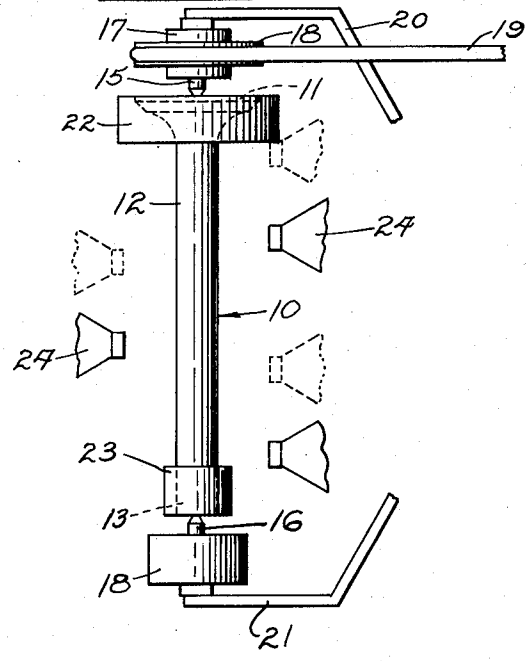
March 2, 1948. R. A. KEMPE 2,436,928

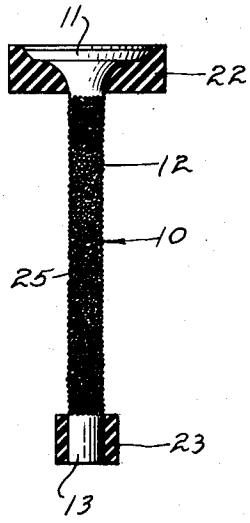
METHOD OF AND APPARATUS FOR MAKING POPPET VALVES

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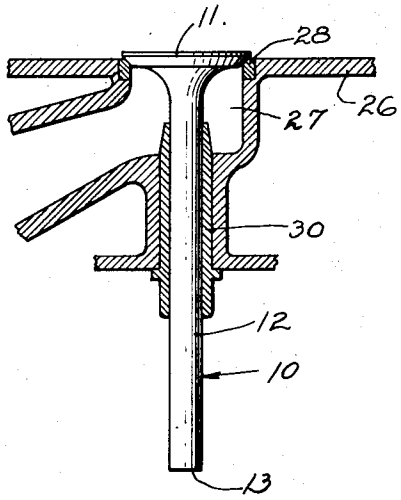
Fig—1



Fig—2



Fig—3



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METHOD OF AND APPARATUS FOR MAKING POPPET VALVES

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4 Claims. (Cl. 123—188)

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This invention relates to a method of and apparatus for making valves, such as poppet valves, and more particularly to a method of and apparatus for work hardening the guide portion of a valve stem.

Heretofore it has been recognized in the valve manufacturing art that scuffing and galling of the valve stem tends to occur at the point where it enters the guide in which the valve is reciprocated. This condition is disadvantageous because it not only weakens the valve stem at this point, but detracts from an efficient guiding of the valve in the guide cooperable with the stem. Moreover any wear of the stem in its guide results in an increase in the friction thus contributing to an increase in the wear and tear of the parts.

Various efforts have been made in the past to solve this undesirable condition, in other words, to minimize scuffing resulting from abrasion of the valve stem with the guide during operation of the associated engine. Some have proposed nitriding in which particular types of steel are used, such, for example, as austenitic stainless steel, but have found that corrosion resistance has been decreased. Others have proposed plating the guide portion of the stem with another type of material, but this is costly and is not as economically desirable as the present proposed method.

It is an object therefore of this invention to provide a new method of and apparatus for treating valve stems so as to make them more resistant to galling and scuffing as they move back and forth in their respective guide.

Another object of this invention is to provide a method of and apparatus for treating the guide portion of a valve stem which is commercially feasible and economical and which does not detract from other desirable characteristics of the valve.

Another object of this invention is to provide a method of and apparatus for treating the guide stem portion of a valve stem so as to augment the surface hardness of the same and yet make possible the use of alloys in the valve stem which ordinarily would not be completely suitable, due to the fact that they might not be hardenable to complete satisfaction by the usual heat treating methods.

Still another object of this invention is to provide a method for treating the guide portion of a valve stem made of a suitable alloy which method increases the surface hardening of the alloy and also does not decrease the corrosion resistance of the same.

In accordance with the general features of this invention, there is provided in a method of manufacturing a valve including a head and a stem, the step of substantially uniformly shot blasting the surface of the guide portion of the stem to work harden the same.

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Still another feature of this invention relates to supplementing the foregoing step by grinding the shot blasted portion so as to reduce the same to the desired diameter and also to eliminate the visual effect of the shot blast.

Another feature of the invention relates to the movement of the valve during the shot blasting operation, such as the rotating or oscillating of the same, or both, whereby a uniform treatment of the surface being work hardened is effected.

Yet another feature of the invention relates to the protection of certain parts of the valve during the shot blasting operation, such, for example, as the head and valve stem end part, such protection being effected by enveloping the same in a suitable cover of rubber or the like.

A further feature of the invention relates to the provision of an apparatus for carrying out the steps of the foregoing advantageous method.

Other objects and features of this invention will more fully appear from the following detailed description taken in connection with the accompanying drawing which illustrates a single embodiment thereof and in which:

Figure 1 is a somewhat diagrammatic view of an apparatus for practicing my novel method, the dotted illustrations show how the nozzles may be moved lengthwise of the stem so as to effect a uniform treatment of the stem.

Figure 2 is a side elevational view of a valve stem treated in accordance with the features of this invention, and showing the construction of the covering for the head end of the valve and the extremity of the stem of the valve; and

Figure 3 is a fragmentary cross sectional view through a portion of an engine cylinder, showing an elevation of a valve that has been treated in accordance with the features of this invention.

As shown on the drawings:

The reference character 10 designates generally a valve which is illustrated as being of the poppet type, although my invention is equally well applicable to other types of valves. The valve of this invention is of the type that is adapted to be used either with the exhaust or intake port of engines such as are used in airplanes and automobiles. In fact, in Figure 3, I have illustrated the valve 10 as being applied to the port of an engine.

The valve 10 includes the usual head 11, a stem 12, cooperable with a guide in an engine, and an extremity for the stem, which, in this case, I have designated by the reference character 13.

In Figure 1 I have illustrated diagrammatically an apparatus for practicing the method of my invention, the valve 10 being engaged at its extremities by centers 15 and 16 carried by blocks 17 and 18 respectively. The block or collar 17 has mounted on it a pulley 18 for rotating the valve 10, which pulley may be driven by any suitable means, such for example, as a belt 19.

In addition, if it is so desired, the two blocks 17 and 18 may be engaged by parts 20 and 21 of a suitable arm or yoke for reciprocating the valve 10 in the direction of its longitudinal axis. Any suitable mechanism may be employed for rotating the valve and for oscillating the same.

During the practicing of my method, I find it desirable to cover the extremities of the valve such as the head 11 and the free lower end 13 of the stem. In Figure 2, I have illustrated a rubber block 22 enveloping the lateral surfaces of the head 11 and a rubber sleeve 23 enveloping the extremity 13 of the stem. These covers may be made of any suitable material and the sole purpose is to prevent the shot blast from pitting the extremities of the stem; or in other words, those portions of the valve other than the guide portion to be work hardened.

During the rotation of the valve as shown in Figure 1, the surface of the guide portion of the stem 12 is subjected to a barrage of shots applied thereto through suitable air nozzles 24 and spaced longitudinally of the stem. These nozzles 24 may be of any desirable construction and of any suitable number to insure a uniform treatment of the surface of the guide portion of the stem 12. The dotted illustrations in Figure 1 illustrate movement of the nozzles longitudinally of the stem during the method of shot blasting the stem. If it is so desired, the nozzles may be moved longitudinally of the stem and the stem may be reciprocated in the direction of its axis. Both or either of these steps may be employed as desired, consistent with the objective of obtaining a uniform treatment of the stem.

After the stem 12 has been thus work hardened by being subjected to a barrage of shots, the surface of the same becomes pitted as indicated at 25 in Figure 2. It is this pitting of the surface which work hardens the outer layer of the metal of the stem so that the stem is better able to resist scuffing, galling and abrasion during its oscillation in a guide in an engine.

While the shot may be impelled by air pressure, it is to be understood that other types of means of impelling the shot may be employed, such for example, as apparatus wherein the shot is impelled by centrifugal force. The essential idea is that the stem should be hit uniformly by the shot in the same degree so as to enable a substantially uniform surface hardening of the alloy stem thereby increasing the fatigue life of the alloy that is in the stem. I have found that this method of treating the stem does not decrease the corrosion resistance as in the case of certain existent methods of case hardening, such as the nitriding of austenitic stainless steel. Moreover, my method is much more economically feasible and one wherein the difficulty is not met by plating the stem with another material.

As noted before, the impingement of metallic particles or shot on the stem of the valve results in its being pitted at the same time as the surface of the stem is hardened. This pitting, however, at least from the standpoint of its visibility is obviated during the subsequent reduction of the stem to the desired diameter. The stem may be reduced by any suitable mechanism although excellent results may be obtained by grinding the same during which operation the pits are removed so that they are no longer visible without detracting from the desirable work hardening characteristics accorded to the metal of the stem during the shot blasting of the same.

In Figure 3 I have illustrated a finished valve

after the stem 12 has been ground to reduce it to the desired diameter and after the covers or gaskets 22 and 23 have been removed. This finished valve is shown applied to an engine block 26 having the usual port 27 which may be either the exhaust or inlet port. Disposed about the port is an annular seat 28 on which the head end 11 of the valve stem is adapted to be seated. The cylinder block is also provided with a conventional valve stem guide 30 in which the stem 12 is adapted to reciprocate during the operation of the valve.

This novel valve made in accordance with the teachings of my aforesaid method is better able to resist scuffing and galling by abrasion with the guide during operation of the engine.

I claim as my invention:

1. As an article of manufacture, a valve of the poppet type including a head and a stem, said stem having a guide portion the outer area of which is shot work hardened, said stem, however, having a ground surface only at said shot worked area and which is substantially free of pits.

2. As an article of manufacture, a valve having a head and a stem adapted for guided movement in a valve guide structure, said stem having a guide portion the outer area of which is shot-hardened, said stem also having a smooth machined surface only at said shot-worked area.

3. As an article of manufacture, a valve having a head and a stem, said stem having a shot-worked hardened guide area, the penetration of the hardening being sufficient to afford a hardened guide surface after the guide portion of said stem has been machined to its operating diameter.

4. In a valve having a stem adapted for sliding movement in a valve guide, a pre-stressed, shot-worked hardened guide area uniformly disposed on said stem and coaxial therewith, the axial length of said hardened surface being determined by the distance of travel of said stem in said guide to provide a continuous corrosion-resistant, hardened contact surface, said stem having a ground surface only at said shot-worked guide area.

ROBERT A. KEMPE.

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