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CYLINDER HEAD

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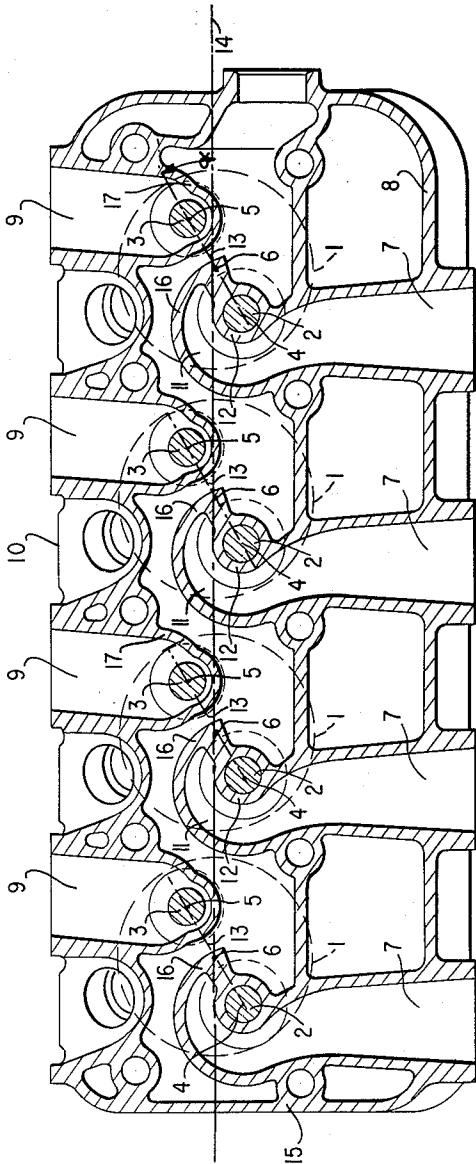


FIG. 1

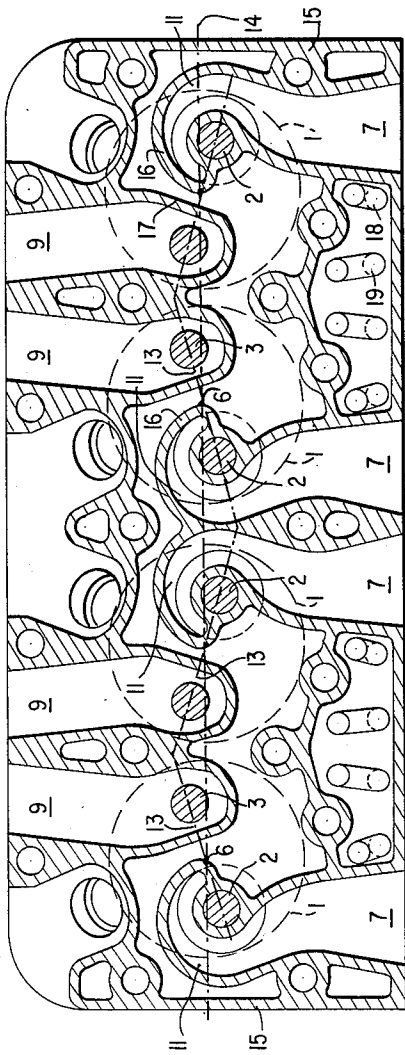


FIG. 2

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CYLINDER HEAD

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The present invention relates to a cylinder head for a multi-cylinder multi-cycle in-line internal combustion engine, operating with a compression ratio of 1:8 to 1:14, provided with a water cooling system and externally applied ignition, in which for each cylinder one inlet and outlet valve each are arranged suspended parallelly to the cylinder longitudinal axis, and in which the inlet channel leads in the direction toward the one cylinder head longitudinal side and the outlet channel in the direction to the other cylinder head longitudinal side.

The present invention essentially consists in constructing the inlet channel for each cylinder in proximity to the valve in spiral shape, winding about the valve guidance and by arranging the inlet and outlet valve for each cylinder offset or displaced in such a manner that a plane in which lie the longitudinal axes of both valves and the longitudinal axis of the cylinder, is disposed at an angle to the plane in which lie the longitudinal axes of all cylinders, and by displacing both the inlet valve as well as the outlet valve in direction of the channels thereof toward the cylinder head longitudinal sides.

With internal combustion engines having externally applied ignition which operate with compression ratios, falling between the compression ratios of the conventional Otto engine and the diesel engine, that is, between 1:8 and 1:14, it has proved necessary for achieving a knock-free operation, to take measures at the inlet for the combustion air by means of which there is imparted to the combustion air within the cylinder intensive and forceful circulatory movements about the cylinder longitudinal axis. As particularly suitable for this purpose is an inlet channel which winds in proximity to the valve spirally-shaped about the valve guide means because, in contrast to some other means for producing a rotary movement in the combustion air, for example, an arrangement of deflector valves, the filling of the cylinder is not impaired thereby. However, it is disadvantageous with such an arrangement that the spirally-shaped portion of the inlet channel requires a relatively large amount of space within the cylinder head so that the cooling of the cylinder head which is thermally highly loaded by reason of the utilized high compression ratio can be realized only in an inadequate manner. A sufficient water passage remains between the spirally-shaped portion of the inlet channel and the portion of the outlet channel in proximity to the valve only if the valve diameter remains below the extent which would be applicable with an arrangement of usual channels.

In contradistinction thereto, it is possible in accordance with the present invention to create, within the cylinder head, space between the inlet channel and the outlet channel for a sufficient passage or flow cross section of the water notwithstanding the high compression ratio and the spirally-shaped configuration of the inlet channel. Additionally, there is achieved by the present invention an arrangement in which the channels may be kept relatively short so that the heating of the combustion air by the cooling water within the inlet channel becomes very small and also the heating of the cooling water by the hot exhaust gases becomes relatively slight. Furthermore, it is also of particular advantage that both valves may be actuated by way of push-rods from one cylinder longi-

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tudinal side by means of rocker arms which may have the same dimensions in length and may be interchangeably alike among themselves.

According to a further feature of the cylinder head construction in accordance with the present invention, the spirally-shaped portion of the inlet channel may be arranged with the largest cross sectional surfaces thereof in the direction toward the neighboring cylinder or toward the front or rear closure wall of the cylinder head so that most of the available space between two cylinders within the cylinder head and also the space at the beginning and at the end of the cylinder head may be fully utilized for the accommodation of the spirally shaped portions of the inlet channel.

With a four-cylinder engine, in which a water passage is provided only between the second and third cylinder, the spirally-shaped portion of the inlet channel having the largest cross sectional surfaces may be arranged facing the closure wall of the cylinder head with the first and fourth cylinder and may be arranged mutually facing each other with the second and third cylinder. By the use of such an arrangement, there is achieved a more clean design and construction which enables to arrange only three connecting pipes from the common suction pipe or intake manifold to the suction channels and only two connecting pipes from the outlet channels to the common exhaust manifold.

If it becomes necessary to impart to the combustion air not only a component in the circumferential direction of the cylinder, but also a component in the axial direction of the cylinder downwardly thereof, the admission or inlet cross sections of the inlet channels, according to a further feature of the present invention, may be arranged at the top side of the cylinder head.

With a cylinder head having a common suction pipe or intake manifold flangedly connected to the inlet channels which, for purposes of heating by means of cooling water, is of double-wall construction, according to still another feature of the present invention, the common suction pipe or intake manifold may be connected with a short-circuiting or by-pass line, by-passing the radiator of the internal combustion engine which by-pass line is controlled by a thermostat. As a result thereof, an effective preheating of the drawn-in combustion air or fuel-air mixture may be achieved at a time in which the preheating is particularly necessary. With relatively cold cooling water the thermostat controls the cooling water through the by-pass line and with higher atmospheric temperatures, this by-pass line is completely closed off. Consequently, an intensive preheating at the suction or intake pipe takes place soon after starting of the internal combustion engine, whereby during the winter such preheating is also present while driving whereas, while driving through a mountain pass, for example, in the summer, the preheating is effectively rendered completely ineffectual, i.e., is completely turned off.

Accordingly, it is an object of the present invention to provide a cylinder head construction which eliminates the shortcomings and drawbacks encountered with the prior art constructions mentioned hereinabove.

It is another object of the present invention to provide a cylinder head construction for internal combustion engines having water cooling and external ignition, which permits operation of the engine at compression ratios higher than those of conventional Otto engines without impairing the good filling of the cylinders, without danger of over-heating and without special means other than the configuration of the inlet channels to impart to the combustion air or mixture flowing therethrough a sufficient vortexing or turbulence enabling the operation of the engine at these high compression ratios.

Still another object of the present invention resides in the provision of a cylinder head construction of clean design and simple layout which permits sufficiently large cross sections for the passages of the cooling water to assure knock-free operation of the engine.

A further object of the present invention resides in the provision of a multi-cylinder internal combustion engine operating with externally applied ignition at compression ratios substantially above those normally used for such engines which assures sufficient space for the cooling water flow in the cylinder head while at the same time permitting the use of large valves and valve channels.

A still further object of the present invention resides in the provision of a cylinder head construction in which heating of the combustion air within the inlet channel by the cooling water is kept relatively small while at the same time heating of the cooling water by the exhaust gases is also minimized.

Still another object of the present invention resides in the provision of a cylinder head construction for engines of the type described hereinabove which permits the use of interchangeable valve actuating parts, utilizes the space available within the cylinder head in a very favorable and advantageous manner and permits reducing the number of connecting pipes or ducts between the intake and outlet manifolds and the respective inlet and outlet channels.

Still another object of the present invention resides in a provision of a cylinder head construction in which a particularly favorable preheating of the combustion air is assured during all seasons.

These and other objects, features and advantages of the present invention will become more obvious from the following description when taken in connection with the accompanying drawing which shows, for purposes of illustration only, two embodiments in accordance with the present invention, and wherein

FIGURE 1 is a horizontal cross sectional view through a first embodiment of a cylinder head construction in accordance with the present invention, and

FIGURE 2 is a horizontal cross sectional view, similar to FIGURE 1, through a modified embodiment of a cylinder head construction in accordance with the present invention.

Referring now to the drawing wherein like reference numerals are used throughout the two views to designate like parts, and more particularly to FIGURE 1, reference numeral 1 designates therein the several cylinders of a multi-cylinder engine. One suspended inlet valve 2 and one suspended outlet valve 3 each is coordinated or operatively associated with each cylinder 1. The center longitudinal axis 4 of the inlet valve 2 and the center longitudinal axis 5 of the outlet valve 3 are disposed parallel to the center longitudinal axis 6 of the cylinder 1. The inlet channels 7 lead from the one longitudinal side wall 8 of the cylinder head toward the inlet valves 2. The outlet channels 9 lead from the outlet valves 3 to the oppositely disposed longitudinal side wall 10 of the cylinder head. The inlet channels 7 are each provided in proximity to the corresponding inlet valve with a spirally-shaped channel portion 11 which for purposes of imparting a rotary movement to the inflowing combustion air or fuel-air mixture winds about the valve guide means 12 of the corresponding inlet valve 2. The plane 13 in which are disposed the center longitudinal axes of the inlet valve 2 and of the outlet valve 3, respectively, and the center longitudinal axis 6 of the corresponding cylinder 1, is disposed at an angle α to the plane 14 in which lie the center longitudinal axes 6 of all cylinders 1. The inlet valve 2 is offset with respect to the outlet valve with each cylinder in such a manner that the inlet valve 2 is moved closer to the longitudinal side wall 8 and the outlet valve 3 closer to the longitudinal side wall 10 of the cylinder head. The various planes 13 are all disposed parallel to each other. The channel portions 11 of the inlet channels 7 are displaced with the larger cross sectional surfaces there-

of toward the neighboring cylinder. With the last cylinder, the channel portion 11 is directed against the cross wall 15 of the cylinder head.

There is achieved by the valve arrangement and channel construction within the cylinder head described hereinabove, with engines operating at relatively higher compression ratios of the order of 1:8 to 1:14, that notwithstanding the arrangement of spirally-shaped channel portions 11 at the inlet channels 7 for achieving a sufficient air eddying or vortexing, sufficient space remains between the walls 16 of the inlet channel 7 and the walls 17 of the outlet channel 9 in order to eliminate or carry away, by large quantities of cooling water, the larger amount of produced heat expected at this place by reason of the high compression ratio.

The angle α between the planes 13 and 14 may thereby be selected of such value, for example, 15° that the actuation of the valves is possible from one engine longitudinal side, by means of rocker arms and push rods, all of the same length.

In the cylinder head of the second embodiment illustrated in FIGURE 2, the planes 13 in which lie, for each cylinder 1, the center longitudinal axes 4 and 5 of the valves 2 and 3 and the center longitudinal axis 6 of the cylinder 1, are not disposed parallel to each other as in the first embodiment, but instead in such a manner that the planes 13 intersect between each two adjacent cylinders. It is possible by such an arrangement with the illustrated cylinder head for a four-cylinder engine having only one water passage between the second and third cylinders, to arrange the spirally-shaped channel portions 11 of the inlet channels 7 at the first and last cylinders to each face the cross walls 15 of the cylinder head and at the second and third cylinder to face one another. As a result of such an arrangement of the inlet channels, the outlet channel 9 of the first and second and those of the third and fourth cylinders are disposed adjacent each other. Sufficient space for the passage of larger quantities of cooling water thereby remains between the walls 16 of the inlet channels 7 and the walls 17 of the outlet channels 9. If the angles α between the planes 13 and the planes 14 amount to about 15 to 20° , then, with each cylinder, the valves may be actuated from one cylinder longitudinal side by way of push rods 18 and 19 and the required rocker arms may be made of equal lengths.

Whereas with the cylinder head according to the first embodiment, one common suction intake pipe or manifold with four connecting pipes leading to the inlet channels 7 is still necessary, it suffices in the second embodiment to provide an arrangement of a common suction intake pipe or manifold with three connecting pipes. Only two connecting pipes are necessary leading to the outlet channels 9 with the exhaust common intake pipe or manifold.

Since with the cylinder heads of both embodiments, a preheating of the sucked-in combustion air or drawn-in mixture is not possible by the exhaust or the common exhaust intake pipe because the channels lead toward different cylinder head sides, the common suction intake pipe or manifold in accordance with the present invention is advantageously of double wall construction and is operatively connected with a by-pass line controlled by a thermostat and by-passing the radiator of the internal combustion engine. The thermostat constructed appropriately as two-valve thermostat guides the cooling water initially completely through the by-pass line. With higher atmospheric temperatures the by-pass line is closed. After starting of the engine, there takes place an intensive heating of the common suction intake manifold. In winter, a good heating of the common manifold is also assured during the drive. On the other hand, while driving through a pass, for example, in the summer, the heating or preheating is completely turned off by such an arrangement.

While we have shown and described two embodiments in accordance with the present invention, it is understood

that the same is not limited thereto, but is susceptible of many changes and modifications within the spirit and scope thereof, and we therefore do not wish to be limited to the details shown and described herein, but intend to cover all such changes and modifications as are encompassed by the scope of the appended claims.

We claim:

1. A cylinder head for a multi-cylinder multi-cycle in-line combustion engine operating at a compression ratio of about 1:8 to 1:14 and provided with water cooling and externally applied ignition, comprising:

inlet and outlet channel means for each cylinder means, inlet and outlet valve means having valve guide means for controlling respective inlet and outlet channel means and suspended substantially parallelly to the cylinder longitudinal axis,

the inlet channel means leading in the direction toward one longitudinal side of the cylinder head and the outlet channel means leading in the direction toward the other longitudinal side of the cylinder head,

the inlet channel means for each cylinder means being constructed substantially spirally-shaped about the respective valve guide means in proximity to the corresponding inlet valve means, and the inlet and outlet valve means for each cylinder means being arranged offset in such a manner that a plane containing the longitudinal axes of both valve means and the longitudinal axis of the cylinder means is disposed at an angle to the plane containing the longitudinal axes of all cylinder means,

and the inlet channel means extending in proximity to the corresponding inlet valve means approximately tangentially to the respective valve guide means in such a manner that the spirally-shaped portions of the inlet channel means of adjacent ones of said cylinders spiral in opposite directions.

2. A cylinder head for a multi-cylinder four-cycle in-line combustion engine operating at a compression ratio of about 1:8 to 1:14 and provided with water cooling and externally applied ignition, comprising:

inlet and outlet channel means for each cylinder means, a single inlet and a single outlet valve means having valve guide means for controlling respective inlet and outlet channel means and suspended substantially parallelly to the cylinder longitudinal axis.

the inlet channel means leading in the direction toward one longitudinal side of the cylinder head and the outlet channel means leading toward the other longitudinal side of the cylinder head,

the inlet channel means for each cylinder means being constructed substantially spirally-shaped about the respective valve guide means in proximity to the corresponding inlet valve means, and the inlet and outlet valve means for each cylinder being arranged offset in such a manner that a plane containing the longitudinal axes of both valve means and the longitudinal axis of the cylinder means is disposed at an acute angle to the plane containing the longitudinal axes of all cylinder means, the substantially spirally shaped portion of the inlet channels of adjacent ones of said cylinders being spiralled in opposite directions,

the inlet cross sections of the inlet channel means being arranged on the top of the cylinder head.

3. In a four cylinder multi-cycle in-line internal combustion engine which operates with a compression ratio of about 1:8 to 1:14 and with a water cooling system and externally applied ignition, and in which there is provided for each cylinder an inlet valve and an outlet valve arranged in a suspended manner substantially parallelly to the cylinder longitudinal axis, and in which the inlet channels lead in the direction toward one cylinder head longitudinal side and the outlet channels in the direction toward the other cylinder head longitudinal side, a pas-

sage for the cooling water being provided only between the second and third cylinder,

the improvement essentially consisting of a cylinder head construction for such engine having closure walls and containing the inlet and outlet channels and the valve guide means for the inlet and outlet valves, each inlet channel being substantially spirally-shaped in proximity to the corresponding inlet valve about the respective valve guide means,

and the inlet and outlet valves for a respective cylinder being so arranged and constructed that a plane substantially containing the longitudinal axes of both valves and the longitudinal axis of the cylinder is disposed at an angle to the plane substantially containing the longitudinal axes of all cylinders,

the substantially spirally-shaped portion of the inlet channels of adjacent ones of said cylinders being spiralled in opposite directions.

4. A cylinder head for a multi-cylinder multi-cycle in-line combustion engine operating at a compression ratio of about 1:8 to 1:14 and provided with water cooling and externally applied ignition, comprising:

inlet and outlet channel means communicating with each cylinder means tangentially to the walls thereof, a single inlet and a single outlet valve means having valve guide means for controlling respective inlet and outlet channel means and suspended substantially parallelly to the cylinder longitudinal axis,

the inlet channel means leading in the direction toward one longitudinal side of the cylinder head and the outlet channel means leading in the direction toward the other longitudinal side of the cylinder head,

the inlet channel means for each cylinder means being constructed substantially spirally-shaped about the respective valve guide means in proximity to the corresponding inlet valve means, and the inlet and outlet valve means for each cylinder means being arranged offset in such a manner that a plane containing the longitudinal axes of both valve means and the longitudinal axis of the cylinder means is disposed at an acute angle to the plane containing the longitudinal axes of all cylinder means,

and the inlet channel means extending in proximity to the corresponding inlet valve means approximately tangentially to the respective valve guide means in such a manner that the spirally-shaped portions of the inlet channel means of adjacent ones of said cylinders spiral in opposite directions.

5. In a four cylinder multi-cycle in-line internal combustion engine which operates with a compression ratio of about 1:8 to 1:14 and with a water cooling system and externally applied ignition, and in which there is provided for each cylinder a single inlet valve and a single outlet valve arranged in a suspended manner substantially parallelly to the cylinder longitudinal axis, and in which the inlet channels lead in the direction toward one cylinder head longitudinal side and the outlet channels in the direction toward the other cylinder head longitudinal side, a passage for the cooling water being provided only between the second and third cylinder,

the improvement essentially consisting of a cylinder head construction for such engine having closure walls and containing the inlet and outlet channels and the valve guide means for the inlet and outlet valves, each inlet channel being substantially spirally-shaped in proximity to the corresponding inlet valve about the respective valve guide means,

and the inlet and outlet valves for a respective cylinder being so arranged and constructed that a plane substantially containing the longitudinal axes of both valves and the longitudinal axis of the cylinder is disposed at an acute angle to the plane substantially containing the longitudinal axes of all cylinders,

the substantially spirally-shaped portion of the inlet

channels of adjacent ones of said cylinders being spiralled in opposite directions, the inlet openings of the inlet channels being disposed on the top of the cylinder head.

6. In a multi-cylinder multi-cycle in-line internal combustion engine which operates with a relatively high compression ratio and with a water cooling system and externally applied ignition, and in which there is provided for each cylinder a single inlet valve and a single outlet valve arranged in a suspended manner substantially parallelly to the cylinder longitudinal axis, and in which the inlet channels lead in the direction toward one cylinder head longitudinal side and the outlet channels in the direction toward the other cylinder head longitudinal side, the improvement essentially consisting of a cylinder head construction for such engine containing the inlet and outlet channels and the valve guide means for the inlet and outlet valves, the inlet channels being approximately spirally-shaped in proximity to the corresponding inlet valves about the valve guide means, and the inlet and outlet valves for a respective cylinder

being so arranged and constructed that a plane substantially containing the longitudinal axes of both valves and passing at least approximately through the longitudinal axis of the cylinder is disposed at an acute angle of approximately 15° to the plane substantially containing the longitudinal axes of the cylinders the spirally-shaped portions of the inlet channel means of adjacent ones of said cylinders being spiralled in opposite directions.

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