United States Patent

[11] 3,598,092

[72] Inventor Soichiro Honda
Tokyo, Japan

[21] Appl. No. 857,660
[22] Filed Sept. 15, 1969
[45] Patented Aug. 10, 1971
[73] Assignee Honda Giken Kogyo Kabushiki Kaisha
Tokyo, Japan
[32] Priority Sept. 14, 1968, Sept. 20, 1968
[33] Japan
[31] 43/66351 and 43/67653

[54] **AIR COOLING APPARATUS FOR AN INTERNAL COMBUSTION ENGINE OF A VEHICLE**
1 Claim, 5 Drawing Figs.

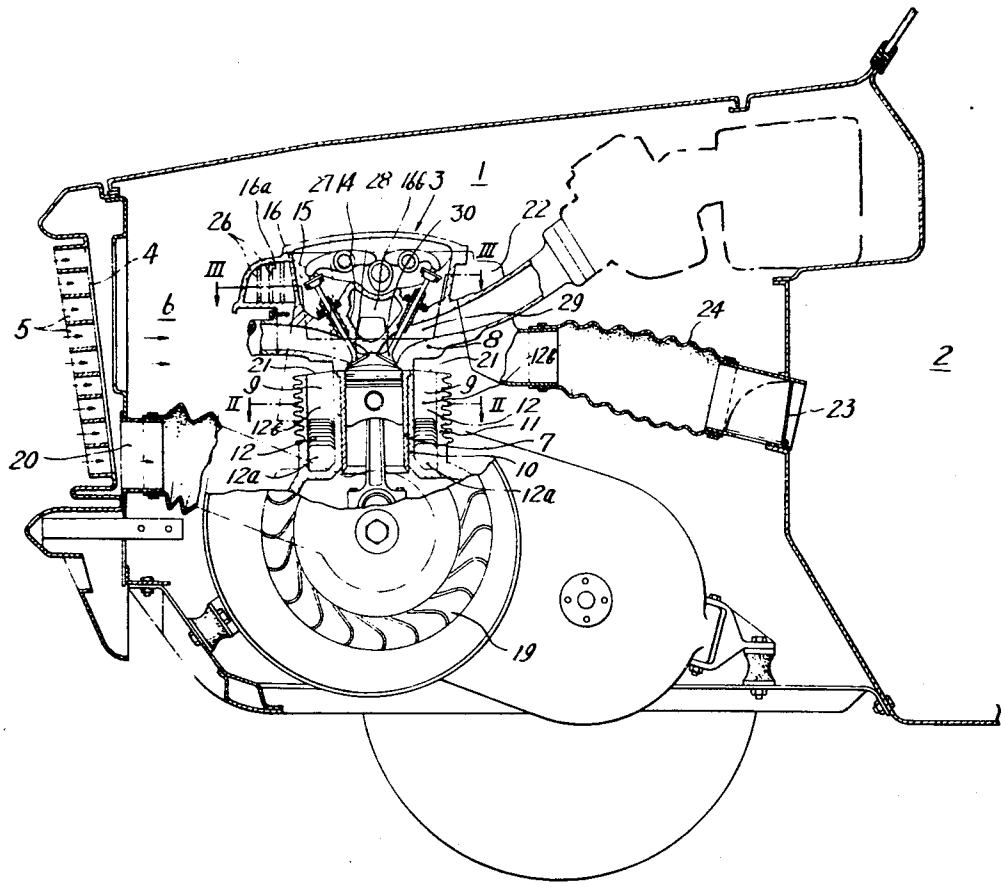
[52] U.S. Cl. ..... 123/41.28, 123/41.61, 123/41.65, 123/41.67, 123/41.69, 237/12.3 A
[51] Int. Cl. F02f 1/32, F02f 1/34, F01p 1/02
[50] Field of Search ..... 123/41.6, 41.61, 41.62, 41.65, 41.67, 41.69, 41.70, 41.28; 237/12.3 A

[56] References Cited
UNITED STATES PATENTS

1,359,727	11/1920	Munson	123/41.61
1,520,521	12/1924	Tisserant	123/41.61
1,622,388	3/1927	Masury et al.	123/41.61
1,662,486	3/1928	Ashley	237/12.3 A
1,827,600	10/1931	Morgan et al.	123/41.6
1,884,321	10/1932	Smith	123/41.67 X
1,906,045	4/1933	Chevrolet et al.	123/41.67 X
2,182,866	12/1939	Gabrielson	123/41.6
2,969,780	1/1961	Wyczalek	123/41.67 X

Primary Examiner—Al Lawrence Smith
Attorney—Waters, Roditi, Schwartz and Nissen

ABSTRACT: An engine of a vehicle is positioned in an engine compartment such that airflow, produced upon movement of the vehicle, passes over the engine to cool the same, the engine having inner and outer walls defining a passage extending along the line of engine cylinders for being supplied with separate cooling air from a blower. Heat conducting plates extend in the passage to form a plurality of passageways extending at right angles from the passage for the further flow of cooling air.



PATENTED AUG 10 1971

3,598,092

SHEET 1 OF 3

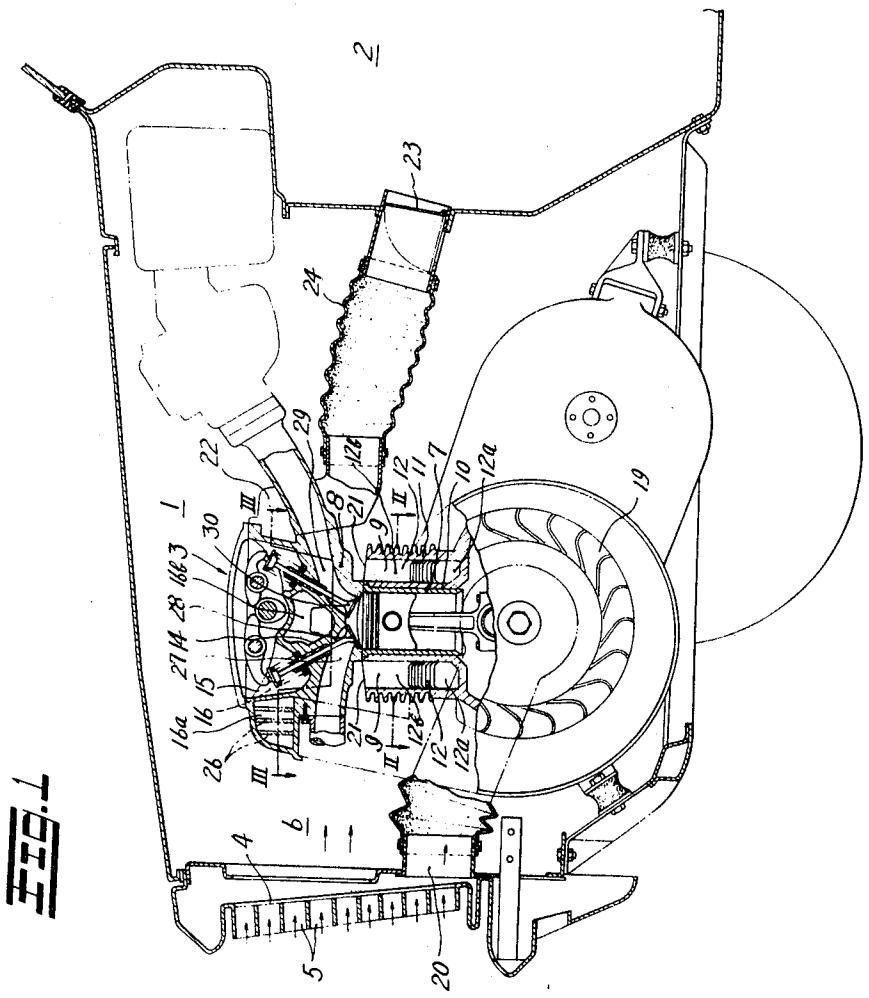


FIG. 1

INVENTOR

Soichiro Honda

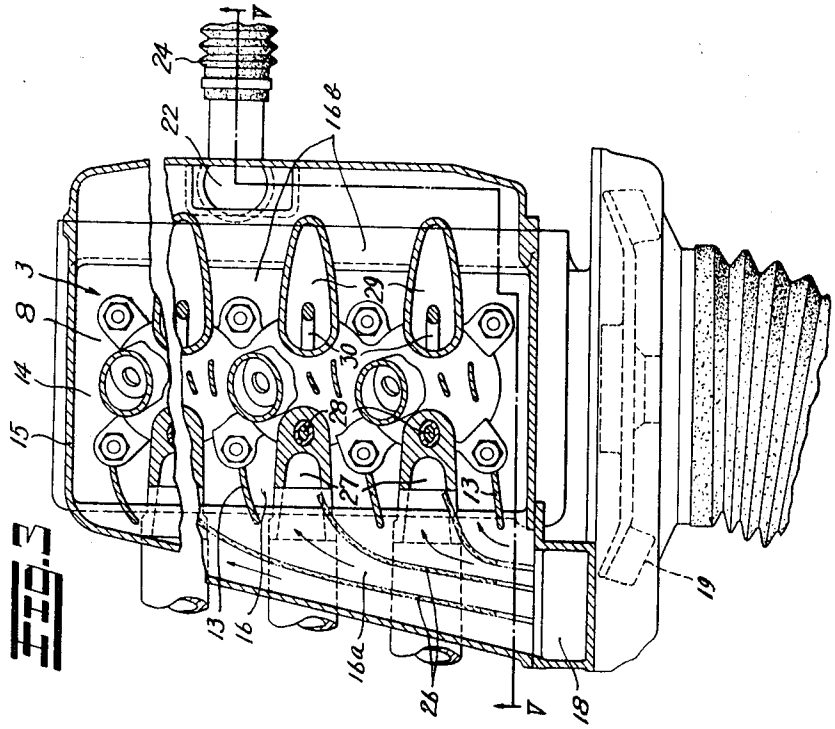


FIG. 3

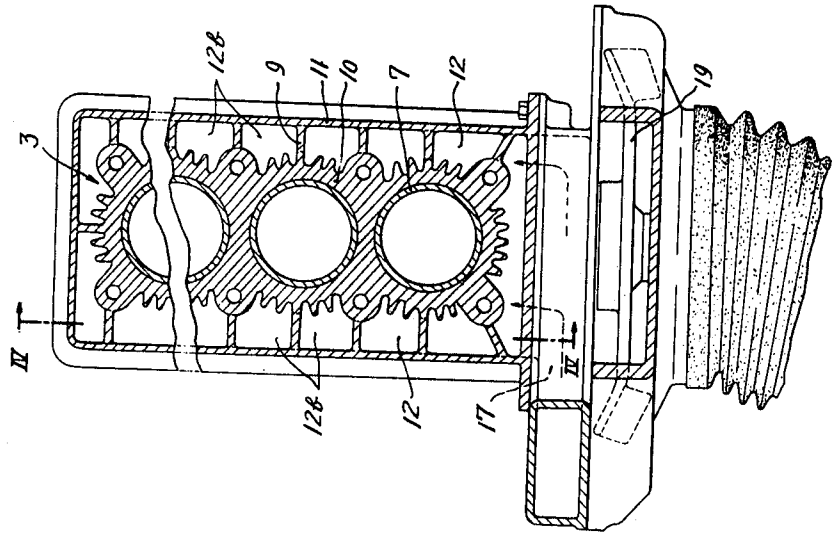


FIG. 2

INVENTOR
Soichiro Honda

FIG. 5

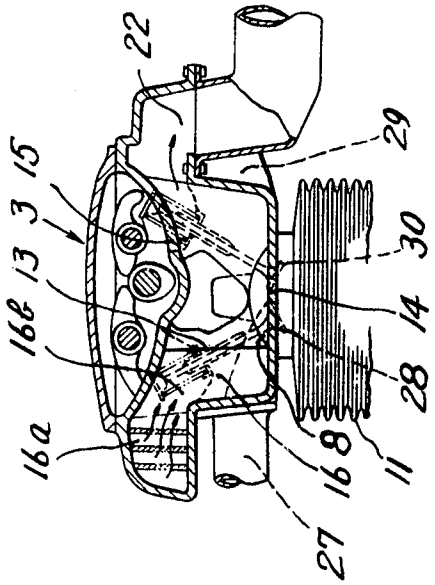
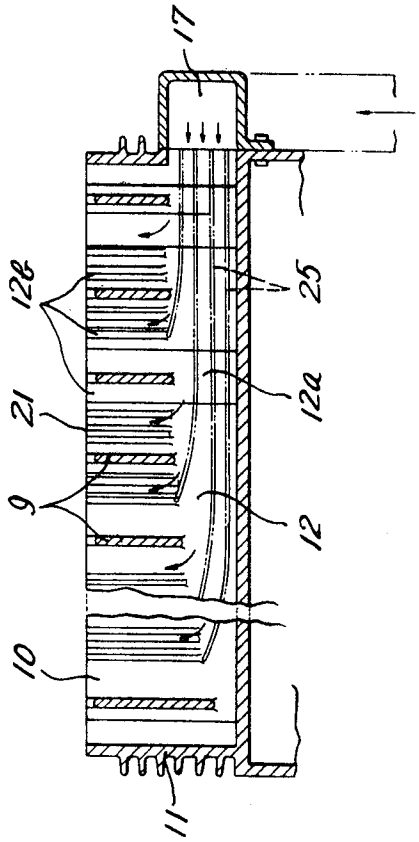


FIG. 4



INVENTOR

Soichiro Honda

AIR COOLING APPARATUS FOR AN INTERNAL COMBUSTION ENGINE OF A VEHICLE

BRIEF SUMMARY OF THE INVENTION

This invention relates to apparatus for the air-cooling of an internal combustion engine of the multiple cylinder-type mounted on a motorcar for driving the same.

According to this invention, such an internal combustion engine is mounted in an engine compartment in which airflow, produced by movement of the vehicle, passes over the engine to cool the same. The outer portion of said engine is formed with a passage for the forced flow of separate cooling air, said passage being formed between inner and outer double walls and extending along the line of cylinders of the engine, said passage having one end connnected with a supply of forced cooling air and a plurality of heat conducting plates interconnecting between the inner and outer walls for forming distribution passage extending from said air supply passage at right angles thereto. It is preferable in this case that the air supply passage is so constructed that the cross-sectional area thereof decreases gradually from the supply end toward the other end, and that the air supply passage is provided with longitudinally extending partition walls for being divided into flow passages for each cylinder.

According to a feature of the invention, the forced cooling air passage formed at the engine cylinder head portion is so arranged that the forced cooling air flows therethrough from the engine exhaust port side toward the engine air inlet port side.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side view, partly broken away and in section, of one embodiment of apparatus according to this invention;

FIG. 2 is a sectional view taken along the line II–II in FIG. 1;

FIG. 3 is a sectional view taken along the line III–III in FIG. 1;

FIG. 4 is a sectional view taken along the line IV–IV in FIG. 2; and

FIG. 5 is a sectional view taken along the line V–V in FIG. 3.

DETAILED DESCRIPTION

Referring to the drawings, numeral 1 denotes an engine compartment at the front portion of a vehicle, numeral 2 denotes a passenger compartment behind the engine compartment 1, and numeral 3 denotes an internal combustion engine of the multiple cylinder-type enclosed in the engine compartment 1 for driving the vehicle. This engine 3 is positioned laterally in such a manner that the cylinders are arranged in a line extending substantially at right angles to the direction of travel of the vehicle.

The engine compartment 1 has a front wall 4 with a number of openings 5 in wall 4, so that airflow, caused by the travel of the vehicle, passes into the engine compartment 1 through the openings 5 to cool the engine 3. In other words, the engine 3 is positioned within an airflow passage 6 to face frontwards for being air-cooled by the flowing air.

The engine 3 comprises, in known manner, a cylinder main body portion 7, and a cylinder head portion 8 on the body portion 7. The outer surface of the main body portion 7 is formed with inner and outer double walls 10, 11 which are interconnected by a plurality of heat conducting plates 9, so that there are formed a forward and a rearward passage 12 extending in the direction of the line of cylinders. Similarly the outer surface of the head portion 8 is formed with inner and outer double walls 14 and 15, which are interconnected by a plurality of heat conducting plates 13, so that there is formed over the head portion 8 a passage 16 extending in the direction of the line of cylinders. The passages 12 have a common air supply opening 17 at one end thereof and the passage 16 also has, at one end, an air supply opening 18. These air supply openings 17 and 18 are in communication with an air intake opening 20 in the front surface of the engine compartment 1 through a common air blower 19 driven by the engine 3, so that the external air admitted through the air intake opening 20 by the operation is forcibly supplied through the respective air supply openings 17 and 18 to the passages 12 and 16, respectively, to provide a forcible air-cooling to the main body portion 7 and the head portion 8. Each of the passages 12, is open at its top throughout the whole length thereof for constituting an air discharge opening 21 facing the lower surface of the cylinder head portion 8, so that the air discharged from the discharge openings 21, acts on the lower surface portion of the head portion 8 which is at a comparatively high temperature for effecting air-cooling thereof. The passage 16 has, on the side opposite the air supply opening 18, a discharge opening 22 in communication with the interior of the passenger compartment 2 through a conduit pipe 24 having a valve 23 therein, so that the air discharged from the opening 22 can be led to the interior of the passenger compartment 2 for being utilized as a heating source.

Each of the cooling air passages 12 is formed at its lower half with an air supply passage 12*a* extending in the direction of the line of cylinders and connected at one end with the air supply opening 17, and is formed at its upper half with a plurality of distribution passages 12*b* divided by the heat conducting plates 9 and extending from the air supply passage 12*a* at right angles thereto. Thus the heat conducting plates 9 also serve as distribution plates, in addition to its inherent heat abstraction purpose. The air supplied from the air supply opening 17 flows through the air supply passage 12*a* from one end to the other and at the same time is distributed by the plates 9 to pass through the distribution passages 12*b* and then be discharged from the discharge opening 21. During this travel, the air provides cooling for the main body portion 7. Similarly, the cooling air passage 16 is formed with distribution passages 16*b* by the heat conducting plates 13. Namely, the passage 16 is formed with an air supply passage 16*a* on one side extending in the direction of the line of cylinders and connected at one end with the air supply opening 18. The passage 16 is formed on the other side, adjacent the passage 16*a*, with distribution passages 16*b* divided by the heat conducting plates 13 and extending at right angles with said air supply passage 16*a*, so that the air supplied from the air supply opening 18 flows through the interior of the supply passage 16 from one end to the other end and at the same time is divided by the plates 13 to pass through the distribution passages 16*b* and then be discharged from the discharge opening 22. During this travel the air effects forcible air-cooling of the head portion 8.

Each cylinder of the engine 3 has an exhaust port 27 cooperating with an exhaust valve 28 and an air-fuel intake port 29 cooperating with an intake valve 30 as in a conventional engine, and these ports 27, 29 are arranged in such a manner that the port 27 is in front of the port 29 in relation to the direction of flow of the forced cooling air, so that the cooling air during its travel through the passage 16 cools the exhaust port 27 at a comparatively high temperature and is heated and then acts on the air intake port 29 of comparatively low temperature so as to heat the same, whereby fuel which is liable to be liquidized to adhere to the inner surface of the intake port 29 is heated thereby to be vaporized for improving the supply of the fuel.

The air supply passage 12*a* is constructed to be of gradually decreased size in sectional area by gradually increasing the projection of heat conducting plates 9 from one end to the other of the passage 12*a* as clearly shown in FIG. 4. As a consequence, the distribution of air into the distribution passages 12*b* can be made as uniform as possible. Almost the same effect can be obtained for the passage 16*b*; by causing the outer wall 15 of the passage 16*a* to be gradually tilted inward as clearly shown in FIG. 3 to gradually diminish the size of the passage 16*a*. Additionally each of the air supply passages 12*a*, 16*b* is provided with longitudinally extending pluralities of partition walls 25, 26 as shown in dotted lines, so that the distribution of air to every cylinder can become more uniform.

Thus, according to this invention, an internal combustion engine is positioned in an airflow passage and at the same time is provided on the outer surface thereof with a forced cooling air passage, so that the engine may be cooled both by the air flowing through the engine compartment and by the forced cooling air, and the forced cooling air passage is formed on one side with an air supply passage extending in the direction of the line of cylinders and on its other side with distribution passages extending at right angles thereto so that the forced cooling air can be supplied uniformly to the engine for improving the uniformity of air-cooling. In this case, the heat conducting plates themselves are utilized also as distribution plates so as to be economical. According to further features of this invention, the air supply passage is of gradually decreased size in sectional area and also the passage is divided by longitudinally extending partition walls, so that the distribution of the forced cooling air to every portion, that is, the air-cooling can be made as uniform as possible. Additionally, the forced cooling air passage is arranged so that the air flows from the engine exhaust port side of comparatively high temperature toward the engine air intake side of comparatively low temperature, whereby the heat of the former is transmitted to the latter for raising the temperature thereof to vaporize any liquid fuel adhered to the inner surface of the air intake side.

What I claim is:

1. Cooling apparatus for an internal combustion engine for a vehicle, said vehicle having a compartment for said engine in which air flows past the engine as the vehicle moves whereby the engine is cooled, said engine having a plurality of cylinders extending generally in a line and including inner and outer walls defining a passage extending along the line of cylinders, means for supplying cooling air to said passage at one end thereof for flow therealong, and a plurality of heat conducting plates to form a plurality of distribution passageways extending from said passage at right angles thereto; said heat conducting plates interconnecting the inner and outer walls and extending into said passage in increasing amounts in proportion to the distance from the end at which cooling air is supplied whereby said passage diminishes in cross section from said end.