United States Patent

Honda

[15] **3,650,249**

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[54] APPARATUS FOR UTILIZING COOLING AIR FOR AN INTERNAL COMBUSTION ENGINE FOR HEATING A PASSENGER COMPARTMENT

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[30] **Foreign Application Priority Data**

Sept. 4, 1969 Japan.....44/69727

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[51] **Int. Cl.**.....**F01f 1/32,** F01p 1/10, B60h 1/02

[58] **Field of Search**.....237/12.3 A; 123/41.32, 41.6, 123/41.61, 41.62, 41.65, 41.67, 41.69, 41.70, 41.28, 193.4, 169 R, 169 C, 169 PA, 169 PH, 169 CL

[56] **References Cited**

UNITED STATES PATENTS

1,250,009	12/1917	Ponsot	123/169 UX
1,508,383	9/1924	Densley	237/12.3 A
1,662,486	3/1928	Ashley	237/12.3 A
1,827,600	10/1931	Morgan et al.	123/41.67 UX
1,910,591	5/1933	Chilton	123/169 X
1,962,987	6/1934	Fedden	123/169 UX
2,063,825	12/1936	Otwell	237/12.3 UX
2,095,791	10/1937	Chilton et al.	123/41.32
2,149,027	2/1939	Meredith	123/169
2,182,866	12/1939	Gabrielson	123/41.67 UX
3,302,881	2/1967	Laing et al.	237/12.3 A

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[57] **ABSTRACT**

An internal combustion engine for a motorcar has, at the outer surface of at least its cylinder head portion, a forced cooling air passage which is in communication at its outlet with the interior of the passenger compartment. The spark plugs are positioned within this passage and a tubular partition wall surrounds each plug to isolate the plug in airtight manner from the interior of the passage. Each partition wall has an opening at its upper end in communication with the external air. The tubular wall may be provided at its base portion with an opening extending into the interior of the passage, so that a portion of the cooling air within the passage flows into the interior of the tubular wall and out through the opening at the upper end. The upper end of the tubular wall may be provided with a cover and the opening at the upper end extends laterally beneath the cover.

10 Claims, 3 Drawing Figures

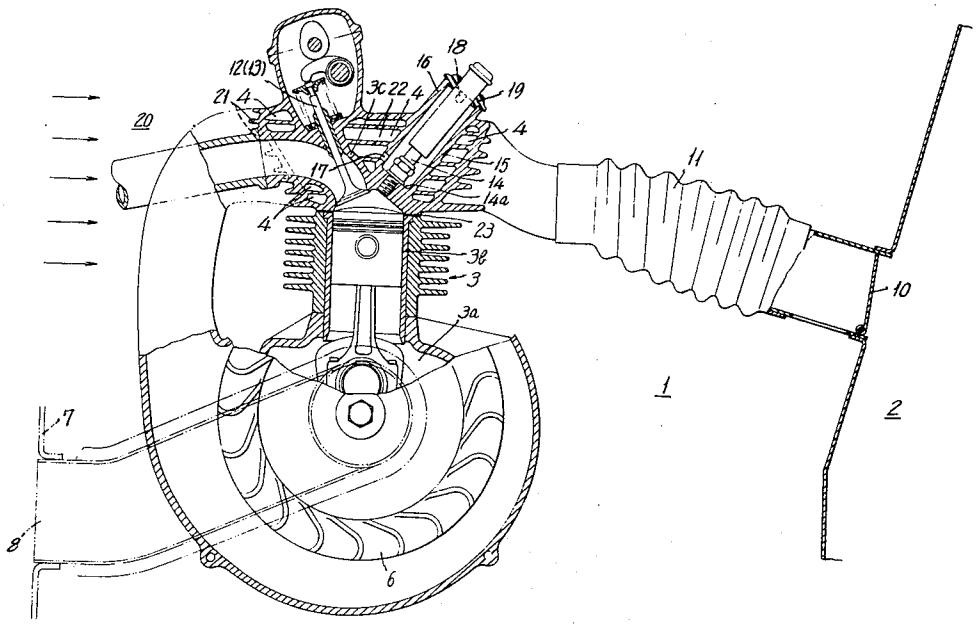
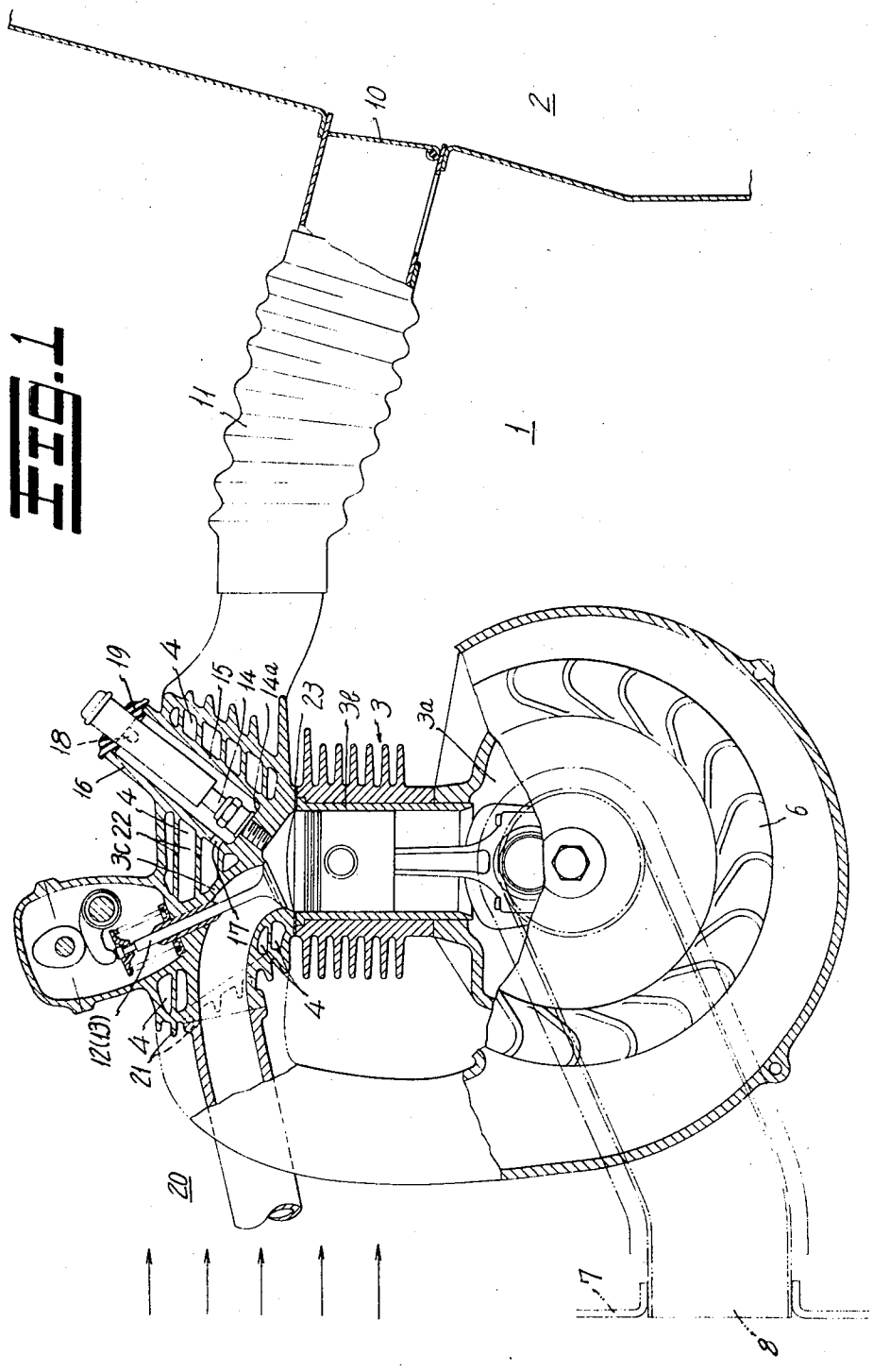


FIG. 1



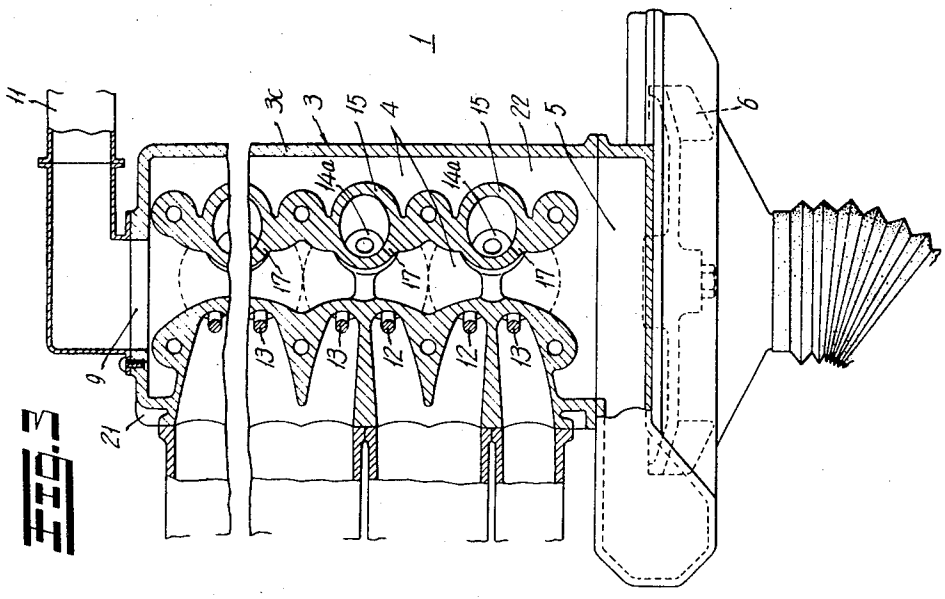

1
11
3c
3
15
4
15
22
5
6
14a
14a
17
17
17
13
13
12
12
13
9
21

FIG. 3

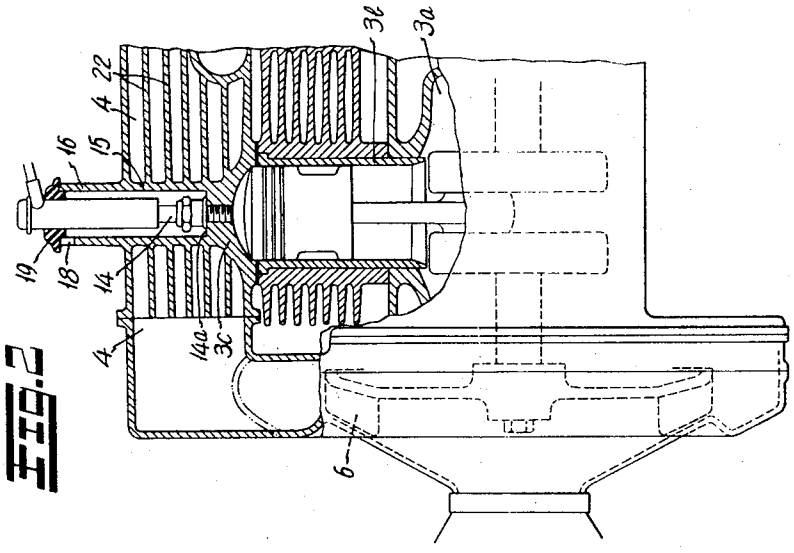

3b
3a
22
4
16
15
19
18
14
4
14a
3c
6

FIG. 2

APPARATUS FOR UTILIZING COOLING AIR FOR AN INTERNAL COMBUSTION ENGINE FOR HEATING A PASSENGER COMPARTMENT

BRIEF SUMMARY OF THE INVENTION

It has been known in a motorcar, to employ a forced cooling air passage on the outer surface of an internal combustion engine in communication, at its outlet opening, with the interior of the passenger compartment so as to utilize the cooling air for the engine as heating air for the passenger compartment. If, in this case, a spark plug is positioned within the passage, any gas which has leaked from the interior of the engine through the attaching portion of the base end of the spark plug becomes mixed with the cooling air within the forced cooling air passage so as to be led into the passenger compartment along with the air, and this is undesirable from a health standpoint.

An object of this invention is to provide an apparatus free from this deficiency.

According to this invention, in an apparatus of the type in which an internal combustion engine is installed in a motorcar for powering the same, there is provided at the outer surface of at least the cylinder head portion of the engine, a forced air cooling passage and this passage is in communication at its outlet with the interior of the passenger compartment. The spark plugs are each positioned within the passage and a tubular partition wall surrounds each plug for isolating the same in airtight manner from the interior of the passage, the interior of the wall being open at its upper end to the external ambient air outside the passage.

According to a feature of this invention, the tubular wall is provided at its base end with an opening providing communication between the interior thereof with the interior of the passage so that a portion of the cooling air within the passage may flow along the plug to cool the same.

According to a further feature of this invention, a covering is provided at the upper end of the tubular wall and the opening at the upper end of the wall is formed as a lateral opening beneath the cover.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side view, partly in section, of one embodiment according to this invention,

FIG. 2 is a side view, partly in section, of the same embodiment viewed from a direction at right angles thereto, and

FIG. 3 is a top plan view, partly in section, of the embodiment.

DETAILED DESCRIPTION

Referring to the drawing, numeral 1 denotes the engine compartment provided at the front portion of the motorcar, numeral 2 denotes the passenger compartment provided behind the engine compartment, and numeral 3 denotes an internal combustion engine provided within the engine compartment 1 for driving the motorcar. The engine 3 is of multiple cylinder type extending transversely with respect to the direction of travel of the car. The engine comprises upper, middle and lower portions, i.e., a lower crank chamber portion 3*a*, a cylinder main body portion 3*b* and a cylinder head portion 3*c*. A forced cooling air passage 4 is formed on the outer surface of the cylinder head portion 3*c* so as to surround the same. The passage 4 is in communication at its inlet opening 5 with an air blower 6 positioned at one side of the engine 3 and driven thereby and the blower 6 leads to an air intake opening 8 in a front surface wall 7 of the engine compartment 1. The passage 4 is in communication at its outlet opening 9 with the interior of the passenger compartment 2 through a conduit 11 containing a switch controlled valve 10, so that by the operation of the blower 6 the external air is supplied through the air intake opening 8 to produce a flow of forced cooling air within the passage 4, whereby the engine 3 is cooled by the cooling air and the thus heated cooling air is then led into the passenger compartment 2 for being utilized for heating purposes.

As in the conventional case, the engine 3 has an air inlet valve 12, an exhaust valve 13 and a spark plug 14 for each cylinder. If, in this case, the spark plug 14 is positioned within the passage 4, a cooling thereof can be obtained, but there is the deficiency that if there is a gas leakage at the wall portion 14*a* to which the base end of the plug 14 is attached, the gases from the engine cylinder mix with the cooling air within the passage 4 to be undesirably led into the passenger compartment 2 along with the cooling air.

In order to remove this deficiency, according to this invention, a tubular wall 15 is provided at the periphery of the plug 14 so as to isolate the plug 14 from the air space within the passage 4 in airtight manner, and the tubular wall 15 is in communication at its upper end portion 16 with the outside air. Accordingly, if gas leakage is produced at the wall portion 14*a* at the base end of the plug 14, the leaked gas travels upwardly within the tubular wall 15 for being discharged to the exterior from the open end at the top portion 16 of the wall 15. Thus, the gas can be positively prevented from mixing with the cooling air within the passage 4.

According to another feature of this invention, the tubular wall 15 is provided, at its side surface against which the cooling air within the passage 4 blows, with an opening 17 so that the cooling air may be allowed to blow thereinto. Accordingly, a flow of cooling air is produced within the tubular wall 15 to improve the cooling effect on the plug 14 and also effectively to exhaust any gas which may remain within the tubular wall 15.

According to a further feature of this invention, the upper surface of the open end of the tubular wall 15 is covered with a seal member 19 and a lateral exhaust opening 18 is provided in wall 15 below the member 19. With this arrangement, any exhaust of interior gas or of cooling air entering the opening 17 is not obstructed while any entrance of rain or the like from above can be prevented so that the spark plug 14 can be effectively protected therefrom.

The engine 3 is positioned within the airflow 20 caused by travel of the car so that the engine may be additionally cooled by such airflow during movement of the car. Additionally, for increasing the air cooling of the head portion 3*c*, cooling fins 21 are provided at the outer surface thereof extending in the passage 4 and also horizontal fins 22 are provided at the interior thereof interconnecting the inner and outer walls thereof so as to serve both as cooling and heat transmitting means. The passage 4 is so disposed as to be somewhat spaced from the joint portion 23 between the cylinder head portion 3*c* and the cylinder main body portion 3*b*, so that even if there is a gas leakage at that portion, the leaked gas can be prevented from flowing into the passage 4 and to the passenger compartment along with the heated air.

Thus, in the apparatus according to the invention, the spark plugs are positioned within the forced cooling air passage, so as to be cooled by the air flowing within the passage. Additionally, the plugs are isolated from the interior of the passage by the tubular wall 15 and is exposed to the exterior of the top end of the wall, so that if gas leaks between the bottom of the plugs and the adjacent wall, the leaked gas will be discharged to the exterior and the danger and disadvantage of mixing of the leaked gas with the cooling air within the passage for conveyance to the passenger compartment is avoided. According to another feature of the invention, the interior of the tubular wall is charged, via the opening 17, with a portion of the cooling air within the passage 4, so that air cooling of the plug may be improved. According to another feature of the invention, the plug is effectively protected by sealing cover 19 from any entrance of foreign matter such as rain water or the like.

What is claimed is:

1. For cooling an internal combustion engine of a vehicle in which the engine has at least a cylinder head portion thereof exposed to an air passage leading to a passenger compartment of the vehicle for supplying heated air thereto, said engine having spark plugs positioned within said passage; an improvement comprising a tubular partition wall surrounding each plug and isolating the plug in airtight manner from said

passage and the air flowing therein, and means providing communication between the interior of each said partition wall and external ambient atmosphere outside said passage.

2. An improvement as claimed in claim 1 wherein said means is constituted by an opening in the partition wall at the top thereof.

3 An improvement as claimed in claim 2 wherein each said partition wall has an opening at the bottom thereof in communication with said passage for flow of air from the passage through said partition wall and to said opening in the top of the wall to produce cooling airflow around the plug in the partition wall.

4. An improvement as claimed in claim 2 comprising covering means closing each said tubular wall at the top thereof, said opening in the wall extending laterally therein beneath said covering means.

5. An improvement as claimed in claim 2 comprising fins on said cylinder head portion in said passage to enhance heat exchange.

6. An improvement as claimed in claim 1 wherein said cylinder head portion has inner and outer walls and heat exchange fins extending therebetween.

7. An improvement as claimed in claim 6 wherein said heat-exchange fins are substantially horizontal.

8. An improvement as claimed in claim 7 wherein said tubular partition wall and plugs are inclined with respect to said horizontal fins.

9. An improvement as claimed in claim 8 wherein each said tubular partition wall encloses the associated plug along substantially the entire length thereof.

10. An improvement as claimed in claim 2 wherein said engine has a cylinder main body portion with a joint with said cylinder head portion, said passage being positioned above said joint.

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