Dec. 12, 1939. J. B. GABRIELSON 2,182,866

MULTICYLINDER INTERNAL COMBUSTION ENGINE

Filed Oct. 15, 1937 3 Sheets-Sheet 1

Fig. 1.

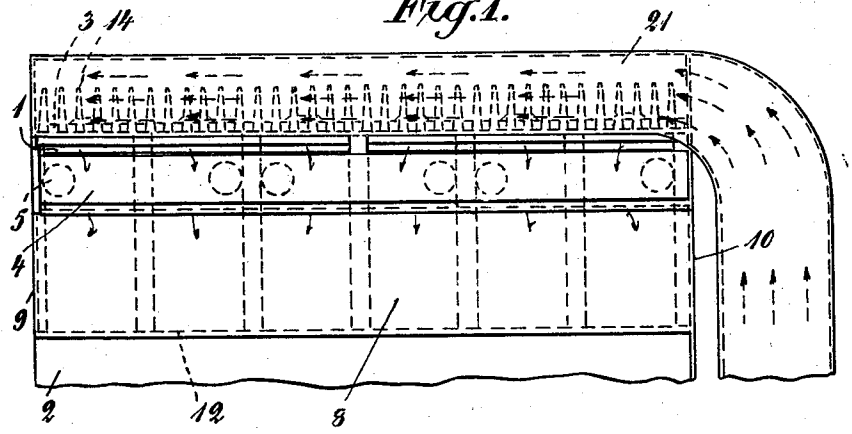


Fig. 2.

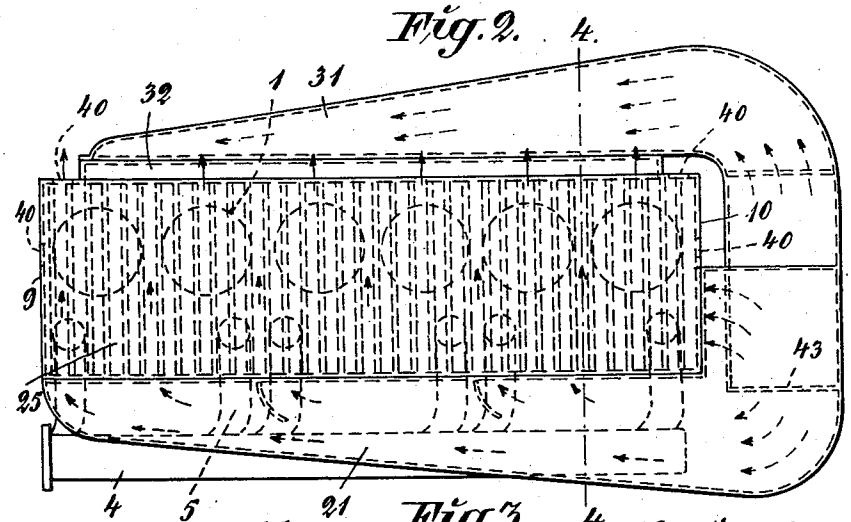
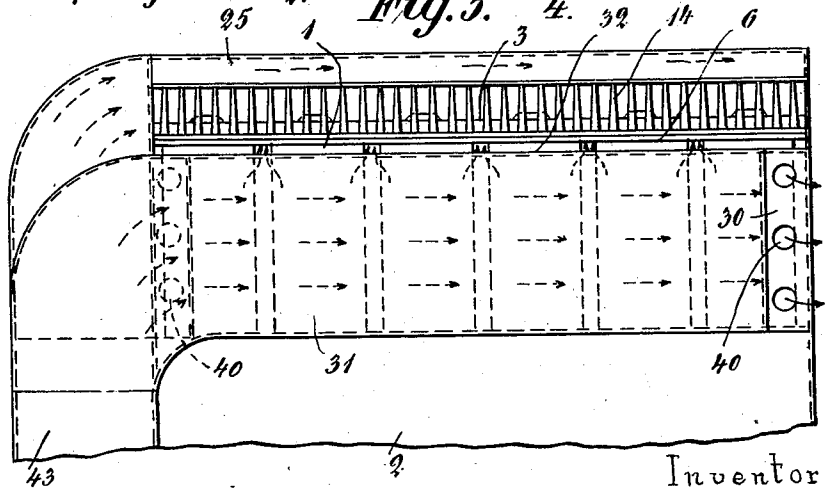


Fig. 3.



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MULTICYLINDER INTERNAL COMBUSTION ENGINE

Filed Oct. 15, 1937 3 Sheets-Sheet 2

Fig. 4.

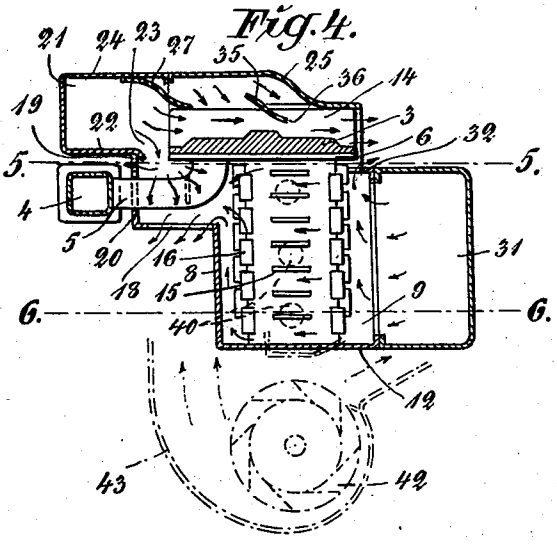


Fig. 5.

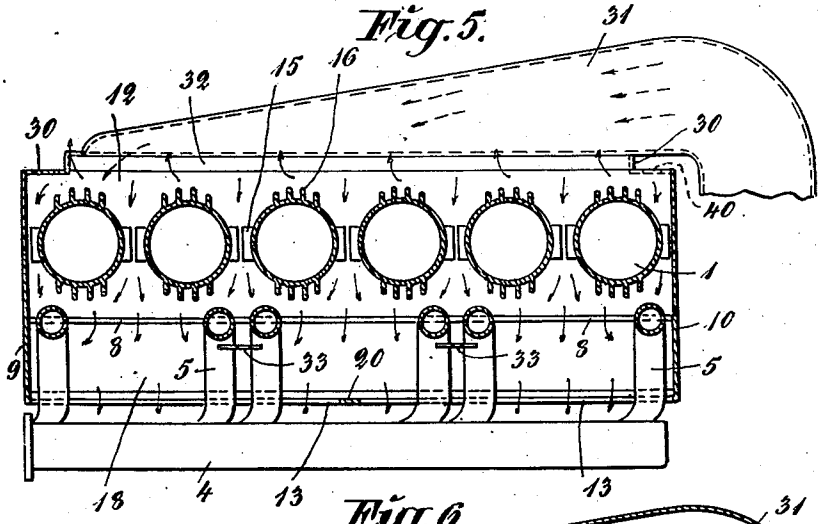
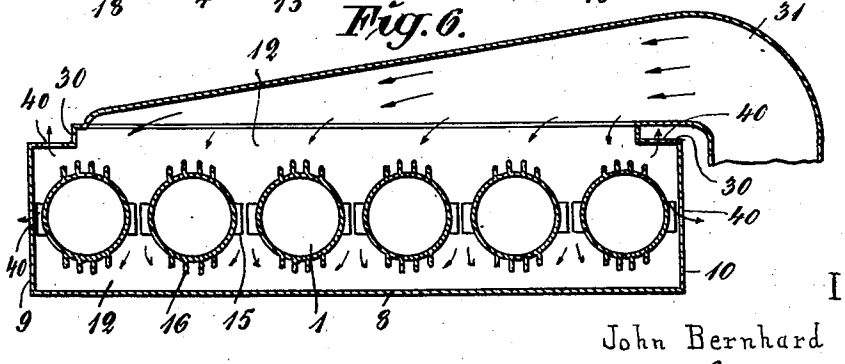


Fig. 6.



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MULTICYLINDER INTERNAL COMBUSTION ENGINE

Filed Oct. 15, 1937 3 Sheets-Sheet 3

Fig. 7.

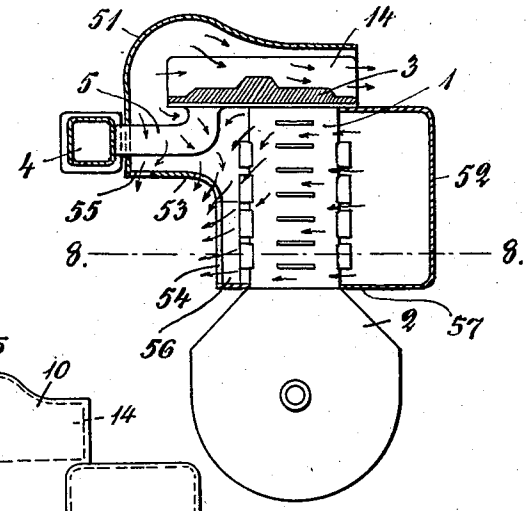


Fig. 9

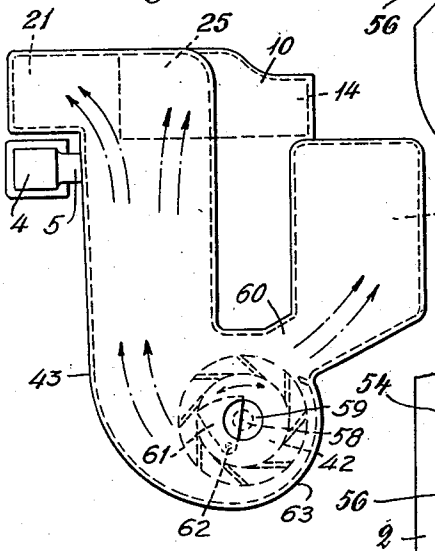
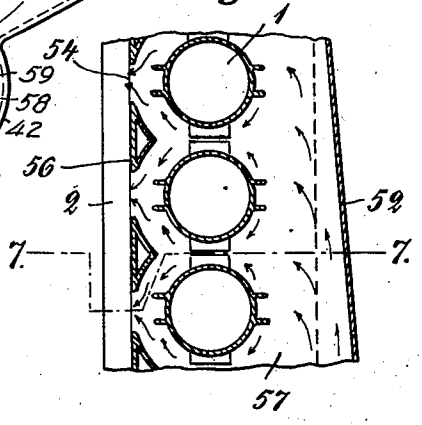


Fig. 8.



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UNITED STATES PATENT OFFICE

2,182,866

MULTICYLINDER INTERNAL COMBUSTION ENGINE

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Application October 15, 1937, Serial No. 169,133
In Sweden October 15, 1936

10 Claims. (Cl. 123—171)

The present invention relates to multicylinder internal combustion engines. More particularly the invention relates to such engines of this kind in which the outlets for the exhaust gases are arranged laterally of the cylinders, i. e. to so called side valve engines. The object of the invention is to provide an efficient system for cooling side valve engines by means of currents of air.

It has been previously proposed to cool engines of the side valve type by means of an air current which is directed towards the exhaust side of the cylinders and is brought to flow around each cylinder either along the periphery thereof or in axial direction along the cylinder, so that the air current first takes up heat from the upper portions of the exhaust side of the engine and thereafter sweeps along the engine cylinders proper. It has also been proposed, in cooling the exhaust side of the engine and of the cylinders according to the above described method, to let a separate air current sweep over the top side of the cylinder cover. However, systems designed in the above indicated manner produce only an insufficient and uneven cooling, in that on the one hand a temperature rise which is detrimental to the material cannot be avoided, and on the other hand deformations occur which impair the proper operation of the engine.

The inconveniences attendant to the previously known air cooling systems for internal combustion engines of the side valve type have been avoided according to the present invention by providing at the exhaust side of the engine one or more flow paths for supplying cooling air to the mutually adjacent portions of exhaust pipes and cylinders and for withdrawing said cooling air through an outlet opening positioned at the same side of the engine. Preferably said flow paths extend between an air inlet positioned at the exhaust side of the engine close to the exhaust pipes and an air outlet positioned at the same side of the engine.

The invention will now be described more in detail having reference to the drawings attached to this specification and forming part thereof, which drawings show an application of the invention in an automobile engine. In said drawings

Figure 1 is a view of the right hand or carburetor side of an automobile engine provided with a cooling system according to a first embodiment of the invention;

Figure 2 is a plan view of the engine according to Figure 1;

Figure 3 is a view of the left hand side of the engine according to Figure 1;

Figure 4 is a vertical section on the line 4—4 in Figure 2 viewed in a direction towards the rear part of the engine;

Figures 5 and 6 are horizontal sections on the lines 5—5 and 6—6 in Figure 4;

Figures 7 and 8 illustrate a second embodiment of the invention, Figure 7 showing a vertical section on the line 7—7 in Figure 8 and Figure 8 a horizontal section on the line 8—8 in Figure 7;

Fig. 9 illustrates a front elevation of an engine according to Fig. 1.

Such parts of the engine, for example carburetor, supply conduits, ignition system and valve mechanism, on which the invention has no direct bearing, have been omitted from the drawings for the sake of clearness.

In the embodiment according to Figures 1 to 6 the engine is provided with six cylinders 1 connected to a common crank case 2 of which a portion only is shown on the drawings. The cylinder covers are built together to form a single engine cover 3. Each cylinder communicates with the exhaust manifold 4 through an exhaust pipe 5 which extends from the underside of the cover flanges 6 of the cylinders. The bolts which hold the cover 3 in sealing contact with the flanges 6 are not shown on the drawings. The cylinders are positioned in a common cooling chamber the roof of which consists of the cover flanges 6 and the side walls of which are arranged at a suitable distance from the cylinders so that the latter can be swept over by the cooling air on all sides. On the exhaust side of the engine the cooling chamber is limited by a side wall 8 which joins with an end wall 9 at the rear end of the engine and with an end wall 10 at the fore end thereof. The walls are supported by a bottom 12 secured at the lower ends of the cylinders. According to the shown embodiment the walls 8, 9 and 10 and the bottom 12 are cast integral with the cylinders, as is shown most clearly in Figure 4.

The heat emitting surfaces of the cooled engine parts can be enlarged in known manner by means of cooling ribs. Figure 4 shows a manner of arranging such ribs. The engine cover 3 is provided with cooling ribs 14 extending transversely of the cover, the upper edges of such ribs lying in a common plane. The cylinders are provided with cooling ribs of a direction, mutual distance and size which is adapted to the direction of flow and to the amount and distribution of the cooling air supplied. In the shown example horizontal cooling ribs 15 are provided on the front and rear sides of the cylinders, and vertically extending cooling ribs 16 are provided on the wall portions of the cylinders coinciding with the sides of the

engine. Said latter cooling ribs are comparatively short and are arranged in rows along the cylinders in such a manner that cooling air passages are provided between the end edges of the ribs.

An extension of the cooling air chamber (Figures 4 and 5), which surrounds the exhaust pipes 5, is provided with an outlet opening 18 extending along the entire length of the engine below the exhaust pipes as well as with two slit-shaped smaller outlet openings 19 arranged above said pipes in a vertical cooling chamber wall 20. Said wall supports an air distribution duct 21 which extends along the entire length of the engine cover 3, 6, 14 and has a flow area which decreases gradually towards the rearmost cylinder of the engine. The lower wall 22 of said duct is connected to the vertical cooling chamber wall 20 between which and the engine cover 3 there is a free passage 23 for the cooling air flowing out from the duct. The upper wall 24 of the duct joins to a hood 25 forming an air distribution duct above the cooling ribs 14 on top of the engine cover. The two ducts have a common dividing wall 27 which bears with its lower edge against the cooling ribs 14. At the left hand side of the engine the hood 25 is bent downwards so as to bear against the upper edges of the cooling ribs 14. The openings between the cooling ribs form together the outlet for the cooling air which passes from the ducts 25 and 21 over the cover 3. The cooling of the ribs 14 and of the cover 3 is thus effected on the one hand by means of an air current coming from the duct 21 in a substantially horizontal direction and on the other by means of cooling air which is supplied from above from the duct 28. Through cooperation between said air currents an effective cooling is obtained also of the deeper portions of the ribs and of the free surfaces of the cover 3.

The cooling air chamber surrounding the cylinders has no wall on the left hand side of the engine (see particularly Figure 6). Through the intermedium of wall elements 30 of L-shaped cross section positioned at the two outer cylinders the chamber is here connected to an air distribution duct 31 the area of flow of which decreases in the direction towards the rear cylinder. The main portion of the cooling air supplied by means of said duct sweeps over the cylinders and is discharged through the outlets 18, 19 positioned at the exhaust side whereas a smaller portion, after having flushed over the wall portion of the cylinders being nearest to the duct, particularly the upper part of said wall portion, discharges through free passages between the upper portions of the cylinders and a frame piece 32 provided for fixing the upper edge of the duct.

The cooling air passing from the duct 21 through the passage 23 and the greater portion of the air supplied to the cooling chamber by means of the duct 31 have thus common outlets. The two air currents meet in the chamber surrounding the exhaust pipes 5. The velocity of flow will therefore become rather high at this point and on account of the different directions of flow of the two currents at their entrance into said chamber eddies are set up which further increase the cooling effect. If required guide plates or the like can be provided, of course, in the intermediate spaces between each group of two exhaust pipes in such a manner that the velocity of flow around the pipes is still more increased. For the same purpose the outlet opening 18 can be divided into a number of smaller openings which compel the air to discharge near the exhaust pipes. The cooling air which from the drum 21 strikes the exhaust pipes disposed two and two close to each other and flows down between said pipes is, of course, heated comparatively much. To prevent said heated air from being carried inwards through eddies, a vertical guide plate 33 (Figures 4 and 5) is provided between the pipes. The plate is preferably made of a material having a good heat conducting capacity so that it will serve at the same time as a cooling rib for the pipes. It is obvious that the exhaust pipes 5 can also be provided with suitable cooling ribs and that guide plates or the like can be provided for directing the current of cooling air for example towards the under side of the cylinder cover flange 6. Plates for guiding the cooling air can be provided also at the engine cover 3. In Figure 4 is shown such a guide plate 35 which engages with tongues between the cooling ribs 14. By means of said guide plate the cooling air carried through the duct 25 is divided into two currents of air which enter between the ribs consecutively in the direction of the ribs and produce together with the cooling air current from the distribution duct 21 a turbulence which is favourable for the cooling action.

In addition to the above mentioned outlets for the cooling air coming from the cooling chamber suitable outlet openings can be arranged at suitable positions in the chamber walls. In Figures 4 to 6 such openings 40 are shown in the wall elements 30, and also in the end walls 9 and 10 in the shape of circular recesses.

The supply of cooling air to the distribution chamber can be effected in any suitable manner. Preferably, a centrifugal fan 42, Fig. 9, is used which can be connected directly to the motor shaft 58. The fan 42 is arranged in a casing 63 and connected with ducts 43 and 60 arranged at the front end of the engine with the air intake 59 preferably facing forwards. The duct 43 is connected to the fore ends of the distribution chambers 21, 25 and duct 60 with the distribution chamber 31 the flow areas of these ducts corresponding to the amount of air passing through the respective sections. The inlet opening of the fan or the ducts are preferably provided with a shiftable shutting-off member 61 which is pivotally connected at 62 with and arranged inside the front wall of the casing 63 so that the amount of air can be regulated either by hand or automatically under control of a thermostat.

In the embodiment described each distribution duct 21, 25, 31 supplies two air currents each of which cools an appertaining portion of the engine. The air from the duct 21 will thus pass partly over the portions which are most intensely heated by the exhaust gases to finally leave through the outlet 18 provided at the same side of the engine, and partly over the engine cover 3 discharging at the other side of the engine. The air currents from the duct 31 pass partly along the sides of the cylinders facing the duct and to the outlet between the members 6 and 32, at which outlet an ejector action is caused by the air discharged from the duct 25, partly around the cylinders to the outlet 18, the cooling chamber wall 8 giving to the air current on the exhaust side of the cylinders a direction upwards, i. e. towards the cylinder top and the exhaust pipes. Finally, the air from the duct 25 is divided by means of the guide plate 35 into two streams which cool each one portion of the cover 3 and of the ribs 14.

In Figures 7 and 8 is diagrammatically shown a modified and simplified air cooling arrangement which differs only in less important points from the one already described. The engine cylinders

are here surrounded with three casings 51, 52 and 53 of which the casings 51 and 52 form air distribution ducts corresponding to the ducts 21, 25 and 31 respectively in the first embodiment. The casing 53 is provided with outlet openings 54 which are arranged on the exhaust side at the lower part of the cylinders. An outlet opening 55 is provided immediately below each exhaust pipe. By means of guide members 56 arranged right opposite the spaces between the cylinders and adjacent the outlets 54 the cooling air is made to sweep over the lee side of the cylinders. The casings 52 and 53 are formed with a common bottom portion 57 which embraces the cylinders and is supported by the latter in a suitable manner. The air supply arrangements can be of previously described kind and be connected to the ducts 51 and 52 in the manner previously referred to.

As should be clear from the above described embodiment it is essential for the invention that cooling air of a sufficiently low temperature is supplied to the mutually adjacent portions of the exhaust pipes and the cylinders and thus to that part of the cylinder cover plate 6 which is nearest to said portions. According to the two embodiments shown cooling air is supplied to said portions both from the exhaust side and from the other side of the engine, the cooling air which has passed the lower portions of the cylinders and therefore has a comparatively low temperature being directed upwards, according to the first embodiment, by means of the wall 8 towards the cylinder cover. In certain cases the cooling air current directed upwards by means of the wall 8 will alone be quite sufficient for cooling the portions in question of the cylinder cover and of the adjacent portions of the cylinders and exhaust pipes, the air current flowing upwards from the duct 21 or 51 respectively and directed to the exhaust pipes being then not required so that the cooling air passage 23 can be shut off.

The invention also comprises the case that the cooling air required for cooling the mutually adjacent portions of each cylinder and its exhaust pipe is admitted through a separate air intake communicating with a separate distribution duct positioned below the exhaust pipe, the air being preferably admitted from below into the cooling air chamber enclosing the exhaust pipes and discharged therefrom in a direction from the cylinders, for example through openings in the wall 20.

I claim:

1. An air-cooled internal combustion engine comprising, in combination, a plurality of cylinders provided with a cylinder head and spacedly arranged substantially in line, exhaust valves and exhaust passages positioned along one side of said cylinder head, exhaust pipes connected with said exhaust passages, means forming a passage-way for a first current of air for cooling the top of said cylinder head, means forming another passage-way for a second current of air for cooling said cylinders, means forming a third passage-way for a third current of air for cooling said exhaust pipes, said passage-ways for said three separate air currents extending substantially perpendicularly to said line of cylinders, a fan assisting in producing said air currents and air distribution ducts leading from said fan to said air passage-ways.

2. An air-cooled internal combustion engine comprising, in combination, a plurality of cylinders provided with a cylinder head and spacedly arranged substantially in line, exhaust pipes extending from the underside of said cylinder head laterally of and spaced from said cylinders, a first air-conducting jacket surrounding the top of said cylinder head, a second air-conducting jacket surrounding said cylinders and including portions of said exhaust pipes facing said cylinders, said second jacket having inlets arranged at a side of said engine opposite to its valve side and outlets arranged at said valve side so as to cause air to flush over the cylinder walls and then to pass over said inside portion of said exhaust pipes, means for directing a third current of air towards outer portions of said exhaust pipes, a fan assisting in producing air currents passing said jackets and directing means, and air conducting means leading from said fan to said cooling jackets and said air directing means.

3. In an air-cooled internal combustion engine as described in claim 2, baffling means for leading said third current of air, after being heated through contact with said exhaust pipes, spaced from said cylinder walls.

4. In an air-cooled internal combustion engine as described in claim 2, said fan arranged at one end of said engine and said air ducts extending from said fan along the entire length of said engine.

5. In an internal combustion engine as described in claim 2, said directing means for the third current of air being arranged so as to direct said air towards portions of said exhaust pipes positioned adjacent to said cylinder head.

6. An air-cooled internal combustion engine comprising, in combination, a plurality of cylinders provided with a cylinder head and spacedly arranged substantially in line, exhaust pipes extending from the underside of said cylinder head laterally of and spaced from said cylinders, a first air-conducting jacket surrounding the top of said cylinder head, a second air conducting jacket surrounding said cylinders, a third air-conducting jacket surrounding the outside of said exhaust pipes, a fan, a first air duct extending from said fan along the valve side of said engine above said exhaust pipes, said first duct having outlets for supplying cooling air to said first and third jackets, and a second air duct extending from said fan along a side of said engine opposite to said valve side, said second duct having outlets for supplying cooling air to said second jacket.

7. In an air-cooled internal combustion engine as described in claim 6, said second and third jackets having a common outlet arranged at said valve side of the engine.

8. An air-cooled internal combustion engine as described in claim 6, characterized in that a wall of said second jacket which extends along said cylinders on said valve side of the engine is arranged to lead said second air current along said cylinders in an upward direction towards the cylinder head, said jacket wall having an upper edge adjacent to the underside of said exhaust pipes, so that the air is forced first to flush over the cylinders and then to flow towards said pipes.

9. In an internal combustion engine as described in claim 6, a third air duct extending along said engine above said cylinder head, said third duct provided with outlets for discharging a fourth current of air towards the top of said cylinders.

10. An air-cooled internal combustion engine comprising, in combination, a plurality of spacedly arranged cylinders provided with a cylinder

head and comprising exhaust valves and exhaust passages arranged along one side of said cylinders and exhaust pipes connected with said exhaust passages, means for forming a passage-way for a first current of air for cooling the head of said cylinders, means for forming another separate passage-way for a second current of air for cooling said cylinders, means for forming a third separate passage-way for a third current of air for cooling said exhaust pipes, said passage-ways for said three separate air currents extending across said cylinders, and means for supplying cooling air to said three separate passage-ways.

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