Nov. 5, 1935. D. J. CAMPBELL 2,019,480

METHOD OF HARDENING IRON CASTINGS

Filed Oct. 24, 1932 2 Sheets-Sheet 1

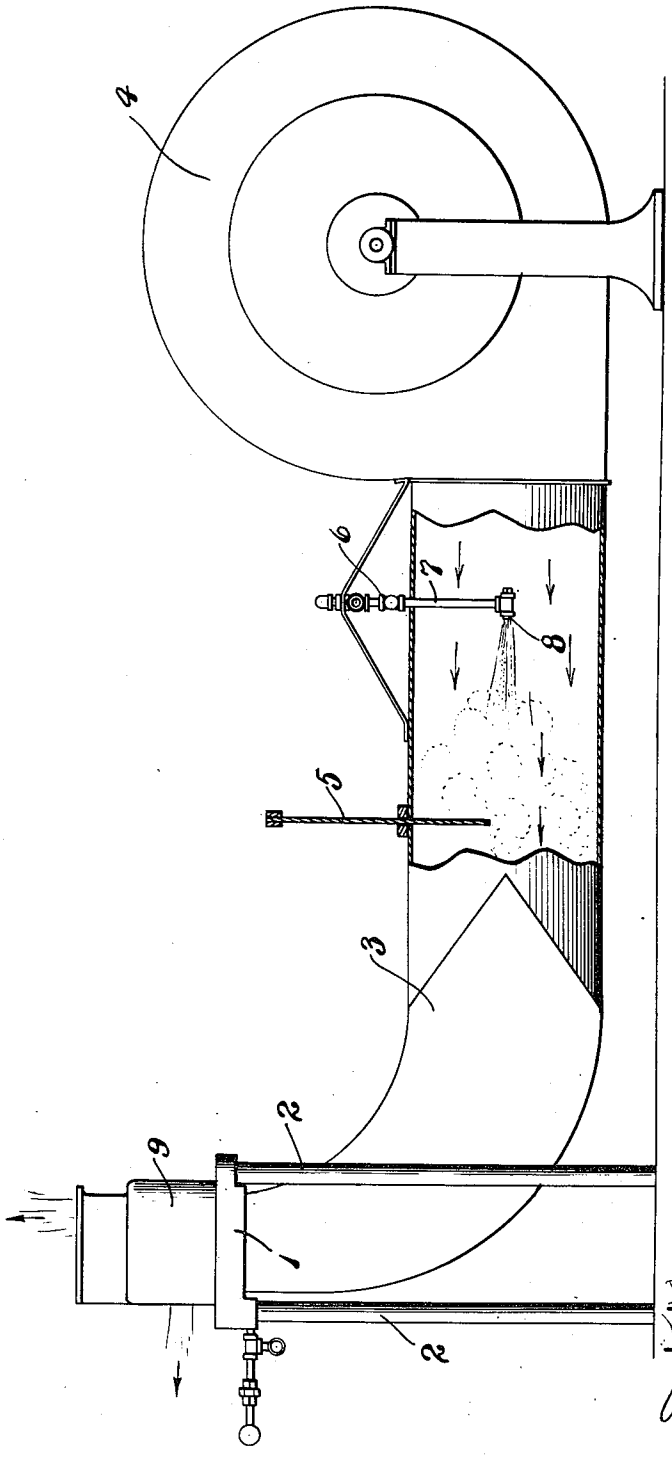


Fig. 1.

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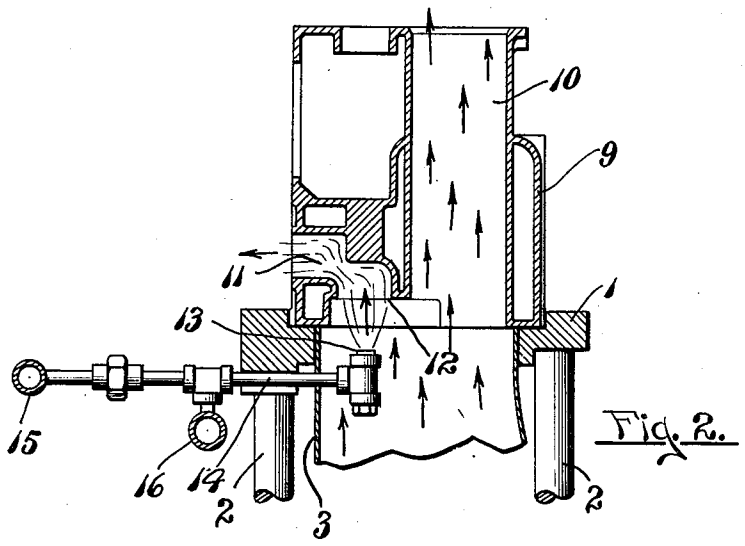


Fig. 2.

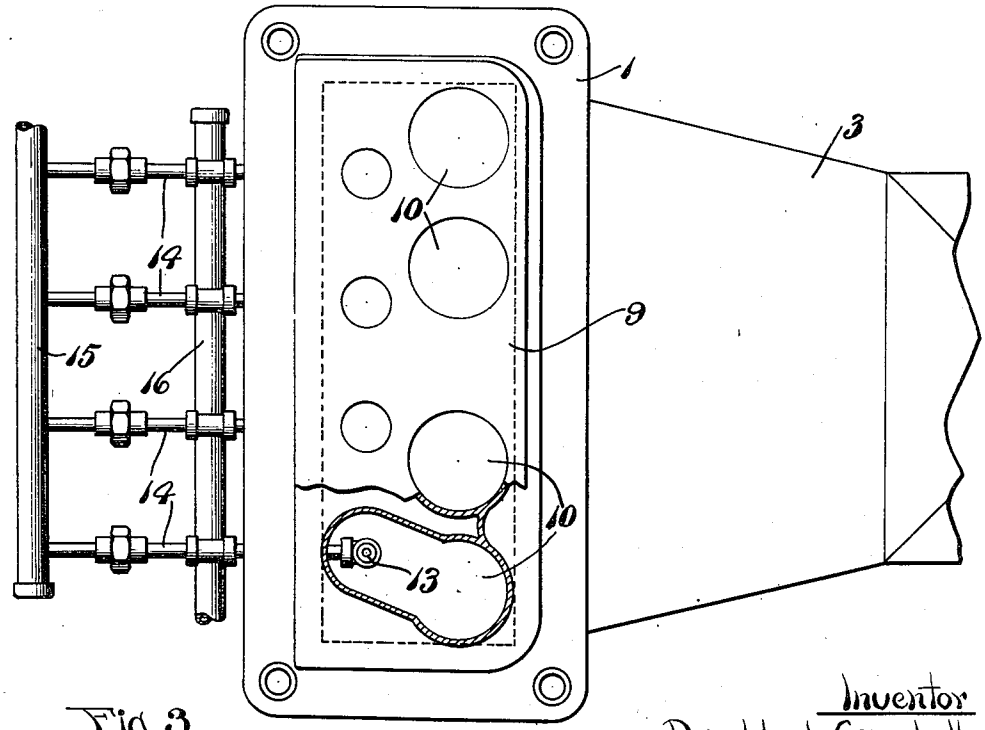


Fig. 3.

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METHOD OF HARDENING IRON CASTINGS

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3 Claims. (Cl. 148—20)

This invention relates to a method of increasing the hardness of cylinder walls and of the valve seats in cylinder blocks of engines, particularly internal combustion engines.

Places where considerable wear takes place in internal combustion engines are at the inner walls of the cylinder, due to piston reciprocation and the bearing of the piston rings against the walls, and at the valve seats due to rapid opening and closing of the valves with resultant striking or pounding of the valves on their seats.

My present invention is directed toward the hardening of such cylinder walls and valve seats whereby the same will be more resistant to the wear and service to which they are subjected and will have a much longer life with the casting of the cylinder block of ordinary cheap cast iron; and at the same time it is designed with this invention to provide cylinder blocks, using the regular and economical grades of cast iron previously used and thereafter appreciably harden the block at the wearing inner walls of the cylinders and at the places where the valve seats are made.

An understanding of the invention for the attainment of the above expressed objects as well as many others not at this time stated may be had from the following description, taken in connection with the accompanying drawings, in which,

Fig. 1 is a side elevation partly in section of apparatus which may be used in carrying out the method which I have invented.

Fig. 2 is a fragmentary enlarged vertical section illustrating the manner in which a cylinder block is treated for such cylinder wall and valve seat hardening, and

Fig. 3 is a fragmentary enlarged plan view of the cylinder block located with respect to the apparatus for the completion of the method or process.

Like reference characters refer to like parts in the different figures of the drawings.

The apparatus which I have preferably used includes a cylinder block carrying table 1, positioned horizontally and carried at the upper ends of supporting posts 2. The table 1 is open at its inner portions and in actuality is more of an open frame than a table. Connected at said opening is one end of a pipe or conduit 3 through which air or other suitable fluid may be blown from a blower 4. The passage of the air as to quantity and the like is designed to be controlled by an adjustable gate 5 slidable vertically as shown in Fig. 1.

Between the gate and the blower, means for introducing a spray of water, steam or the like into the conduit 3 is provided, there being above and outside the conduit a suitable water and air or steam supply indicated generally at 6, with a pipe or a plurality of pipes 7 extending into the conduit 3 and provided with nozzles 8 at their lower ends from which a mixture of air and water under pressure may be sprayed into the blown column of air passing through the conduit 3.

With my process a cylinder block 9 is first heated to a temperature of at least 1300° F. or in excess thereof. The block thus heated is placed on the supporting table 1, as shown in Fig. 2, in an inverted position so that the air and/or combined air and water blown through the conduit passes through the various passages in the cylinder block which are open for such passage. For example, the cylinders 10 and the ports 11, both intake and exhaust, for the engine, are positioned so that the air blown or the combined air and water sprayed therein are directed through said cylinder and port passages. It is at the points indicated at 12 in Fig. 2 that the valve seats are made in a cylinder block and where it is desirable that the metal be especially hardened; also throughout the inner sides of the walls of the cylinders 10.

The highly heated metal at or above 1300° F. is contacted against and semi-chilled by the blast of air or by the water saturated blast of air passing through the cylinder 10 and the ports 11 whereby, due to the rapid cooling and semi-chilling the cast iron, the metal undergoes a change in chemical composition approximating but less than fully chilled cast iron. Very hard chilled cast iron would be objectionable by reason of troubles in machining. But by varying the temperatures of the cylinder block casting or the temperatures of the water saturated air blast any reasonable desired degree of hardness of the iron in the walls of the cylinder and in the port passages 11 may be attained.

Furthermore it is evident that the water may be dispensed with and the air blast at atmospheric temperature used, or the air may be refrigerated and cooled to a desired temperature before it is blown through the block passages. Furthermore low pressure saturated steam has been used and found to be a good cooling medium and when used causes a very desirable structure graduating from maximum hardness at the inner surfaces to a less and less degree of hardness as the distance increases from the surfaces upon which the cooling medium has acted.

Inasmuch as the valve seats may require a greater degree of hardness than the cylinder

walls, an auxiliary or additional cooling treatment for the port passages so as to harden the iron where the valve seats are formed to a greater degree may be used. For example, a nozzle 13, as shown in Fig. 2, may be located directly underneath the lower end, when the block is inverted as in Fig. 2, of each of the port passages 11. Pipes 14 to supply the nozzles are associated with pipes 15 and 16, the former carrying water and the latter compressed air whereby there is a projection of water saturated air upwardly directly at the valve seat ends of the ports 11. It is evident that by varying the temperature of the water and air or by using air alone which may be either at atmospheric temperature or cooled, or if a softer degree of iron is desired, warmed, substantially any degree of hardness for the valve seat portion of the block may be had.

It is to be understood that while air saturated with water has been described as used the invention is not in any sense confined to the use of such particular specific cooling medium. Any other medium equivalent in effect may be employed which can be circulated and which will contact the heated cylinder block at the inner surfaces or walls of the cylinders and at the port passages so as to rapidly cool and thus harden the metal at the points desired. For example, I have in some cases employed steam of low pressure and at a temperature of 300° F. The temperature of the cylinder block being in excess of 1300° F. such steam at 300° F. projected against the parts to be hardened, reduces the temperature thereof quite rapidly with a consequent change in structure of the metal from coarse open grain to a fine close grain which is much more capable of withstanding the wear than the coarser softer metal as it was before treatment.

The rapid or semi-rapid reduction of temperature at the surface to be hardened is of course controllable within wide limits. A reduction in temperature of the portions of the metal at the surfaces to be hardened to below 1000° F. will provide hardening and the greater the reduction in temperature the greater the degree of hardening.

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

1. The method of hardening the inner walls of cylinders and the valve seat portions of a cast iron engine cylinder block, which consists in casting the block from melted iron to form, thereafter heating the block to a temperature in excess of 1300° F., passing a relatively large cooling stream of suitable media through the cylinders and against the valve seat portions and also providing a second cooling stream of air or the like and locating the last mentioned stream so as to cause it to flow through the valve seat portions.

2. The method set forth in claim 1 in which the second cooling stream of air or the like has a greater cooling capacity for each unit of surface than the first mentioned cooling stream.

3. The method of hardening the cylinder walls and valve seat portions of cast metal cylinder blocks which consists in producing a cast metal cylinder block having a plurality of engine cylinders and valve seat portions, heating the cylinder block to a temperature such that the walls of the cylinders and the valve seat portions will have a temperature in excess of 1300 degrees Fahrenheit and when heated passing a suitable cooling media into the said cylinders and against the valve seat portions in such proportion as to cool the walls and valve seat portions with sufficient rapidity to cause a hardening of the walls and valve seat portions, and preventing contact between the cooling media and the outside of the cast metal cylinder block.

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