

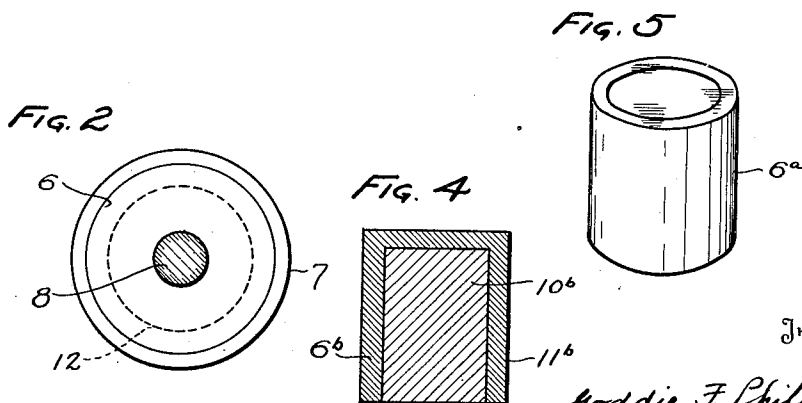
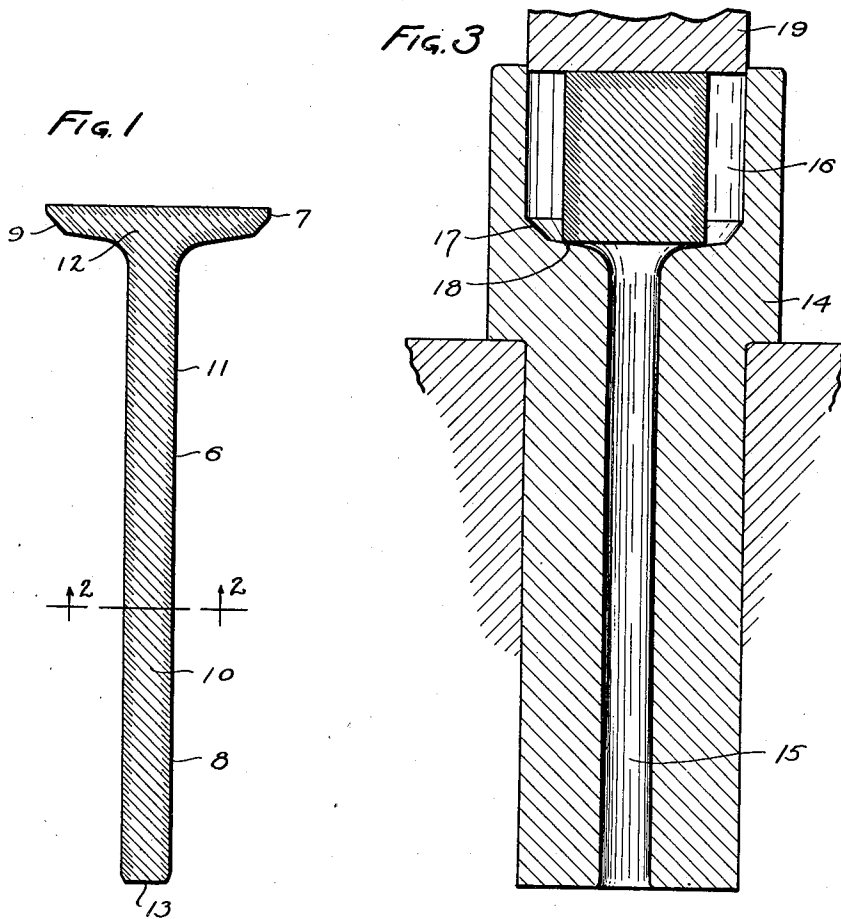
Nov. 29, 1938.

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2,138,528

METHOD OF FORMING A VALVE

Original Filed Feb. 10, 1932



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UNITED STATES PATENT OFFICE

2,138,528

METHOD OF FORMING A VALVE

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Original application February 10, 1932, Serial No. 592,031. Divided and this application January 23, 1933, Serial No. 652,987

4 Claims. (Cl. 207—10)

This invention relates to metal valves for internal combustion engines, and the like, such as are subjected to the heat and corrosive action of the burning gases in the combustion chamber. The present application is a division of my co-

pending application Serial No. 592,031 filed February 10, 1932.

One object of the present invention resides in the method of making a valve in which the valve is formed by extruding a composite billet, the finished valve having a core and a shell or sheathing formed of different metals, the material from which the core is made being one having superior heat conducting characteristics while the sheathing metal is one that is not as good a heat conductor but which has superior heat resisting and corrosion resisting properties enabling it to protect the enclosed valve head portion of the core against the deteriorating and destructive influences of the hot products of combustion.

It is another object of the invention to provide a novel process of making a valve in which a billet is formed from a core enclosed at least at one end at the sides in a shell of a different material, the composite billet being heated and then extruded through a die conforming to the shape of the finished valve head and valve stem. Thus the shell and core materials will be integrally bonded and united together in order that the heat can be effectively transmitted to the core material and conducted by the core from the head down to the stem portions of the valve and then dissipated out through the valve stem shell.

A further object of the invention is the provision of an extruded valve having a core of soft steel and having a sheathing of heat resisting and corrosion resisting steel, the tip end of the valve stem being hardened in order that it may effectively withstand the blows of the valve tappet.

The invention further consists in the several novel features hereinafter fully set forth and claimed.

The invention is clearly illustrated in the accompanying drawing, in which—

Fig. 1 is a central longitudinal section through a poppet valve embodying the present invention;

Fig. 2 is a cross-section thereof taken on the line 2—2 of Fig. 1;

Fig. 3 is a diagrammatic sectional view illustrating a composite metal billet from which the valve is made, and the die through which it is extruded to form the completed article;

Fig. 4 is a cross-sectional view of a preferred form of billet employed; and

Fig. 5 is a perspective view of a second form of composite metal billet.

Referring to the drawing, and first more particularly to Figs. 1 and 2, the reference character 6 designates a poppet valve of conventional form having a disk-like head 7 upon one end, from which head extends the stem 8. The head is provided with the usual tapered seating surface 9, and the end of the stem is made square while the edge thereof is chamfered off.

The stem and head comprise a metal core 10, encased or sheathed in a surface portion or casing 11 which encloses the core throughout its entire extent, or at least throughout the head and the major portion of the stem. The surface portion or sheathing 11 is also of metal, but one that has different properties from the metal constituting the core. The sheathing metal is of a type that will effectively withstand the destructive influences of the hot gases and the products of combustion of an internal combustion engine. Its heat resisting and corrosion resisting properties are superior to that of the metal constituting the core. The core metal on the other hand is one that can effectively conduct the heat, its heat conductivity being superior to the sheathing metal in order that the heat can be effectively withdrawn or carried off from the heat portions of the valve and dissipated through the valve stem. The sheathing metal is preferably a heat resisting steel such as silchrome stainless steel or a suitable steel alloy having a high chromium content, or the like. Such steels are rather poor heat conductors but can very effectively withstand the destructive influences of the hot products of combustion. The core material may as one example of the invention be a soft steel which is capable of being readily hardened such as carbon steel or chrome nickel steel or may be of other materials capable of effectively carrying and conducting the heat. The core material should also be of a character that lends itself to the forging operation that is employed in the process of manufacture.

The part of the core which is contained in the head flares out radially as indicated at 12, and the surface portion or sheathing around said flaring part 12 is preferably considerably thicker than the surface portion which is contained on the stem. In the finished valve, the extreme lower end of the stem may be ground off to provide a flat end face 13, and in the finished valve said end of the stem is preferably hardened by any suitable process. As the part of the core contained in the head flares out radially as above

mentioned, the outer parts of the valve head are effectively cooled, and the temperature at and adjacent the valve seat is maintained considerably less than would be the case if the entire outer portions of the valve head were formed of a metal having poor heat conductivity.

The valve, in accordance with the present invention, is formed from a billet such as the billet 6b shown in section in Fig. 4. This billet is composed of a core 10b preferably cylindrical in shape and formed of a material having good heat conductivity although less resistant to corrosion and deterioration than the sheathing metal. The billet core 10b fits preferably rather tightly in a cup-shaped or thimble-like shell 11b of a steel having superior heat resisting properties. The composite billet is of a size calculated to contain sufficient material to form the valve shown in Fig. 1.

The billet may be formed in various ways. It may be made for instance by placing a bar of the core material in an ingot mold and pouring the heat resisting non-corrosive metal around it and afterwards drawing the composite metal out to the right diameter and thereafter dividing the bar into billets of predetermined length such as the billets shown in Fig. 5 and designated 6a. Preferably, however, the billets are formed by shrinking a thimble or cup 11b upon a round short rod 10b, to form the billet illustrated in Figs. 3 and 4.

In carrying out the process of the present invention, the composite billet, such as the billet shown in Fig. 4, is extruded through a die 14. The die 14 is formed with a cavity comprising a cylindrical hole 15 of approximately the diameter of the stem 8 of the valve, and a cavity 16 having a tapered portion 17 at its lower end and a bottom wall 18 conforming to the shape of the lower side and edge of the valve head. A suitable power press is employed for extruding the composite metal billet through the die, and said press employs a plunger 19 which is forcibly brought down upon the billet and the latter is forced into the tapered portion of the cavity of the die and through the cylindrical hole 15 therein.

The billet is, of course, previously heated to a temperature at which it may be extruded through the die, and from actual experiments made, it has been found that the sheathing metal portion 11b of the billet follows down the cylindrical hole 15 around the metal which forms the core portion of the stem, the casing or sheathing surface portion becoming thinner toward the lower end of the stem. The lower portion of the billet is thus reduced in diameter to form the valve stem while the upper portion of the composite billet is expanded out radially to form the valve head. Since the entire top of the billet core is covered by the sheathing metal the latter will completely enclose and protect the outflared core part of the finished valve head. As shown in the drawing, the surface metal in the head portion of the valve is comparatively thick while the inner core metal thins out into a tapering widely spread portion, as appears in Fig. 1, where the heavier cross hatching indicates the surface material and the lighter cross hatching indicates the core or inner material.

When the composite metal billet is extruded through a die, as above described, the inner metal or core and the outer metal or casing are integrally united throughout their entire extent by the pressing and stretching action that takes place to form a good bond between the two met-

als in order that heat may be effectively transferred from one metal to the other. This integral connection between the two metals furthermore effectively prevents any possibility of disconnection between the two metals when in use and when it is subjected to the hot products of combustion of the engine. A valve is thus formed which is particularly adapted for use as the exhaust valve, in which the surface portion is composed of a heat resisting non-corrosive steel, so highly desirable in a poppet valve of this character, and which protects and encloses the core metal. Valves made in accordance with the herein described process are made very economically and with great rapidity. The extruded stem may be made only a few thousandths of an inch larger in diameter than the finished valve leaving only a very little metal to be removed by a single grinding or similar operation. When the core metal is of soft steel capable of being hardened, the action of the tappet on the end of the valve is effectively resisted.

This article is not to be confused with one in which a sleeve or cap is placed upon the end of a rod and the two forged together between dies. In these articles only the end portion of the stem is covered by a different material, and more or less difficulty is encountered in integrally uniting the two materials. By extruding the composite metal billet through a die, not only the entire head, but all or practically all, of the stem portion of the valve has a surface portion or sheathing composed of a heat resisting non-corrosive steel.

While the process herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise process, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. The process for the manufacture of bodies of several metal layers, consisting of providing a cylindrical core of hard metal of the class including iron and steel, with a coating of uniform thickness of a metal of similar hardness of the class including iron and steel alloys, for instance, chrome nickel steel, placing the coating around the core, heating this composite body and extruding the heated body.

2. The process for the manufacture of solid bodies made of a plurality of metal layers, which comprises providing a cylindrical core of hard metal of the class including iron and steel, providing a coating of uniform thickness of steel alloy of high chromium content and having superior corrosion-resistant qualities, placing the coating around the core so that it extends throughout the entire length of the core, heating this composite body and extruding the heated body.

3. The process for the manufacture of solid poppet valves made of a plurality of metal layers, which comprises providing a cylindrical core of hard metal of the class including iron and steel, providing a coating of uniform thickness of steel alloy of high chromium content having superior corrosion-resistant qualities, placing the coating around the core to extend throughout the length of the core, heating this composite body and extruding the heated body to form the stem portion of the valve while die-forming the head portion of the valve.

4. The process for the manufacture of solid

poppet valves made of a plurality of metal layers, which comprises providing a cylindrical core of steel, providing a coating of uniform thickness of chromium steel alloy having superior corrosion-resistant qualities, placing the coating
5 around the core so that it extends continuously along the cylindrical surface of the core and

across one end of the core, heating this composite body and extruding the heated body by exerting high pressure against that end of the body across which the coating extends so as to form an extruded valve stem having an outer layer of chromium steel alloy, and die-forming the valve head.

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