surface.

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