Sept. 6, 1932. J. B. FISHER 1,875,580

COOLING SYSTEM

Filed Oct. 19, 1928

Fig. 1

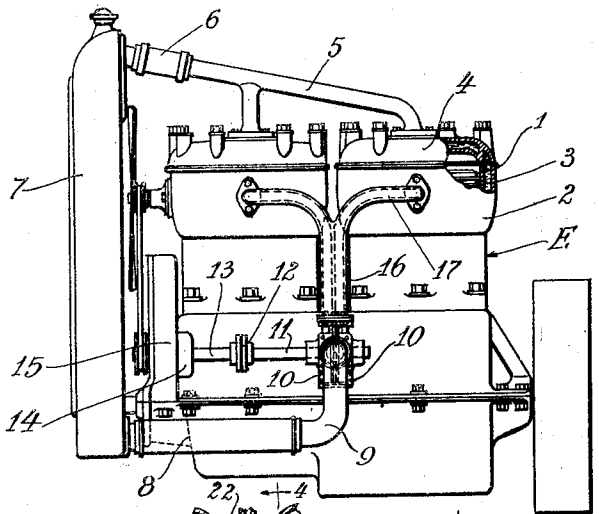


Fig. 3

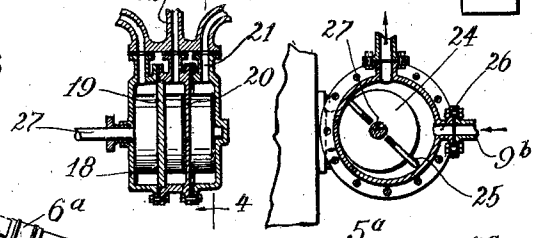
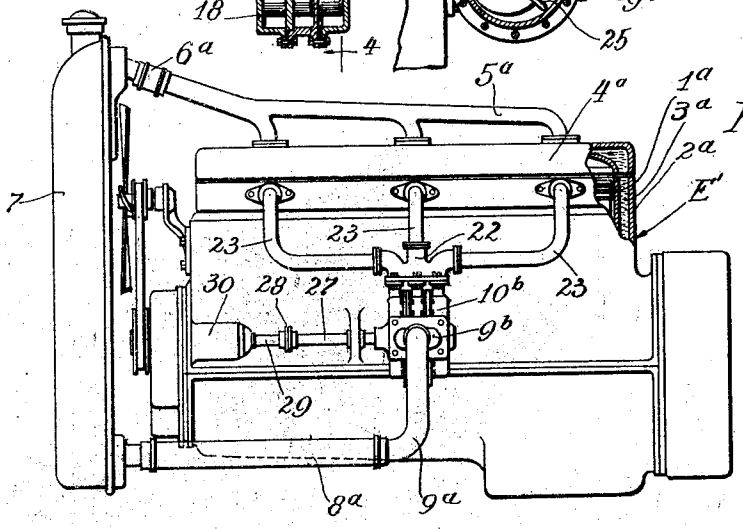


Fig. 4

Fig. 2



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UNITED STATES PATENT OFFICE

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COOLING SYSTEM

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This invention relates to internal combustion engines, and more particularly to means for cooling the cylinder walls of such engines.

The primary object of my invention is to maintain a uniform supply of cooling water to each cylinder or group of cylinders of a multicylinder engine. This condition is not always obtained in common practice where it is customary to use a single pump discharging into a branched pipe, one branch leading to each cylinder or group of cylinders. It has been found that with this construction, under certain conditions, there is great inequality of flow through the various branches. This is due to the fact that the path through any one branch is sufficiently unrestricted to take the full discharge of the pump without any great pressure being built up at the junction of the various branches.

If a steam pocket starts to form in a cylinder, it displaces water and thereby increases the resistance to flow through this cylinder. This slight increase is sufficient to divert the flow to the other cylinder or cylinders. This reduction of flow through the first cylinder reduces the cooling and further aids the formation of the steam pocket with resulting increase in pressure and reduced flow. This condition usually occurs in a spasmodic manner, first in one cylinder and then in another, jumping from one to the other for no apparent reason.

When the engine is operated in an inclined position, as is necessary in such machinery as tractors and logging machinery, where angles of forty-five degrees are not unusual, there is a very definite tendency to inequality of distribution between the high and low end of the engine.

The difficulties described above are effectively overcome by a pump which has a series of impellers discharging to independent pipes leading to individual cylinders or groups of cylinders. In this way the full pump pressure is always available to force cooling water through each cylinder jacket regardless of the conditions within the jacket or the conditions of engine tilting.

In its broader aspects, my invention comprehends means for supplying cooling water to the cylinders of an internal combustion engine at a plurality of points or zones, the supply of water being under pressure at each point or zone independently of the water supplied at the other points or zones.

By this means the temperature of the cylinders may be maintained substantially constant and at a proper value to assure maximum efficiency in operation of the engine. Further objects and advantages of my invention will appear from the detailed description.

In the drawing:—

Fig. 1 is a side view of an internal combustion engine of known type, and its associated radiator, illustrating my invention as applied thereto;

Fig. 2 is a view similar to Fig. 1 showing a different form of the invention;

Fig. 3 is a vertical sectional view through the pump assembly taken in the direction of the axis thereof, parts being shown in elevation; and

Fig. 4 is a section taken substantially on line 4—4 of Fig. 3.

In Fig. 1 of the drawing I have illustrated my invention as applied to an internal combustion engine E of known type, this engine having four cylinders arranged in pairs, each pair of cylinders 1 being disposed within a water jacket 2 which provides a water space 3 about each cylinder. The head of the cylinder is carried by engine head 4 which is secured to the cylinder block in a known manner. The water jackets 2 are connected by a water return pipe 5 and a hose section 6 to a radiator 7 of known type, adjacent the top thereof.

The lower portion or hot well of the radiator 7 is connected by a hose section 8 to an inlet pipe 9 which is connected to the inlet openings of two pumps 10 of a pump assembly suitably mounted on the engine frame. These pumps are driven by a shaft 11 connected through a suitable coupling 12 to shaft 13 of a generator 14 which is driven through suitable gearing enclosed in a housing 15, this gearing being driven from the crank shaft of the engine in a manner well understood in the art. A connector 16 is suitably secured

to the upper portion of the pump assembly and is provided with two parallel passages which open into water supply pipes 17, the discharge ends of which are secured to the water jackets 2 and open into the same, in a known manner. The connector 16 is thus of substantially Y-shape and the pipes 17 communicate with the discharge openings of the respective pumps 10.

During operation of the engine the pumps 10 are operated and act to withdraw water from the lower portion of the radiator and to supply this water to the water jackets 2 under pressure. The water is supplied to each jacket independently of the water supplied to the other jacket or jackets so that proper supply and circulation of cooling water in each of the water jackets is assured. In this manner, I supply cooling water to the water jackets at substantially uniform pressure with the result that proper circulation of the water at all points in the water jacket is assured and overheating of the cylinders is prevented, assuring maximum efficiency in operation of the engine.

In the form illustrated in Fig. 2, I have shown an engine E′ in which all of the cylinders 1*a* are disposed in a common water jacket 2*a* providing, with the cylinder walls, water space 3*a*. The engine head 4*a* is provided with a plurality of water outlets connected by the water return pipe 5*a* and hose section 6*a* to radiator 7. The lower portion of the radiator is connected by a hose section 8*a* to a water inlet pipe 9*a*, the upper end portion of which is extended laterally to produce, in effect, a nozzle 9*b* which is suitably secured to a pump assembly 10*b*. This pump assembly is illustrated in Figs. 3 and 4 and includes three pump casings 18 which are secured together in abutting relation in a suitable manner, these casings being separated from each other by circular plates or disks 19 and 20.

The disk 19 is set into a suitable rabbet in the inner side of the central casing 18 and the disk 20 is integral with this central casing and forms the outer side or head thereof. Each of the casings is provided, at its upper portion, with an outlet neck 21 and a three-armed head 22 seats upon and is suitably secured to the upper ends of necks 21. The arms of the head 22 communicate with the respective outlet necks 21 which define the outlet or discharge openings of the pump. Three water supply pipes 23 are secured to the upper ends of the arms of head 22, the upper ends of these pipes being secured to and opening into water jacket 2*a* at a plurality of points or zones thereof.

The pump may be of any suitable or preferred construction. For purposes of illustration I have shown a rotary type of pump well known in the art. This pump includes a rotor 24 which is disposed within the pump casing eccentrically thereof. This rotor carries a pair of blades or vanes 25 which are spring pressed and contact the circumferential wall of the pump casing in the rotation of rotor 24. The inlet opening 26 of each casing 18 communicates with the nozzle 9*b* so that water from the lower portion of the radiator 7 is supplied to all of the pumps equally. The rotors 24 of the pumps are feathered upon, or otherwise secured to, a pump shaft 27 which extends through the pump casing as illustrated. This shaft 27 is connected by a suitable coupling 28 to shaft 29 of a generator 30 which is driven in a known manner, through a suitable gear train, from the crank shaft of the engine.

In the operation of the engine, the water is withdrawn from the lower portion of the radiator 7 and is supplied to the water jacket 2*a* through the pipes 23, at a plurality of points or zones. It is to be particularly noted that the cooling water is supplied to the water jacket at each point under pressure, the pump or other suitable pressure generating means for supplying the water to any one point or zone of the water jacket being independent of the pumps for supplying the water to the other zones of the water jacket. As a result, any back pressure or interference which may occur at one point or zone of supply of water will not adversely affect the supply of water to any other zone or point. Proper supply of water to the various zones of the water jacket, and proper circulation of such water, is thus assured at all times.

In the form illustrated in Fig. 1, the pumps 10 are shown as of the rotary type illustrated in Figs. 2, 3 and 4.

While I have shown, by way of example, a pump having a series of impellers mounted upon a common shaft, I do not limit my invention to this particular form of pump. It is possible to obtain satisfactory results by using a pump structure having independent impellers, or independent pumps or the equivalent thereof may be utilized to force the cooling water through independent conduits or pipes leading to individual cylinders or groups of cylinders.

What I claim is:—

1. In combination, an internal combustion engine having a plurality of cylinders, a common water jacket surrounding the cylinders, a source of supply of cooling water, and means for delivering water from said source of supply to the water space about the cylinders at a plurality of points and under pressure, the water being delivered at each of said points independently

2. In combination, an internal combustion engine having a plurality of cylinders, a common water jacket surrounding the cylinders, a radiator, a water return pipe connecting the water jacket to the radiator adjacent the top thereof, and means for pumping water from

the lower portion of the radiator and delivering it under pressure to the water space about the cylinders at a plurality of points, the water being delivered at each point independently.

3. In combination, an internal combustion engine having a plurality of cylinders, a common water jacket surrounding the cylinders, a radiator, a water return pipe connecting the water jacket to the radiator adjacent the top thereof, and means for delivering water from the radiator to the water space about the cylinders in different zones thereof, the water being delivered to each zone under pressure and independently.

4. In combination, an internal combustion engine having a cylinder block comprising cylinders and a common water jacket enclosing the same, a radiator, a return water pipe connecting the upper portion of the water jacket to the upper portion of the radiator, a plurality of pumps having their intakes connected to the lower portion of the radiator, and water supply pipes connected to the discharge openings of the respective pumps and opening into the water jacket.

5. In combination, an internal combustion engine having a cylinder block comprising cylinders and a common water jacket enclosing the same, a radiator, a return water pipe connecting the upper portion of the water jacket to the radiator, a plurality of pumps having their intakes connected to the lower portion of the radiator, a common drive shaft for said pumps, and water supply pipes connected to the discharge openings of the respective pumps and to the water jacket at different portions thereof.

6. In combination, a multi-cylinder internal combustion engine, a water jacket surrounding the cylinders, a radiator, a water return pipe connecting the water jacket at points adjacent the respective cylinders to the radiator adjacent the top thereof, and means for delivering the water under pressure from the radiator to the water jacket at a plurality of points adjacent the respective cylinders, said means acting to deliver the water to the respective points of the water jacket independently.

7. In combination a multi-cylinder internal combustion engine, a water jacket surrounding the cylinders, a radiator, a water return pipe connecting the water jacket adjacent each end and the center thereof to the radiator adjacent the top thereof, and means for delivering water under pressure from the radiator to the water jacket adjacent both ends and the center thereof simultaneously and independently.

8. In combination, an internal combustion engine including water jacketed cylinders, a source of supply of cooling water, a pump assembly including a plurality of individual pump units, and independent conduits connecting the outlets of the respective pump units to the water space about the cylinders at different zones thereof for delivering water to the respective zones independently.

9. In combination, an internal combustion engine including water jacketed cylinders, a source of supply of cooling water, a plurality of independent conduits communicating at a plurality of points with the water space about the cylinders, and pressure means for delivering water from said source of supply to the respective conduits, said means delivering to each conduit independently of the other conduits.

In witness whereof, I hereunto subscribe my name this 12th day of October, 1928.

JAMES B. FISHER.