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METHOD OF FORMING VALVES

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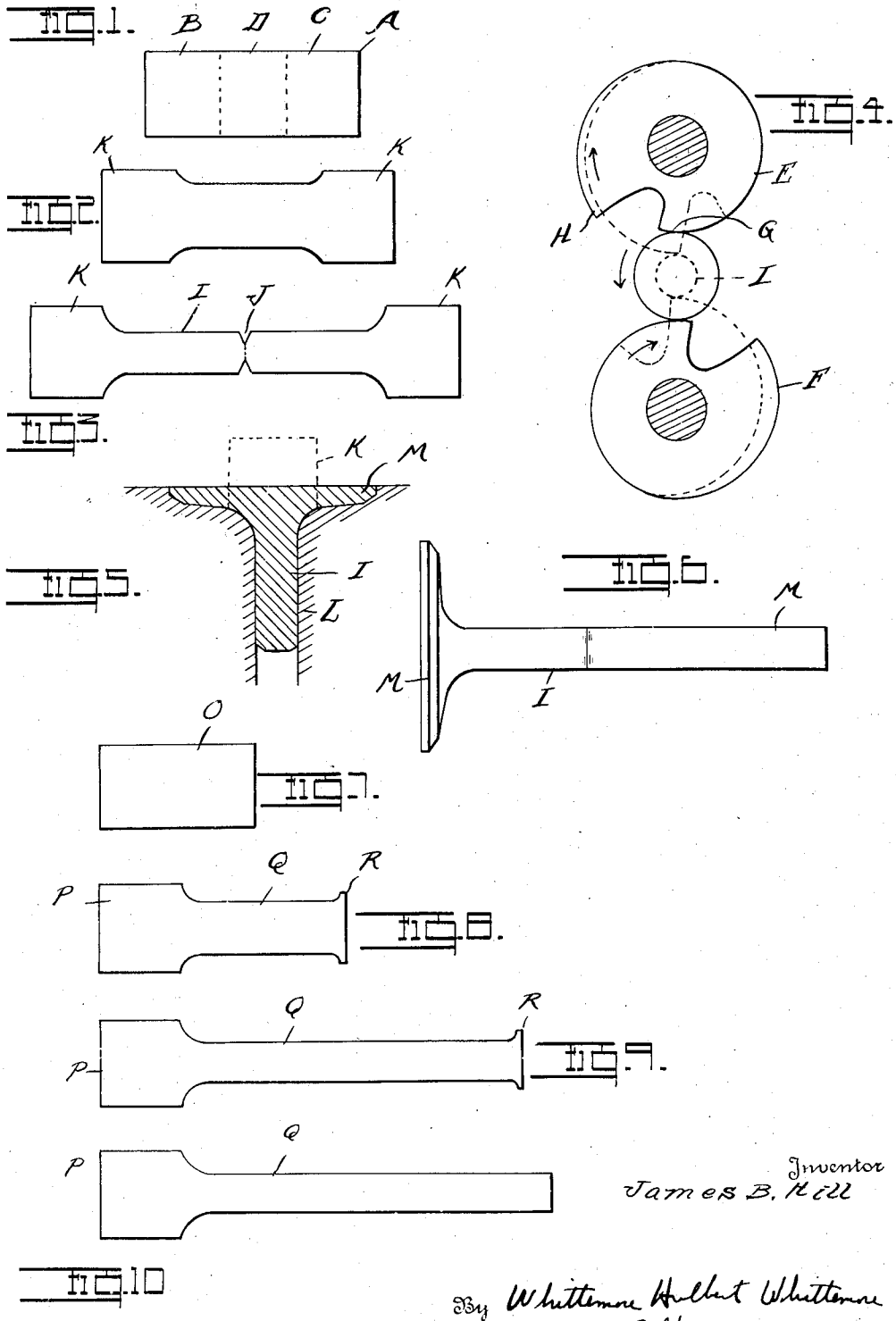


FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

FIG. 7.

FIG. 8.

FIG. 9.

FIG. 10.

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METHOD OF FORMING VALVES

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8 Claims. (Cl. 29—156.7)

The invention relates to the manufacture of valves more particularly for use in internal combustion engines and has for its object simplifying and expediting the process of manufacture and reducing the cost of the manufactured product. To this end the invention consists in the process as hereinafter set forth.

In the drawing:

Figs. 1, 2 and 3 show the blank in the several stages of rolling the same to form a stem;

Fig. 4 is a diagrammatic cross section illustrating the manner in which the blank is rolled;

Fig. 5 shows the step of re-fashioning the head portion of a blank to form a valve head;

Fig. 6 is an elevation showing the step of completing the stem;

Figs. 7, 8, 9 and 10 are views similar to Figs. 1 to 3 showing a modified process.

In the manufacture of valves for internal combustion engines, and more especially exhaust valves, it is desirable to form the head and the portion of the stem exposed to the hot exhaust gases of a relatively non-corrodible metal which can stand the high heat. On the other hand, the portion of the stem which engages the guide bearings can be satisfactorily made of a different grade of metal. The first step of my improved process is designed to quickly fashion a blank with a head portion of sufficient volume to form the valve head and an integral stem portion of reduced diameter. This I accomplish by the rolling of a cylindrical blank about its longitudinal axis and between co-acting eccentric rolls which gradually reduce the diameter of the stem portion and increase the length thereof. Preferably this is accomplished as illustrated in Figs. 1 to 3 in which A is the original cylindrical blank having head forming portions B and C and an intermediate stem forming portion D. This blank is rolled by the eccentric rollers E and F first engaging the portion G thereof which is of smallest radius and completing the operation by a portion H of larger radius. Between the points G and H there is a gradual change in radius so that when the blank is rolled between these rollers E and F moving in the direction indicated by the arrows, it will be progressively reduced from the full diameter to the diameter of the stem I. Just prior to the completion of the rolling of the stem it is centrally severed as indicated at J so as to form two like blanks, each having a head K and a stem I. This rolling operation is performed upon a heated blank and is so quickly accomplished that when the blank disengages from the rolls it still retains most of its original heat in the head portion K thereof. The volume or mass of this head portion K is so calculated as to equal the volume or mass of the completed valve head. The blank is then transferred to a die L in which the head portion K is pressed to form the valve head M. The next operation is to butt weld on to the end of the stem I an extension stem N after which the blank is ready for the finishing grinding or machining operations.

Where the valve is not subjected to as high heat as an exhaust valve, as for instance an inlet valve, the process may be modified to form the entire length of the stem integral with the valve head. This is illustrated in Figs. 7 to 10 inclusive in which O is the original blank which is rolled to form a head P of sufficient volume for forming the valve head, a stem portion Q gradually reduced in diameter and a head portion R sufficient to hold the blank in engagement with the forming rolls. At the completion of the rolling operation this head portion R is rolled down to the same diameter as the stem, as indicated in Fig. 10. From this point on the operation is the same as shown in Fig. 5 in which the head portion P is re-fashioned into the valve head M.

My improved process has the advantage that in the rolling of the stem around its own axis and gradually reducing the diameter thereof, there is no tendency to form overlaps or other defects incident to some of the processes used for reducing diameter. Furthermore, the reduction is so quickly accomplished that the blank remains at proper heat for the head forming operation as indicated in Fig. 5. Thus the production of a single rolling machine is much greater than can be obtained by any other process and by avoiding the necessity of reheating the blank for the succeeding step, the process is further expedited and simplified.

Another advantage of my improved process is that the blanks may be worked at a lower heat than with processes heretofore used. Thus I preferably heat the blank to not over 1800° F. before the rolling process and without reheating, refashion the unrolled portion to form the head. The product thus obtained is superior to a product formed from a blank more highly heated. Still another advantage of my process is that I eliminate the necessity of annealing the blank after the fashioning of the same, which is generally necessary with processes heretofore used.

What I claim as my invention is:

1. The method of forming valve blanks which consists in rolling a cylindrical blank about its own

longitudinal axis to form an integral head and stem, the latter being of reduced diameter and increased length and in re-fashioning the head portion to form thereof the valve head.

2. The method of forming valves which consists in rolling a cylindrical blank about its own longitudinal axis between eccentric rolls to reduce the diameter and increase the length of a portion of said blank to form a stem, leaving a portion of the original diameter and a length to be equal in volume to the completed valve head, and in refashioning the head portion of said rolled blank to form the head of the valve.

3. The method of forming valve stems which consists in rolling a heated cylindrical blank about its own longitudinal axis and between eccentric rolls, having a portion of the radius to receive the full diameter of the blank and a portion of the radius to reduce the blank to the diameter of the stem, a portion only of the length of said blank being thus reduced in diameter leaving a portion of the original diameter and of a length to be equal in volume to the valve head, and in refashioning the head portion of said blank while still under its original heat to form a valve head thereof.

4. The method of forming valves which consists in rolling a heated cylindrical blank about its longitudinal axis and between eccentric rolls which engage only an intermediate portion in the length of the blank and which gradually reduce the diameter of said portion and increase its length, leaving head portions at the opposite ends thereof, removing one of said head portions with the stem integral therewith and refashioning said head portion to form a valve head.

5. The method of forming valves which consists in rolling a heated cylindrical blank about its own axis and between eccentric rolls which engage an intermediate portion only of the length of said blank, leaving at opposite ends head portions of the original diameter and of a length to each be equal in volume to a valve head, severing the stem portion of said blank at the longitudinal center thereof to form two like headed and stemmed blanks and in refashioning the heads of said blanks to form the valve heads.

6. The method of forming valve blanks which consists in rolling a cylindrical blank about its own axis with a portion of the length thereof in contact with relatively moving surfaces progressively approaching each other to form a stem of reduced diameter and increased length and in refashioning the portion of the blank of original diameter to form a valve head.

7. The method of forming valve blanks which consists in rolling a cylindrical blank about its own longitudinal axis with a portion of its length in contact with relatively moving surfaces progressively approaching each other and increasing in width to form a stem of reduced diameter and increased length and in re-fashioning the portion of the blank of original diameter while still under its original heat to form a valve head thereof.

8. The method of forming valve blanks which consists in taking a cylindrical blank of a diameter considerably in excess of the diameter of the valve stem, heating said blank to a temperature not exceeding 1800° F., rolling a portion of the length of said blank about its longitudinal axis between relatively moving surfaces, gradually approaching each other and increasing in width to form a stem of such portion and in refashioning the unreduced portion of said blank without reheating to form a valve head.

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