June 5, 1923. 1,457,944

C. R. SHORT

COOLING SYSTEM FOR INTERNAL COMBUSTION ENGINES

Filed Feb. 2, 1920 2 Sheets-Sheet 1

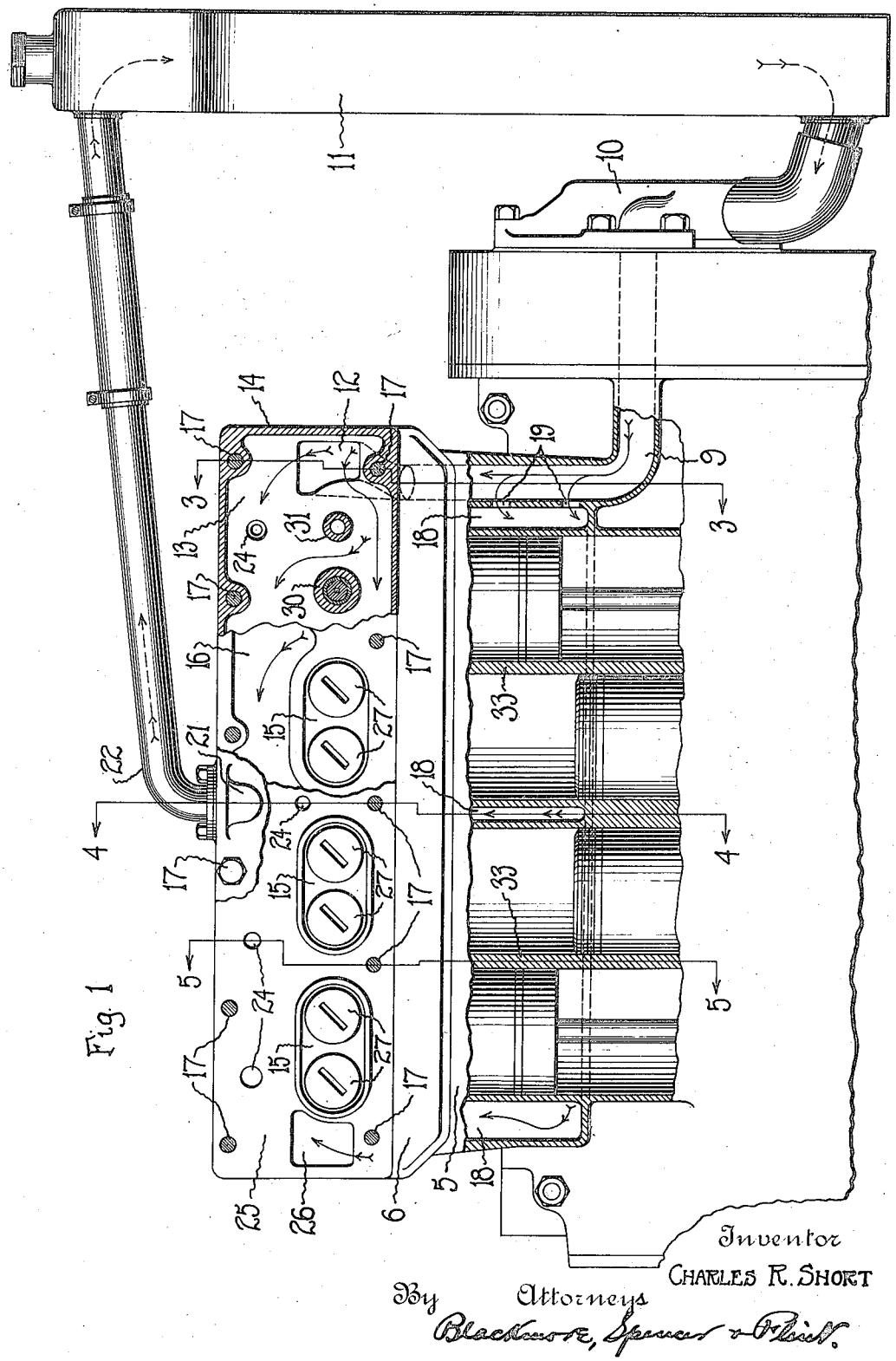


Fig. 1

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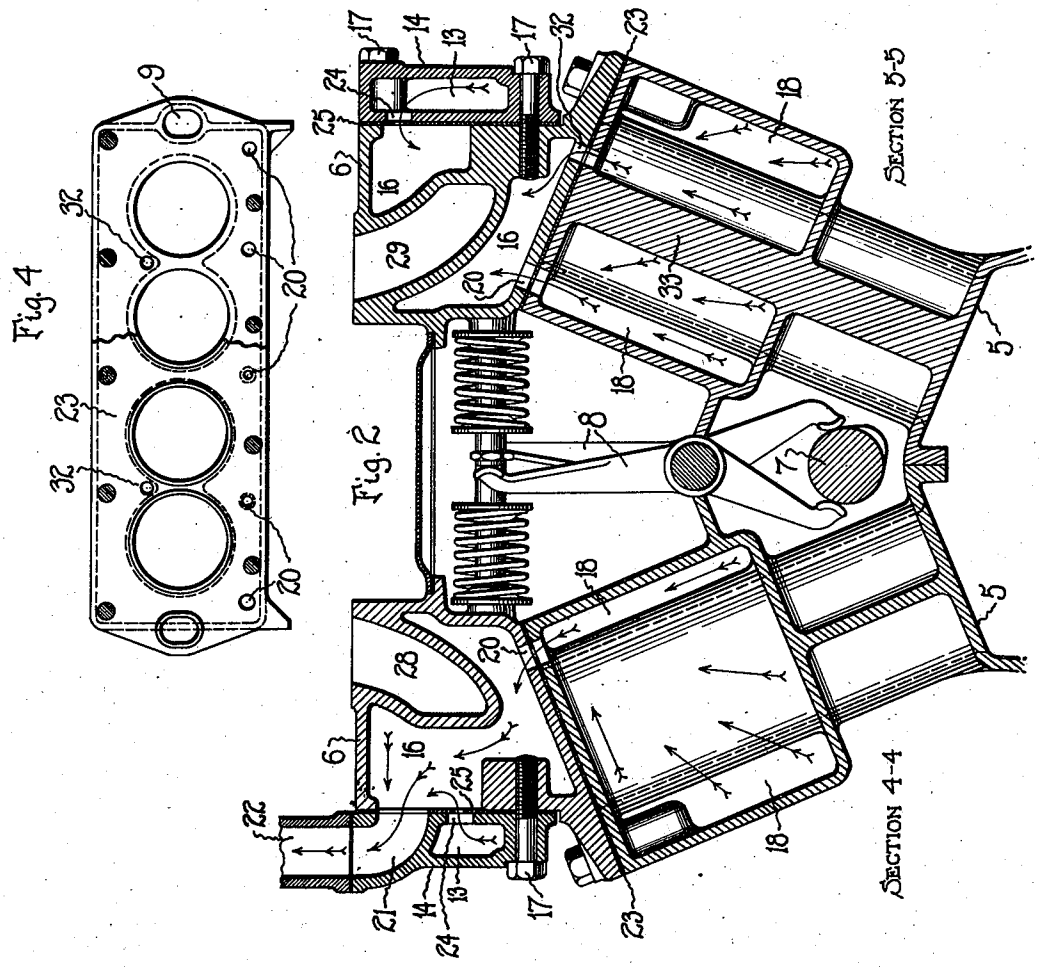
By Attorneys
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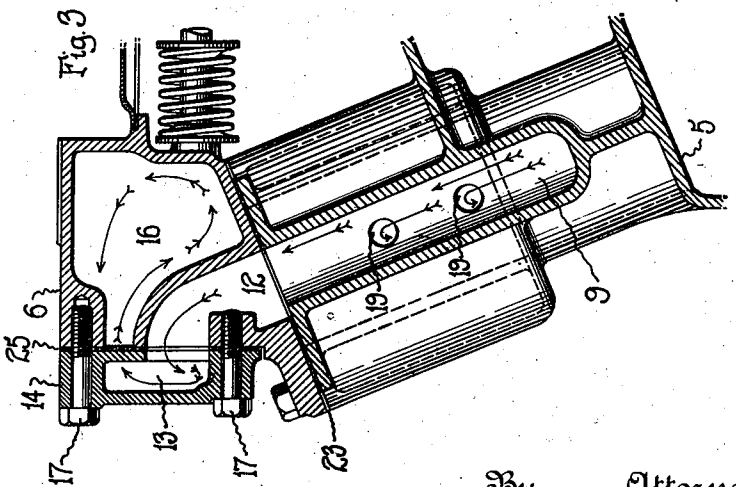
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UNITED STATES PATENT OFFICE.

CHARLES R. SHORT, OF DETROIT, MICHIGAN, ASSIGNOR TO GENERAL MOTORS CORPORATION, OF DETROIT, MICHIGAN, A CORPORATION OF DELAWARE.

COOLING SYSTEM FOR INTERNAL-COMBUSTION ENGINES.

Application filed February 2, 1920. Serial No. 355,576.

To all whom it may concern:

Be it known that I, CHARLES R. SHORT, a subject of the King of Great Britain, and a resident of Detroit, county of Wayne, and State of Michigan, have invented certain new and useful Improvements in Cooling Systems for Internal-Combustion Engines, of which the following is a full, clear, concise, and exact description, such as will enable others skilled in the art to which the invention relates to make and use the same, reference being made therein to the accompanying drawings, which form a part of this specification.

My invention relates to internal combustion engines, and particularly to the jacket construction of the cylinders and of the common head therefor of a multiple cylinder internal combustion engine, and which construction provides certain spaces or passages through which a cooling liquid may flow, to thereby prevent the heating of the cylinders and of the heads to a too high temperature when the engine is in use.

The principal object of my invention is to provide a cylinder jacket and head jacket construction for multiple cylinder internal combustion engines wherein the volume of cooling liquid caused to flow past the various elements and parts thereof to be cooled will in each instance be such as to secure the proper cooling effect upon the several elements; it being desirable, for example, that the cylinder walls of the engine shall be heated to a considerably higher temperature than the valves and valve seats thereof.

A further object of my invention is to provide a cylinder cooling jacket construction for a multiple cylinder internal combustion engine wherein the distribution of the cooling liquid is so regulated and controlled as to secure a substantially equal cooling effect upon the several cylinders, which are commonly formed integrally with one another in a single block and have a single or common jacket space or passage through which a cooling liquid for cooling all the cylinders flows.

A further object of my invention is to provide a cooling jacket construction for the common head of the several cylinders of a multiple cylinder internal combustion engine, and wherein a substantially uniform temperature will be secured throughout the entire length of the head.

A further object of my invention is to provide certain improvements in and relating to the cooling system of multiple cylinder internal combustion engines of the class wherein the cylinders are arranged at an angle to one another and which engines are commonly referred to as of the V-type, and wherein the flow of cooling liquid past the various parts of the engine is regulated and controlled, with the end in view of securing the heating of the said parts in each case to the temperature at which they will operate most satisfactorily.

With the above and other objects of invention in view my invention consists in the improved cylinder and head jacket construction for accomplishing the cooling of a multiple cylinder internal combustion engine by the use of a cooling liquid caused to flow through said jackets and passages illustrated in the accompanying drawings and hereinafter described and claimed; and in such variations and modifications thereof, within the scope of the concluding claims, as will be obvious to those skilled in the art to which my invention relates.

In the drawings accompanying and forming a part of this application and wherein the preferred embodiment of my invention is illustrated:

Figure 1 is a view illustrating one of the two four cylinder blocks of an eight cylinder V-type internal combustion engine, the cooling jacket for the cylinders and for the common head thereof being made in accordance with my invention and the block shown being the left hand one of the blocks shown in Figure 2.

Figure 2 is a view showing a section of a V-type internal combustion engine upon transverse vertical planes; the left hand side of said figure being upon a plane indicated by the line 4, 4, while the right hand side thereof is upon a plane indicated by the line 5, 5 in Figure 1 but shows the right-hand cylinder block, which is symmetrical with the left hand block.

Figure 3 is a view showing a section upon a transverse plane indicated by the line 3, 3, Figure 1.

Figure 4 is a view showing the upper end of the right hand cylinder block in plan; the gasket between said upper end and the under side of the cylinder head being shown in place in the left hand part of said figure, but removed at the right hand end thereof.

Referring now to the drawings, it will be understood that the showing is fragmentary as regards features of the engine with which my invention is in no way concerned, and illustrates so much only of the complete engine as is necessary to an understanding of my invention; and that the right hand cylinder block which is shown in section and on one plane only in Figure 2 is symmetrical with the left hand block illustrated in detail in the drawings and has elements and features of construction and operation like unto the features of construction and operation hereinafter referred to, but shown in most cases as present in and associated with the left hand one only of the two cylinder blocks which form the engine.

Each cylinder block 5 of the engine disclosed herein comprises four separate cylinders arranged parallel with one another, and to the upper ends of said blocks heads 6 which close the upper ends of the cylinders and house the supply and exhaust valves of the individual cylinders are secured; said valves being operated from the cam shaft 7 through suitable operating levers 8, and said valves acting to control the flow of combustible mixture through suitable inlet passages provided in the heads into the several cylinders and of exhaust gases from said cylinders through exhaust passages in the heads; all as is common in internal combustion engines but which valves, passages, and the ports controlled thereby are not shown in detail, as they are not directly involved in the invention to which this present application relates.

Each cylinder block is provided with a cored inlet passage 9 at one end thereof and with which a discharge passage leading from a suitable pump 10, which takes its supply from the radiator 11, communicates. This passage extends upwardly throughout the length of the cylinders and communicates at its upper end with a passage 12 which discharges into the interior 13 of a cover plate 14, which in each case extends along the head and serves as a closure for the various valve pockets, indicated by the reference numerals 15, therein; as well also as a closure for the open side of the cooling liquid passage or chamber 16 provided within and extending along the cylinder head; the said cover plates being detachably secured to the cylinder heads by suitable cap screws 17.

Said passages 9, in addition to being in communication with the cooling liquid spaces or chambers 16 within the cylinder heads through the passages 12 in the heads and the interiors 13 of the cover plates 14, are placed in communication with the cooling liquid spaces 18 within the cylinder blocks and surrounding or substantially surrounding the several cylinders of each block by and through one or more ports 19. It therefore follows that in the case of each cylinder block the cooling liquid discharged into the passage 9 thereof divides, and flows in part through the ports 19 and into the jacket space surrounding the cylinders, and in part directly into the jacket space in the head through the passage 12 and the interior 13 of the cover plate 14 of the head and cover associated with the block in question; and the cooling liquid which finds its way into the space 18 surrounding the cylinders of the block in question flows upward through a plurality of registering openings 20 in the top wall of the cylinder block casting and the bottom wall of the head associated therewith and mingles with the cooling liquid which reaches the jacket space in the head through the passages 12 and cover plate 14; and the cooling liquid supplied in both the ways aforesaid to the interior of each head flows therefrom through a passage 21 and a conduit 22, one for each head, and back into the upper end of the radiator 11.

The registering openings 20 through which the portion of the cooling liquid which flows through the openings 19 and into the jacket space surrounding the cylinders of each block flows into the jacket space 16 in the cylinder head are of small area, as compared with the area of the jacket space or chamber for which they form an outlet, so that the flow of cooling liquid out from said cylinder jacket space and into the interior of the head is constrained, because of the small size of the passage provided by said openings; and the openings adjacent the forward end of the block at which end the passage 9 and ports 19 are located are preferably made smaller than those adjacent the rear end of the block, to thereby secure a movement of the entire mass of cooling liquid away from the inlet passage 9 and equalize the flow of said liquid about and past the several cylinders; it being obviously that the area of the inlet provided by the ports 19 will ordinarily be greater than the combined area of the several outlet passages provided by the openings 20, thus providing a construction wherein the volume of cooling liquid flowing from the cylinder block into the interior of the head is equalized and made to approach substantial uniformity at the various locations at

which such flow occurs; such cooling liquid as cannot escape from the cylinder jacket space 18 through the passage provided by the right hand pair of holes 20, referring to Figure 1, being made to move back, or toward the left, and so on throughout the fore and aft length of the cylinder block, thus materially increasing the supply of cooling water to the cylinders at the rear or left hand end of the cylinder block.

The openings 20 adjacent the right hand or inlet end of the cylinder blocks are commonly made of less area than those further on toward the left hand or discharge end of the block, the said openings increasing in area progressively from the right to the left hand end of the block; and the difference in area of the various passages provided by the said openings may be provided for directly, as by making the said openings themselves smaller at the forward than at the rear ends of the cylinder blocks and heads. A better plan, however, is to make the openings in the abutting walls of the cylinder blocks and heads all of the same size, and to provide the gasket 23 commonly interposed between the meeting walls of the cylinder block and the head with openings of various sizes adapted to register with said openings 20; the openings in the gasket being smallest at the inlet or right hand end of the cylinder block and of progressively increasing area toward the left hand or rear end thereof, as will be understood.

In the same way the portions of the cooling liquid regarded in its entirety which flow through the passages 12 and into the interiors of the cover plates 14 flows from said interior and into the jacket space 16 of each head through a plurality of passages 24 of progressively increasing area from the front to the rear end of the head; said passages in the case of each head being preferably provided in a gasket 25 clamped in place between the cover plate and the open side of the head although as in the case of the cylinder block and the under side of the head said passages may, if desired, be provided by registering openings of predetermined and proper diameters provided in meeting walls or surfaces of said head and cover plate or in a wall of one of said members. This provision of a passage adjacent the forward or inlet end of the cylinder head of insufficient area to provide an outlet for all the cooling liquid from the interior of the cover plate, and the progressively increasing areas of the passages 24 along the length of the head, secures a bodily movement of the cooling liquid toward the rear end of the cover plate and an equalization of the flow and of the cooling effect of the cooling liquid throughout the length of the head casting which closes the open upper ends of the cylinders of each cylinder block.

The greater part of the cooling liquid supplied to each side of the engine through the passage 9 provided therein flows through the passage 12 and cover plate 14 and into the jacket space 16 of the head thereof, as it is desirable to keep the head cooler than the cylinders and an increased amount of cooling liquid has to be supplied to the head to neutralize the heating effect of the heated cooling liquid entering the head from the cylinder jacket space 18 through the passages provided by the openings 20. In the practice of my invention the ports or openings 20 should be made of such a size as to restrict the outflow of cooling liquid from the cylinder jackets to an amount such that the cylinders will be kept heated to the highest permissible temperature under which the pistons will operate, the excess cooling liquid being passed on to the cylinder heads and valves where a considerably lower temperature is desirable, and indeed necessary in actual practice to secure a proper operation of the valves.

In view of the fact that the volume of cooling liquid flowing through the various passages in the heads is greater than the volume flowing through the cylinder jacket spaces, and in order to provide safety or compensating means as regards the flow of cooling liquid out from the cover plate spaces 13, I preferably provide a port 26 in each of the gaskets 25 through which such liquid as does not flow through the several openings 24 may flow into the head jacket spaces 16, as it must do before it can return to the radiator. This port it will be observed is located beyond the rearmost of the series of openings 24; and it will be appreciated that as to each gasket if the total area of the several openings 24 therein is sufficient to provide for or permit the flow of all the liquid entering the space 13 out therefrom, then there will be no flow through the port 26, while if the openings 24 are not of sufficient area to provide for the outflow of all the cooling liquid from the said space, then the excess liquid will flow through the opening 26 and into the interior of the head.

The necessary supply and exhaust passages leading to and from the valves 27 of the engine are formed in the head castings by the use of suitable cores, as is usual in internal combustion engines and as indicated conventionally at 28, 29, Figure 2; the element 30 is the wall of a passage into which the usual spark plug is screwed and which passage obviously leads into the valve pocket 15 which is not shown but which is covered by the cover plate 14, said cover plate being shown in section at the right hand end of Figure 1, but removed throughout the greater part of said figure; 31 designates one of the several priming passages likewise leading one into each valve pocket;

and passages 32 are provided to prevent the trapping of air or steam within the pockets formed beneath the upper end walls of the cylinder castings and the cylinder walls where adjacent cylinders have a common wall, as at 33, no such passages being necessary between the walls of the two middle cylinders as they are spaced apart from one another, as best shown in Figure 1.

In view of the premises it will be appreciated that cooling liquid will be supplied by the pump 10 through the inlet passages 9 to the two cylinder blocks 5, and that the cooling liquid supplied to each cylinder block will flow to the jacket space about and common to the cylinders thereof and to the jacket space within the head thereof simultaneously. Furthermore, the part of the cooling liquid which is supplied to the cylinder jacket space will flow therefrom through the several passages 20 and into the head jacket space simultaneously, and in various volumes as regards the several passages because of their varying areas; while the part of the cooling liquid which is supplied to the jacket space in the head will flow thereinto simultaneously at several points and at various rates, and in different volumes as regards each opening, because of the varying areas of the passages 24 leading from the interior of the cover plate into the head jacket space. Finally, it will be appreciated that the various elements and features which co-operate to distribute the flow of cooling liquid in the way above pointed out may be so designed, proportioned and arranged as to secure different cooling effects at different parts of the engine, so that one part of the engine may be caused to operate at a higher or lower temperature than another; and that as to the cylinders, pistons, valves, etc., or other like parts of each of the individual engines which collectively form the multiple cylinder internal combustion engine disclosed, they may be maintained at substantially uniform temperatures each as regards one another, because of the varying areas of the passages through which the cooling liquid flows from one to the other of the jacket spaces associated with the cylinders and in the cylinder heads and the resulting varying volumes of cooling liquid flowing past the various parts to be cooled.

Having thus described and explained my invention, I claim and desire to secure by Letters Patent:

1. In an internal combustion engine, a cylinder block comprising a plurality of cylinders having a common jacket space or passage through which a cooling liquid may flow; a head for closing the upper ends of said cylinders and having also a jacket space or passage through which a cooling liquid may flow; and a single cooling liquid supply passage formed integrally with said block and communicating with both of said jacket passages or spaces and through which a cooling liquid may be simultaneously supplied to both of said jackets.

2. In an internal combustion engine, a cylinder block comprising a plurality of cylinders having a common jacket space or passage through which a cooling liquid may flow; a head formed separately from said block for closing the open upper ends of said cylinders and having also a jacket space or passage through which a cooling liquid may flow; means for providing a plurality of passages through which a cooling liquid may flow from the jacket space or passage of said cylinders into the jacket space or passage of said head; a single cooling liquid supply passage having two outlets one communicating with one of said jacket passages or spaces and the other with the other of said spaces, and through which passage and outlets a cooling liquid may be simultaneously supplied to both of said jackets; and a single cooling liquid discharge conduit leading from said cylinder head.

3. In an internal combustion engine, a cylinder block comprising a plurality of cylinders formed in a single block and arranged parallel with one another, and having a common jacket space or passage through which a cooling liquid may flow; a head secured to said block and adapted to close the open upper ends of said cylinders and having also a jacket space or passage through which a cooling liquid may flow; and a single cooling liquid supply passage formed in one end of said cylinder block and having two outlets one of which discharges into one of said jacket spaces and the other into the other of said jacket passages or spaces, and through which passage a cooling liquid may be simultaneously supplied to both of said jackets.

4. In an internal combustion engine, a plurality of cylinders formed in a single block and arranged parallel with one another, and having a common jacket space or passage through which a cooling liquid may flow; a head formed separately from and secured to said block and adapted to close the open upper ends of said cylinders and having also a jacket space or passage through which a cooling liquid may flow; a single cooling liquid supply passage located at one end of said cylinder block and communicating with both of said jacket passages or spaces and through which a cooling liquid may be simultaneously supplied to both of said jackets without in either case flowing through the other; means for providing a plurality of passages through which a cooling liquid may flow from the jacket

space or passage of said cylinders into the jacket space or passage of said head; and a single cooling liquid outlet conduit leading from said head.

5. In an internal combustion engine, a plurality of cylinders arranged parallel with one another and having a common jacket space or passage through which a cooling liquid may flow; a head for closing the open upper ends of said cylinders and having also a jacket space or passage through which a cooling liquid may flow; a single cooling liquid supply passage formed integrally with said cylinders and communicating with both of said jacket passages or spaces and through which a cooling liquid may be simultaneously supplied to both of said jackets without in either case flowing through the other; means for providing a plurality of passages through which a cooling liquid may flow from the jacket space or passage of said cylinders into the jacket space or passage of said heads; means for determining the volume of cooling liquid flowing through each of said passages; and a cooling liquid outlet conduit leading from said head.

6. In an internal combustion engine, a plurality of cylinders formed in a single block and arranged parallel with one another, and having a common jacket space or passage through which a cooling liquid may flow; a head secured to and adapted to close the open upper ends of said cylinders and having also a jacket space or passage through which a cooling liquid may flow; a cooling liquid supply passage formed in said cylinder block and located at one end thereof, and communicating with the jacket space or passage aforesaid in said head; a port or opening formed in the wall of said liquid supply passage and through which a cooling liquid may flow into the jacket space or passage of said cylinders; means for providing a plurality of passages through which a cooling liquid may flow from the jacket space or passage of said cylinder block into the jacket space or passage of said head; and a single cooling liquid outlet conduit leading from said head.

7. In an internal combustion engine, a series of cylinders arranged side by side and having a common jacket space or passage through which a cooling liquid may flow; a head for closing the open upper ends of said cylinders and having also a jacket space or passage through which a cooling liquid may flow; means for supplying a cooling liquid to one end of the jacket space or passage aforesaid of said cylinders; a series of passages of progressively increasing area through which a cooling liquid may flow from the jacket space of said cylinders into the jacket space of said head and the one of said passages having the least area being located nearest said cooling liquid supply means; and a cooling liquid outlet conduit leading from said head.

8. In an internal combustion engine, a series of cylinders arranged side by side and having a common jacket space or passage through which a cooling liquid may flow; a head for closing the open upper ends of said cylinders and having also a jacket space or passage through which a cooling liquid may flow; a single cooling liquid supply passage arranged adjacent one end of said series of cylinders and communicating with both of said jacket passages or spaces, and through which passage a cooling liquid may be simultaneously supplied to both of said jackets; a plurality of passages of progressively increasing area through which a cooling liquid may flow from the jacket space of said cylinders into the jacket space of said head and the one of said passages having the least area being located nearest said cooling liquid supply passage; and a cooling liquid outlet conduit leading from said head.

9. In an internal combustion engine, a cylinder block having a series of cylinders arranged side by side, and a common jacket space or passage through which a cooling liquid may flow; a head for closing the open upper ends of said cylinders and having also a jacket space or passage through which a cooling liquid may flow; a cooling liquid supply passage formed in said block and arranged adjacent one end thereof, and which passage communicates with the jacket space or passage of said head; a port or opening formed in the wall of said passage and through which a cooling liquid may flow into the jacket space or passage of said cylinder block; a plurality of passages of progressively increasing area spaced along the joint between the meeting surfaces of said cylinder block and said head and through which passages a cooling liquid may flow from the jacket space of said block into the jacket space of said head and the one of said passages having the least area being located nearest said cooling liquid supply passage; and a cooling liquid outlet conduit leading from said head.

10. In an internal combustion engine, a cylinder block having a plurality of cylinders arranged side by side; a head secured to said block and having a jacket space or passage through which a cooling liquid may flow; a hollow cover plate extending along and secured to said head; means for providing a series of independent passages spaced along said cover plate and through which a cooling liquid may flow from the interior of said cover plate into the jacket space of said head; means for supplying a cooling liquid directly to the interior of said cover plate;

and an outlet passage through which a cooling liquid may flow from the jacket space aforesaid of said head.

11. In an internal combustion engine, a cylinder block having a plurality of cylinders arranged side by side, and a jacket space or passage through which a cooling liquid may flow; a head secured to said block and having also a jacket space or passage through which a cooling liquid may flow; a hollow cover plate extending along and secured to said head; means for providing a series of independent passages spaced along said cover plate and through which passages a cooling liquid may flow from the interior of said cover plate into the jacket space of said head; means for supplying a cooling liquid to the jacket space aforesaid of said cylinder block; means independent of said first mentioned means for supplying a cooling liquid to the interior of said cover plate; and an outlet passage through which a cooling liquid may flow from the jacket space or passage aforesaid of said head.

12. In an internal combustion engine, a cylinder block having a plurality of cylinders arranged side by side, and a jacket space or passage through which a cooling liquid may flow; a head secured to said block and having also a jacket space or passage through which a cooling liquid may flow; a hollow cover plate extending along and secured to said head; means for providing a series of independent passages spaced along said cover plate and through which cooling liquid may flow from the interior of said cover plate into the jacket space of said head; means for providing a series of independent passages spaced along the joint between the meeting surfaces of said cylinder block and said head and through which passages a cooling liquid may flow from the interior of the jacket space of said cylinder block into the jacket space of said head; a single cooling liquid supply passage through which a cooling liquid may be supplied both to the jacket space of said cylinder block and to the interior of said hollow cover plate; and an outlet passage through which a cooling liquid may flow from the jacket space of said head.

13. In an internal combustion engine, a cylinder block having a plurality of cylinders arranged side by side, and a jacket space or passage through which a cooling liquid may flow; a head secured to said block and having also a jacket space or passage through which a cooling liquid may flow; a hollow cover plate extending along and secured to said head; means for providing a series of independent passages spaced along said cover plate and through which passages cooling liquid may flow from the interior of said cover plate into the jacket space of said head; means for providing a series of independent passages spaced along the joint between the meeting surfaces of said cylinder block and said head and through which passages a cooling liquid may flow from the interior of the jacket space of said cylinder block into the jacket space of said head; a cooling liquid supply passage formed in said cylinder block and having a port discharging into the jacket space thereof; a passage provided in said head and the ends of which communicate respectively with said cooling liquid supply passage and with the interior of said cover plate; and a cooling liquid outlet passage leading from the interior of said head.

14. In an internal combustion engine, a cylinder block having a series of cylinders arranged side by side; a head secured to the upper end of said block and having a jacket space or passage through which a cooling liquid may flow; a hollow cover plate extending along and secured to said head; a cooling liquid supply passage so arranged as to discharge into the interior of said cover plate at one end thereof; a gasket having a series of holes of progressively increasing diameter secured in place between the meeting surfaces of said cylinder head and cover plate, and the smallest of which holes lies adjacent the point at which the cooling liquid supply passage aforesaid discharges into said cover plate; and a cooling liquid outlet conduit leading from said head.

15. In an internal combustion engine, a cylinder block having a series of cylinders arranged side by side, and an internal jacket space or passage through which a cooling liquid may flow; a head secured to the upper end of said block and having also a jacket space or passage through which a cooling liquid may flow; a cooling liquid supply passage located at one end of said block and discharging into the jacket space thereof; a gasket having a series of holes of progressively increasing diameter secured in place between the meeting surfaces of said cylinder block and head, and the smallest of which holes lies adjacent said cooling liquid inlet passage when the parts are assembled; and a cooling liquid outlet conduit leading from said head.

16. In an internal combustion engine, a cylinder block having a series of cylinders arranged side by side, and an internal jacket space or passage through which a cooling liquid may flow; a head secured to the upper end of said block and having also a jacket space or passage through which a cooling liquid may flow; a hollow cover plate extending along and secured to said head; a cooling liquid supply passage formed in said cylinder block and located at one end thereof; a passage provided in

said head and the ends of which communicate respectively with said cooling liquid supply passage and with the interior of said cover plate; a port or opening formed in the wall of said liquid supply passage and through which cooling liquid is discharged into the jacket space aforesaid of said cylinder block; a gasket having a series of holes of progressively increasing diameter secured in place between the meeting surfaces of said cylinder block and head, and the smallest of which holes lies adjacent said cooling liquid inlet passage when the parts are assembled; a second gasket having a series of holes of progressively increasing diameter secured in place between the meeting surfaces of said cover plate and said head, and the smallest of which holes lies adjacent the point at which the passage aforesaid in said head discharges into said cover plate; and a cooling liquid outlet conduit leading from said head.

17. In an internal combustion engine, a cylinder block having a plurality of cylinders arranged side by side; a head secured to said block and closing the upper end of said cylinders and having a jacket space or passage through which a cooling liquid may flow; a hollow cover plate extending along and secured to said head; a gasket secured in place between the meeting surfaces of said cover plate and said head, and which gasket is provided with a series of holes of progressively increasing diameter through which a cooling liquid may flow from the interior of said cover plate to the jacket space of said head; a passage formed in said head and discharging into the interior of said cover plate adjacent the one of the holes aforesaid which is the smallest in size; a cooling liquid supply passage communicating with the passage aforesaid in said head; and an outlet passage through which cooling liquid may flow from the jacket space aforesaid of said head.

18. In an internal combustion engine, a cylinder block having a plurality of cylinders arranged side by side; a head secured to said block and having a jacket space or passage through which a cooling liquid may flow; a hollow cover plate extending along and secured to said head; a cooling liquid supply passage discharging directly into the interior of said cover plate at one end thereof; a gasket held in place between the meeting surfaces of said cover plate and said head, and which gasket is provided with a series of holes of varying areas through which cooling liquid may flow from the interior of said cover plate into the jacket space of said head; a port formed in said gasket and located at the end thereof opposite said cooling liquid supply passage; and an outlet passage through which a cooling liquid may flow from the jacket space aforesaid of said head.

19. In an internal combustion engine, a cylinder having a jacket space or passage through which a cooling liquid may flow; a head for closing the upper end of said cylder and having also a jacket space or passage through which a cooling liquid may flow; and a single cooling liquid supply passage formed integrally with said cylinder communicating with both of said jacket passage or spaces and through which a cooling liquid may be simultaneously supplied to both of said jackets without in either case flowing through the other jacket.

In testimony whereof I affix my signature.

CHARLES R. SHORT.