May 4, 1926. 1,583,432

M. M. WILCOX

POPPET VALVE

Filed May 31, 1924

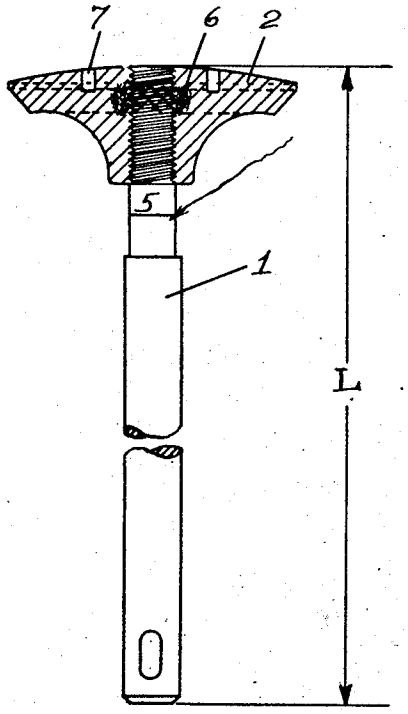


Fig. 1

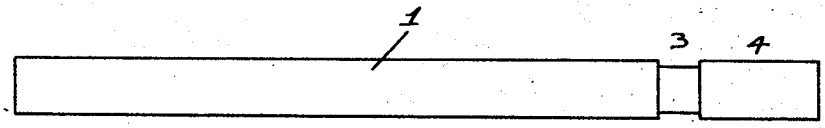


Fig. 2

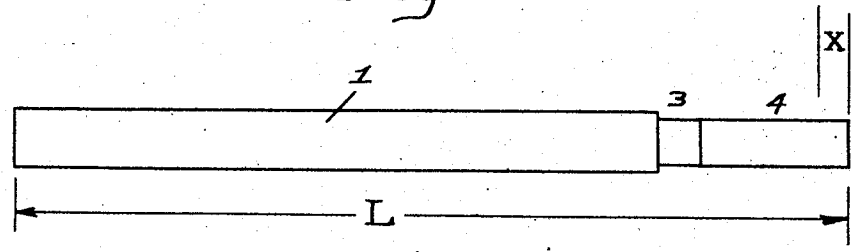


Fig. 3

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Patented May 4, 1926. 1,583,432

UNITED STATES PATENT OFFICE.

MERRILL M. WILCOX, OF SAGINAW, MICHIGAN; A. ELWOOD SNOW ADMINISTRATOR OF SAID WILCOX, DECEASED.

POPPET VALVE.

Application filed May 31, 1924. Serial No. 716,978.

To all whom it may concern:

Be it known that I, MERRILL M. WILCOX, a citizen of the United States, residing at Saginaw, in the county of Saginaw and State of Michigan, have invented certain new and useful Improvements in Poppet Valves; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to poppet valves and pertains more particularly to gas engine exhaust valves and the like in which the valve head is made of an iron casting and the stem is of rolled metal, the head and stem threaded and screwed together, and additionally fastened by electric welding so that the surface metal of some of the threads of the head and stem is slightly fused.

Such a valve construction and the method of making it are described and claimed in my Patent No. 1,470,041, issued Oct. 9, 1923, to which reference may be had.

The objects of my improvement are as follows: first, to cheapen the cost of construction by fabricating the valve stem so as to save a substantial portion of the valve stem material or bar stock that has heretofore been required; second, to increase the tensile strength of that part of the valve stem close to the head and within the head without the necessity of a separate manipulation or heat-treating operation to accomplish that result; third, to also materially increase the resistance to corrosion of that part of the valve stem near the neck of the valve and to do this without the employment of an additional or separate step in the manufacture of the valve.

My improvement also enables me to produce a valve having a considerably smaller stem diameter at the neck of the valve than heretofore, yet of equal strength, and by reason of this smaller diameter important structural advantages are attained that would othewise not be possible in a welded head valve of the character referred to and to which my present invention is especially well adapted.

With the foregoing and certain other objects in view which will appear later in the specification, my invention comprises the devices described and claimed and the equivalents thereof.

In the drawings Fig. 1 is a side view of the valve partly in section.

Fig. 2 is a side view of the stem as it appears after the first machining operation.

Fig. 3 is a similar view, showing the stem after being reduced in diameter at one end and lengthened by swaging.

In the drawings, 1 is the threaded valve stem which is tightly screwed into the internally threaded head 2, the stem and head being united by electric welding, so that the metal of some of the threads on the stem and head is fused and welded as described in my above-mentioned patent.

I accomplish the first of the objects before enumerated, namely, the saving of material or rolled bar stock for the valve stems, by the means which will now be described.

The required over-all length L of the valve stem has heretofore been obtained by cutting the bar stock to that length, but in my improvement I cut the stock for the valve stem shorter than L by a predetermined distance X. I next machine a short part 3 of the length of the stem 1 to a slightly smaller diameter and then by swaging or rolling reduce the diameter of the part 4 to substantially the diameter of the machined part 3, at the same time elongating part 4 by the amount X, thus bringing the overall length of the stem to the required finished dimension L.

In the making of valve stems for automobile engines according to my invention it is customary to use round bar stock of about twenty-five sixty-fourths inch diameter and the part 4 is made thirteen sixteenths inch in length. After swaging, the part 4 is reduced to eleven thirty seconds inch diameter and its length is thereby increased to one and one sixteenth inches, or a net elongation of the part 4 of X=1/4-inch. The finished length L is usually six inches and heretofore the bar stock has been initially cut to that length. Therefore, the method above described effects a net saving of one fourth inch, or about four per cent of the entire quantity of material required for the stem.

In saving this material I also attain a further object of my invention, namely, in-

creasing the strength of the stem where it enters the neck of the head, and also leaving a sharp-edged shoulder which in practice scrapes the carbon out of the throat of the valve stem guide.

Tests of these stems have shown that the swaging operation increases the tensile strength of the part 4 of the stem at the neck of the valve by approximately ten per cent.

By the same operation I also attain the further advantage of increasing the capability of the stem to resist the erosive and corrosive action of the hot exhaust gases at the place on the stem where they impinge most forcibly during the operation of the engine. This resistance to corrosion is imparted to the metal by the swaging of the part 4 because that operation improves the closeness of the grain of the metal, making it more dense and yet preserving the original outer surface or skin which is present on rolled bars and which, as is well known, offers more resistance to corrosion by hot gases than does a newly machined surface.

In Fig. 1 the approximate direction of impact of the hot gases against this rolled part of the stem is indicated by the arrow.

Since the swaged stem 5 is not only more resistant to corrosion, but is also stronger than it was before being swaged, its threaded part can be of somewhat smaller diameter for the same strength and thereby I gain a still further advantage which will now be explained.

In the welding step of the method described in my Patent No. 1,470,041 above referred to, a part of the metal of the cast iron head 2 is fused in the form of a circular band 6 and the nature of this band is changed by the welding operation so that it becomes practically pure white iron and glass-hard, capable of resisting a cutting tool or spoiling a drill.

Now, each engine valve is fitted with a pair of drill apertures 7 to receive a spanner by which the valve is rotated when it is being ground to its seat in the engine. These spanners are of standard dimension and spread and the holes 7 are made accordingly in the valve head after the stem has been welded to the head. Obviously if the glass-hard band of metal 6 extends too far out into the body of the head it would interfere with the proper drilling of the holes 7 and it, therefore, becomes of importance to limit the extent of this hardened area 6 so that it cannot project out to the holes 7. I, therefore, desire to keep the diameter of the part 5 of the stem as small as is commercially practicable, in order to keep the outside diameter of the hardened area 6 within the required limits.

Since the swaging of part 5 increases its tensile strength and its resistance to corrosion by the hot gases, it enables me also to employ a smaller diameter of part 5 than would otherwise be practicable, keeping within the required limits above mentioned, and I thus obtain a further important advantage by constructing the stem in the manner set forth.

By the means above described I have brought into the art of manufacturing poppet valves employing cast iron heads and wrought metal stems certain novel features of construction that not only increase the strength, durability and lightness of the valve, but reduce the cost of manufacture not alone by saving material, but also by reducing the number of machining operations heretofore required.

The extent of the cost-reduction by reason of the saving of stem material will be apparent when it is remembered that on a production basis many thousands of valve stems are manufactured per day and a net saving of four per cent of the stem material constitutes a real and very important gain.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A poppet valve having a cast metal head, a wrought metal stem received within and welded to said head, said stem initially shorter than its required length when finished, and formed near its end adjacent said head with a circular groove, the extremity of said stem swaged to thereby reduce its diameter to approximately the diameter of the bottom of said groove while elongating it to said required finished length and thereby also improving its strength, surface density and capability to resist corrosion.

2. A poppet valve having a cast metal head, a wrought metal stem received within and welded to said head, said stem being initially shorter than its required length when finished, the extremity of said stem swaged to thereby reduce its diameter, increase its strength and surface density, and to elongate said stem to said required finished length.

3. In a poppet valve having a cast metal head, a wrought metal stem made initially shorter than its required length when finished and having an end received within and fixed to said head, the said end swaged to thereby reduce its diameter and to also thereby elongate said stem to said required finished length.

In testimony whereof, I affix my signature.

MERRILL M. WILCOX.