This invention relates to air-cooled cylinder heads for internal combustion engines of the kind having at least one inlet or exhaust port formed in the head and communicating with the usual inlet or exhaust passage in the head, such port or each of such ports being controlled by a poppet valve the stem of which passes in the usual manner through a valve guide extending through the wall of the inlet or exhaust passage opposite the port, and in which in addition to the walls of the passage or passages and the pressure resisting wall which closes the end of the cylinder bore (which walls will be termed collectively for convenience herein the inner walls), there is an outer wall spaced from the inner walls to provide between the inner and outer walls a cooling air passage across which extend cooling fins integral with the inner walls at least and usually integral also with the outer wall which outer wall usually forms the base of the housing for the valve operating mechanism.

In such air-cooled cylinder heads as at present made each valve guide lies for the whole of its supported length within a thickening or boss integral with the inner and outer walls and it is the object of the present invention to provide an improved arrangement in which the cooling of the valve guide or guides and hence of the valve or valves associated therewith as well as the general cooling of the cylinder head will tend to be improved.

To this end according to the present invention, in an air-cooled cylinder head for an internal combustion engine of the kind referred to including inner and outer walls forming a cooling air passage, the valve guide or each of the valve guides extends between and passes through openings in the inner and outer walls so as to be supported by such walls with the part of the valve guide which extends across the cooling air passage directly exposed to the cooling air.

It will be apparent that with this arrangement adequate support for valve guides of adequate length is provided since the two walls can support each valve guide at suitably spaced points while the absence of any boss or thickening around the part of the valve guide which extends across the cooling air passage not only tends to improve the cooling of the guides, which are thus directly exposed to the cooling air, but also provides a bigger passageway for the air than would otherwise be the case, thus facilitating the air flow through the air cooling passage and therefore tending to assist the general cooling of the cylinder head.

It will be understood that the normal cooling fins will extend across the cooling air passage as hitherto.

If desired the part of the valve guide or each valve guide which lies within the cooling air passage may be formed or provided with ribs or projections or be otherwise so formed as to provide a relatively large heat transfer surface exposed to the cooling air.

In one such arrangement the external diameter of the valve guide or each valve guide may be approximately the same throughout its length and the increased heat-transfer surface area may be provided by forming circumferential or other grooves in the part of the guide lying within the cooling air passage while in another arrangement the part of the valve guide which lies within the cooling air space may be provided with cooling fins having an overall external diameter greater than the diameter of the part of the valve guide which passes through the inner wall but equal to or less than the diameter of the part of the valve guide which passes through the outer wall so that the finned part of the valve guide can be passed through the outer wall during assembly of the valve guide in position.

While the invention is particularly applicable to the air cooled cylinder head of engines of the usual overhead-valve-type, that is to say of the type in which both the inlet and exhaust valves are arranged in the cylinder head, it may also be applied to the air cooled cylinder heads of engines in which one or more of the valves are overhead valves and one or more so called side valves and to two-stroke engines in which so called end-to-end scavenging is used and in which one or more inlet or one or more exhaust valves are thus arranged in the cylinder head.

One construction according to the invention and various modifications thereof are illustrated by way of example in the accompanying drawings, in which:

Figure 1 is a cross-sectional vertical plane through the cylinder head of a vertical internal combustion engine, the plane being that indicated by the line 1—1 in Figure 2.

Figure 2 is a sectional view of the cylinder head shown in Figure 1, and

Figures 3 and 4 are cross-sections on a slightly enlarged scale showing two modifications according to the invention.

In the construction shown in Figures 1 and 2 the cylinder head is formed as an integral casting, for example in aluminum alloy or cast iron, comprising a main pressure resisting wall A formed to extend over the upper end of a cylinder bore and to make a gas-tight seal therewith with the aid of the usual gasket in known manner, this pressure sealing wall having formed therein inlet and exhaust ports B and C surrounded by the usual conical seatings B1, C1 which communicate with inlet and exhaust passages B2 and C2 formed integral with the pressure resisting wall A and extending between the ports B and C and openings B3, C3 in vertical outer faces B4, C4 on the head.

The head as shown is of roughly square form in plan and includes an approximately square plate-like flange A4 surrounding the pressure resisting wall A, two approximately parallel side walls A3, A3 integral with and extending upwards from two opposite edges of this flange A4 and integral with the walls of the inlet and exhaust passages B3, C3 where they meet them, an outer horizontal wall A5 formed integral with the side walls A3, A3 and extending between their upper edges at a level substantially above the inlet and exhaust passages B3, C3, and vertical cooling fins A6 extending between the outer wall A6 on the one hand and the pressure resisting wall A, the inlet and exhaust passages B, C, and the flange A7 on the other hand in a direction which is generally parallel to the side walls A3, A3. It will thus be seen that there is formed between the flanges A1, the pressure resisting wall A, the inlet and exhaust passages B, C, and the outer wall A7 a cooling air passage indicated by the reference letter A8 in Figure 1, through which air can flow in a generally horizontal direction parallel to the side walls and over the fins A6.

Formed in each of the passages B3, C3 and in the upper wall A4 above it are bores coaxial with the port, B or C, associated with that passage and supported in these bores so as to make a close fit therewith are valve guides.
D and E. It will thus be seen that the parts D' and E' of these valve guides which extend across the cooling air passage A^4 will be directly exposed to the cooling air stream flowing through that passage. The valve guides D are provided with the usual flanges D^5, E^2 adjacent to their upper ends to limit their downward travel during their insertion into the cylinder head and thus determine their final position, these flanges being surrounded by recesses to act as abutment surfaces for the lower ends of the usual valve springs F acting on the valves, indicated in chain line at G, G'.

For convenience the modifications shown in Figures 3 and 4 are shown as applied to the valve guide associated with the inlet port B.

In the modification shown in Figure 3 the valve guide D^5 is constructed and arranged similarly to the valve guide D in Figure 1 except that instead of the flange D^6 the valve guide is formed of the same overall diameter throughout its length apart from a groove provided at the appropriate point to receive a circlip as indicated at H which limits its downward movement during its insertion into the cylinder head, while grooves D^4 are formed in the part D^5 of the valve guide which lies within the cooling air passage A^4, to provide increased area for heat transfer to the cooling air.

In the modification shown in Figure 4 the hole in the outer wall A^4 is made larger than that in the wall of the inlet passage B^2 and the valve guide D^5 has an inner end portion D^7 of appropriate diameter to engage the hole in the wall of the passage B^2, while the overall diameter of the part D^5 of the valve guide which passes through the wall A^4 and extends across the cooling air passage is of enlarged diameter as shown, the part lying within the cooling air passage being provided with cooling fins as indicated at D^8. With this arrangement, therefore, a substantial surface area for heat transfer is provided without increasing the diameter of the hole in the wall or passage B^2 through which the valve guide passes.

What we claim as our invention and desire to secure by Letters Patent is:

1. An air-cooled cylinder head assembly for an internal combustion engine including a pressure resisting wall having therein at least one port formed for control by a poppet valve and communicating with an inlet or exhaust passage the wall of which is formed in the head, an outer wall spaced from the pressure resisting wall and from the wall of the passage to form, with such pressure resisting wall and passage wall, a cooling air passage across which extend cooling fins integral with the pressure resisting wall and the wall of the passage, openings coaxial with the port being formed respectively in the wall of the passage and in the outer wall, and a separate valve guide extending between the outer wall and the wall of the passage and passing through said openings with the part thereof which lies within the cooling air passage is directly exposed to the air in the passage.

2. An air-cooled cylinder head assembly for an internal combustion engine as claimed in claim 1, in which the part of the valve guide which lies within the cooling air passage is formed with an uneven surface to provide a large heat transfer surface exposed to the cooling air flowing through said passage.

3. An air-cooled cylinder head assembly for an internal combustion engine as claimed in claim 2, in which the overall external diameter of the valve guide is approximately the same throughout its length and the relatively large heat transfer surface area is provided by the provision of grooves in the part of the valve guide lying in the cooling air passage.

4. An air-cooled cylinder head assembly for an internal combustion engine as claimed in claim 1, in which the part of the valve guide lying in the cooling air passage has an overall external diameter which is greater than that of the part which passes through the opening in the wall of the passage but not greater than the diameter of the part of the valve guide which passes through the hole in the outer wall and the part of the valve guide which lies within the cooling air passage is provided with cooling fins.

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