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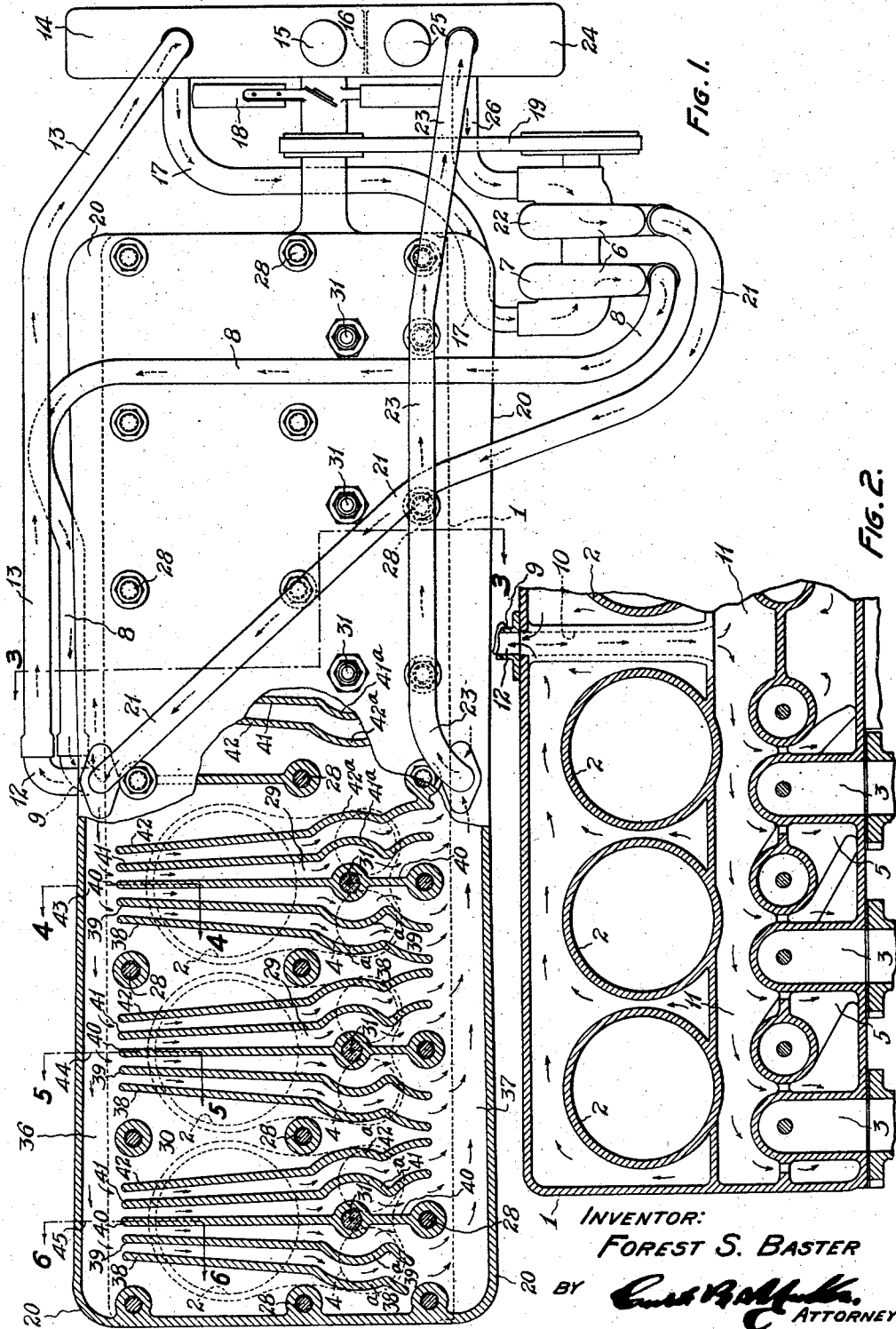
F. S. BASTER

2,216,802

COOLING MEANS

Filed Jan. 13, 1939

2 Sheets-Sheet 1



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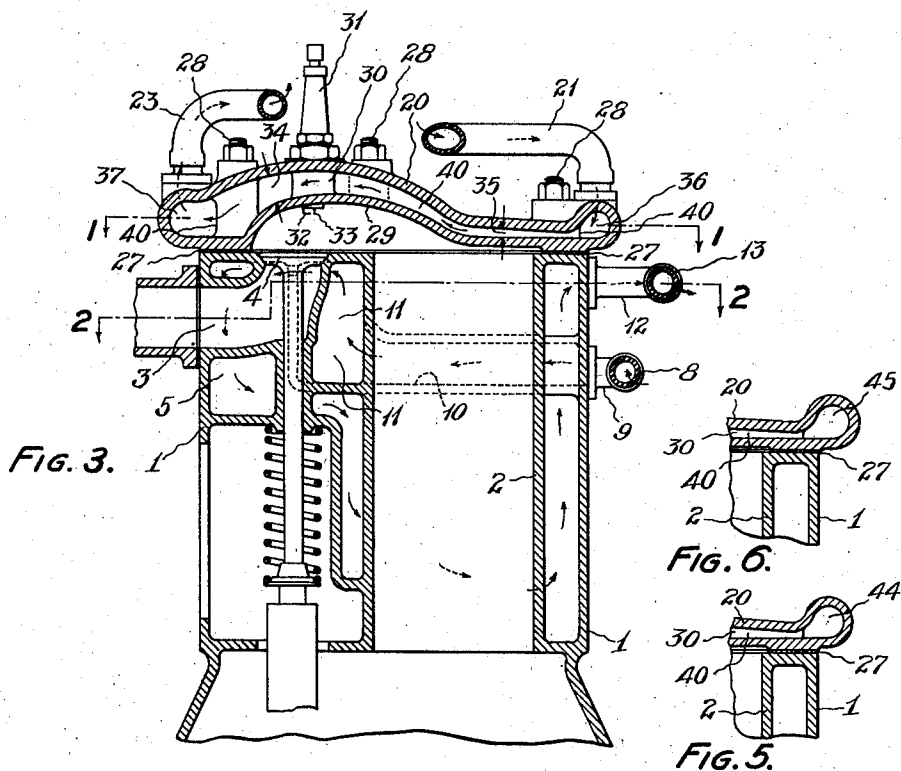
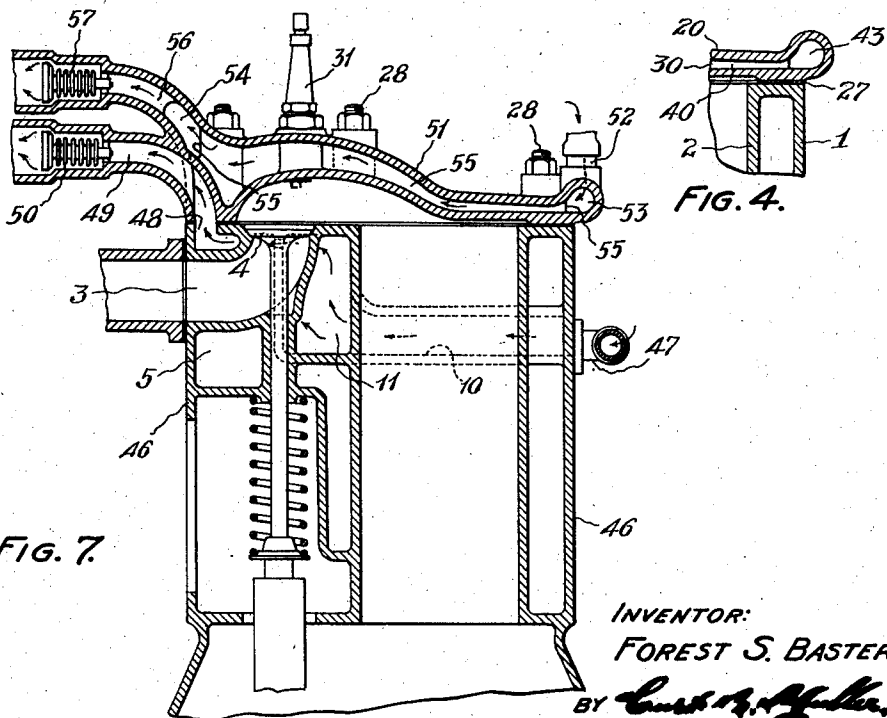
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2 Sheets-Sheet 2



INVENTOR:
FOREST S. BASTER

BY *Charles F. Fuller,*
ATTORNEY

UNITED STATES PATENT OFFICE

2,216,802

COOLING MEANS

Forest S. Baster, Cleveland Heights, Ohio, assignor
to The White Motor Company, Cleveland, Ohio

Application January 13, 1939, Serial No. 250,702

11 Claims. (Cl. 123—173)

My invention pertains to a cooling system and more particularly to a pair of separate water circulating systems for an internal combustion engine.

A further object has been to divide the cooling medium into two independent systems, one reacting directly through the engine block comprising exhaust passages, exhaust valve seats and exhaust valve stem guides; whereas, the second system is for cooling the head which covers the combustion chamber.

A further object has been to provide one cooling system to supply a maximum amount of heat transference from the valve seats and valve guides with the advantageous result of less thermal distortion and longer life, the cooling water also circulating around the cylinder barrels.

Another object has been to provide the second circulatory system so that the flow of the cooling medium is throttled in a prescribed manner consequent to the shape of the water jacket in the head and also so dispersed by means of partition forming ribs in the water jacket as to serve to reinforce the head or to strengthen the roof of the combustion chamber and to also serve to supply additional radiating surfaces. The interior construction of the head is so designed that the velocity of the water flow is high at the entry side where are located those sections of the several combustion chambers which constitute the detonation control areas; whereas on the outlet side the velocity of the water flow decreases as it moves over the combustion chamber roof so that the velocity has dropped considerably on the outlet side which is nearer those sections of the combustion chambers which have the greatest heat loss to cooling. Moreover, oppositely disposed, longitudinally extending header passages, which extend alongside the subjacent row of valves and cylinders, are of progressively increasing size from the longitudinal middle of the head toward each end of the latter.

The following advantages are realized by my design of partitioned hollow head:

(1) Increase in the effectiveness of the detonation control area of the combustion chamber by removing a great amount of heat there.

(2) Increase of the efficiency of the combustion cycle by transference of a minimum amount of heat at the high heat loss or ignition area.

(3) Decrease of the rate of carbon build-up inside of the combustion chamber by keeping the latter operating at the correct temperature and thereby increasing the stability and efficiency of the engine over a longer period of time.

The two independent circulatory systems may

circulate the cooling water into a common radiator or into two separate radiators and connecting manifolds might optionally be employed to accomplish a uniformity of flow through various parts of the engine.

The advantages of my invention as contrasted with the conventional cooling systems are:

(1) A maximum flow to the valve seats and valve stem guides without having the same water travel over the combustion chamber, to realize longer mechanical life and higher thermal efficiency.

(2) Cooling of the head and therefore of the combustion chamber by specially directed and metered flow from its detonation control area to its high heat loss or ignition area, resulting in differentials of heat and of heat transference to give higher thermal efficiencies and a minimum carbon accumulation.

Adverting to the drawings—

Figure 1 is a plan view, partly in section along line 1—1 of Fig. 3 through the head of so much of an internal combustion engine as has operative association with my invention.

Figure 2 is a partial plan section taken in a plane slightly below the top of the cylinder block as indicated by the line 2—2 in Figure 3.

Figure 3 is a vertical section on zigzag line 3—3 of Fig. 1.

Figures 4, 5 and 6 are corresponding sectional detail views taken respectively on lines 4—4, 5—5 and 6—6 in Fig. 1.

Figure 7 is a view corresponding to Fig. 3 of a slightly modified form in which the outlets from the engine of the two circulatory systems are adjacent to each other in a unitary structure.

An engine block 1 comprises along opposite sides respectively, six cylinder barrels 2, six exhaust passages 3, six exhaust valves 4 and a somewhat intricate water jacket which includes a section 5 enveloping the exhaust passage 3 as shown in Fig. 3.

A twin pump unit 6 includes one pump chamber 7 which discharges through a pipe 8 which enters the water jacket of the engine block at 9, then flows through a middle cross passage 10 and thence into a longitudinally extending passage 11 which, as shown in Figures 2 and 3, extends between the row of cylinders and exhaust passages and discharges by flow around the exhaust valve seats and around the exhaust passages. Such a jacket design is shown, described and claimed in my co-pending application filed November 26, 1938, Serial No. 242,529. Exit from the cylinder block is through a higher outlet 12 connected with a conduit 13 which discharges

into the top of one radiator 14 having a capped fill opening 15. As merely exemplified in Fig. 1 the radiator 14 is a unitary structure with another radiator, though completely separated therefrom by a partition 16. From the lower end of the radiator 14, return to the pump chamber 7 is through a conduit 17. The customary fan 18 is shown rotatably mounted behind the radiator and with a belt drive 19 in common with the twin pump.

A hollow head 20 to be mounted upon the top of the engine block receives water at the middle of its one longitudinal side through a conduit 21 connected with the other pump chamber 22 and discharge of the water from the opposite longitudinal middle of the head is through a conduit 23 which is connected with the top of a companion radiator 24 having a capped inlet 25. Connection between the bottom of the radiator 24 and the pump housing 22 is established by means of a conduit 26. It will be observed that the radiator 14 happens to be illustrated as larger than the radiator 24, but it will be understood that their relative sizes are not of vital consequence to my invention and might be varied to suit differing engine designs. Compressed between the deck of the engine block 1 and the bottom of the head 20 is the customary, appropriately apertured gasket 27 and a series of twenty-three bolts 28 which serve to secure the head to the block. The head 20 has upwardly arched sections to define the roofs 29 of six combustion chambers each of which communicates with one of the cylinder barrels and extends over one of the exhaust valves 4 and is furthermore provided with a water chamber 30 extending across from one of its longitudinal sides to its opposite longitudinal side. Each combustion chamber roof is intersected by a spark plug 31 having terminals 32 and 33 located at the high heat loss area of the combustion chamber roof.

As may be observed in Fig. 3 the vertical dimensions of the water chamber 30 vary in a direction from side to side having a greater dimension 34 over the water outlet or ignition side of the combustion chamber than the dimension 35 over the cylinder barrels or detonation control areas which are nearer the inlet side of the head. Generally, the height of the chamber 30 progressively increases from one side to the other or from the inlet side where there is a longitudinally extending header passage 36 toward the outlet side where there is a comparatively larger longitudinally extending header passage 37.

Extending crosswise or in a direction from inlet to outlet side and over each combustion chamber, the head is interiorly provided with five partitions 38, 39, 40, 41 and 42 as clearly shown in Fig. 1. These partitions are so angularly related with respect to each other that they form cross passages therebetween which progressively increase in width, measured longitudinally of the head, from the inlet header 36 to the outlet header 37. Where the pairs of partitions 38 and 39, and 41 and 42 pass a spark plug they are curved around it at 38a, 39a, 41a and 42a in order not to alter the progressive increase in size of the passages therebetween as will be readily understood upon inspection of the left end of Fig. 1. The progressively increased size of the headers 36 and 37 in a direction from the middle of the head toward each of its ends is exemplifiedly accomplished by having the ends of all of the partitions spaced progressively varying distances from the outer walls of the two headers or so that a line drawn

through the extremities of all the partitions in one longitudinal half of the head and along each longitudinal side thereof is not parallel with the corresponding outer wall of the header, Figures 4, 5 and 6 illustrate the varying sizes of the headers on planes passing through each of the three middle partitions 40 and in said three figures the three sectional planes of the headers, progressing in a direction from the middle of the head toward either of its ends, are marked by the numerals 43, 44 and 45. By this duplex arrangement of vari-sized headers and also vari-sized crosswise passages a more balanced water cooling distribution is effected so that each combustion chamber is cooled to substantially the same extent regardless of its proximity to an end of the engine. The double variation in size of each of the crosswise passages, both vertically and relatively transversely is calculated to realize higher thermal efficiencies and a minimum accumulation of carbon due to predetermined metering of the flow and its cooling effect with a differential as between the ignition area of a combustion chamber and its detonation control area.

The modification of Fig. 7 illustrates an engine block 46 having an inlet 47 to its water jacket and an outlet 48 adapted to communicate with a pipe 49 containing a thermostat 50, the pipe 49 being, however, an integral part of a head 51 provided with an inlet 52, having an inlet header 53, and outlet header 54, partitions 55 therebetween, and outlet pipe 56 interiorly though separate from the pipe 49 and containing a thermostat 57. It is to be understood that the pipe 49 returns water to one radiator whereas the pipe 56 delivers it to a companion radiator.

It is to be realized that the scope of my invention comprehends many equivalent constructions. The showing of the drawings and the particular descriptions are merely specific exemplifications of a plurality of mechanical embodiments and arrangements.

I claim:

1. In an engine, a cylinder block and a water-jacketed head forming in conjunction with each other a combustion chamber, said head being formed interiorly with a plurality of passages extending across from one side thereof to the other side, said passages being of predeterminedly varying size, and means for circulating water through said head.

2. In an engine, a cylinder block and a water-jacketed head forming in conjunction with each other a combustion chamber, said head being formed interiorly on opposite sides with headers and also with a plurality of partitions therebetween, said partitions forming passages of progressively varying size in a certain direction and a water circulatory system connected with said headers.

3. In an engine, a cylinder block and a water-jacketed head forming in conjunction with each other a combustion chamber, said head being formed interiorly on opposite sides with headers and also with a plurality of partitions therebetween, said partitions forming passages of increasing size from one end of said chamber toward its other end and means for circulating water through said head.

4. In an engine, a cylinder block and a water-jacketed head forming in conjunction with each other a combustion chamber, said head being formed interiorly with a plurality of passages extending from side to side, said passages each being of varying size in two relatively transverse

directions and means for circulating water through said head.

5 5. In an automotive vehicle, a water circulatory system comprising, a composite engine case including a water-jacketed cylinder block and a
10 10 being closed with respect to each other within said engine case.

6. In an automotive vehicle, a water circulatory system comprising, a water-jacketed head, a
15 15 and complementary connections between said head, pump and radiators and partitions forming variable sized passages within said head jacket for effecting differential velocities of water flow therethrough.

20 7. An oblong water-jacketed internal combustion engine head having an inlet and an outlet, said head being formed interiorly with crosswise extending passages each of varying size from end to end and being also formed with header passages extending along opposite sides, said header
25 25 passages communicating with each of said crosswise passages, the size of one corresponding set of ends of said crosswise passages furthermore varying directly as their distances from the longitudinal middle of said head.

30 8. An internal combustion engine head formed with a water chamber of varying height and having an inlet at its side of least height and having an outlet at its side of greatest height and cross-
35 35 wise extending partitions therein each terminating short of both sides of said head and with adjacent pairs of partitions diverging in a direction from said inlet toward said outlet.

9. An oblong water-jacketed internal combustion engine head having a middle inlet and a middle outlet, said head being interiorly formed with crosswise extending passages each of varying size from its one end toward its other end and said
5 5 head being also formed interiorly with header passages extending along opposite sides of the head and transversely with respect to said crosswise extending passages, said header passages communicating with each of said crosswise pas-
10 10 sages, there being a direct ratio between the size of ends of said crosswise passages along a longitudinal half of the head and the distances of such ends from the nearest longitudinal end of said head.

10. In a water circulatory system for an internal combustion engine, the combination of a pump, a water jacketed head formed with groups of partitions of varying height, a radiator, a conduit from said pump to the portions of the parti-
20 20 tions which are of minimum height, a conduit from the portions of said partitions which are of maximum height to said radiator and a conduit intermediate said radiator and said pump.

11. A head for an internal combustion engine
25 25 comprising walls defining a plurality of combustion chambers and a water jacket over said combustion chambers, said water jacket having inlet and outlet openings in opposed longitudinal walls thereof, a row of transversely disposed partitions
30 30 defining passages extending between the opposed longitudinal walls of said water jacket, said passages each varying in size from end to end and certain pairs thereof varying in length, whereby a differential velocity of flow is effected through
35 35 said passages.

FOREST S. BASTER.