Sept. 20, 1960 A. E. KOLBE 2,953,126

ENGINE COOLANT DISTRIBUTION

Filed Dec. 12, 1958 3 Sheets-Sheet 1

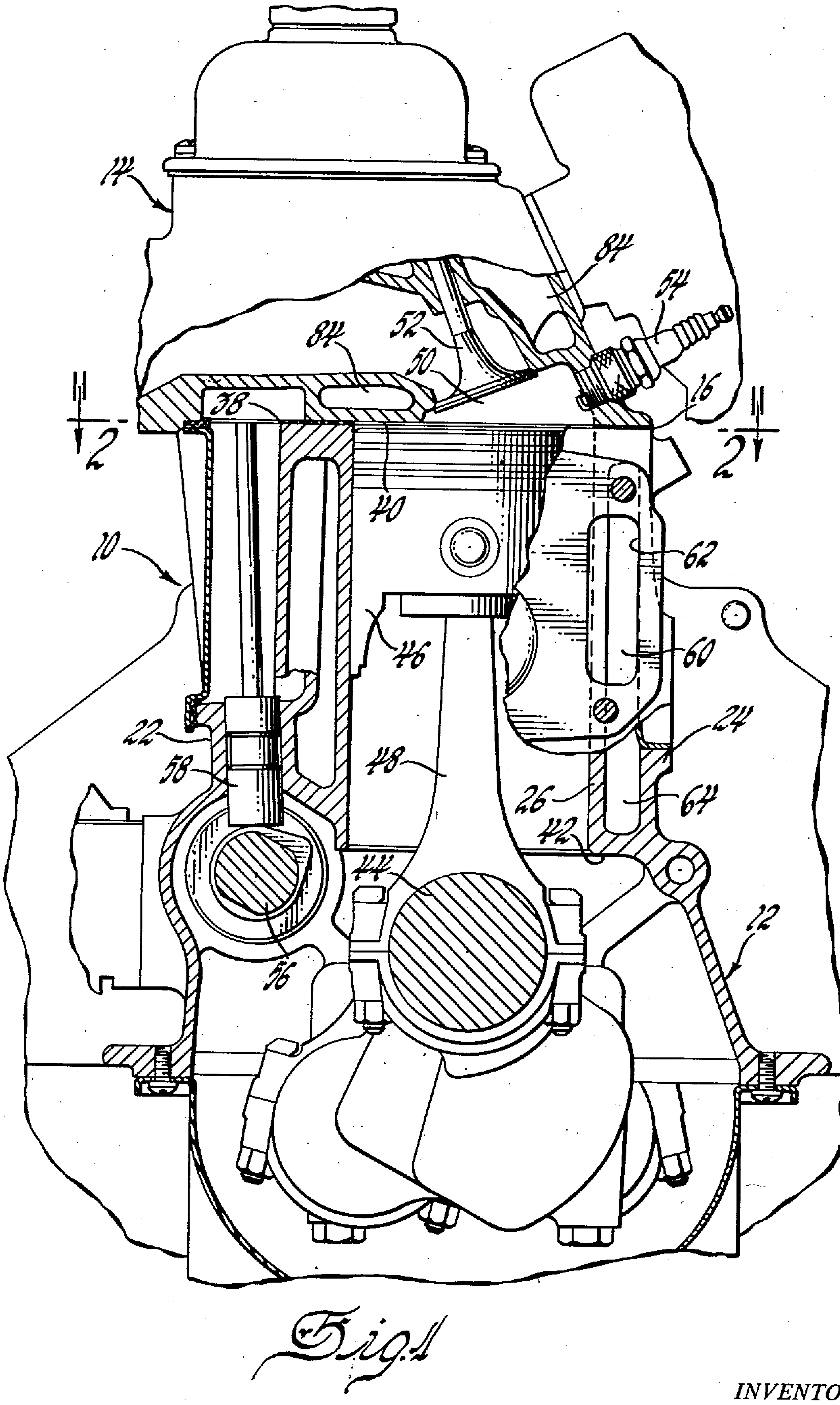

Fig. 1

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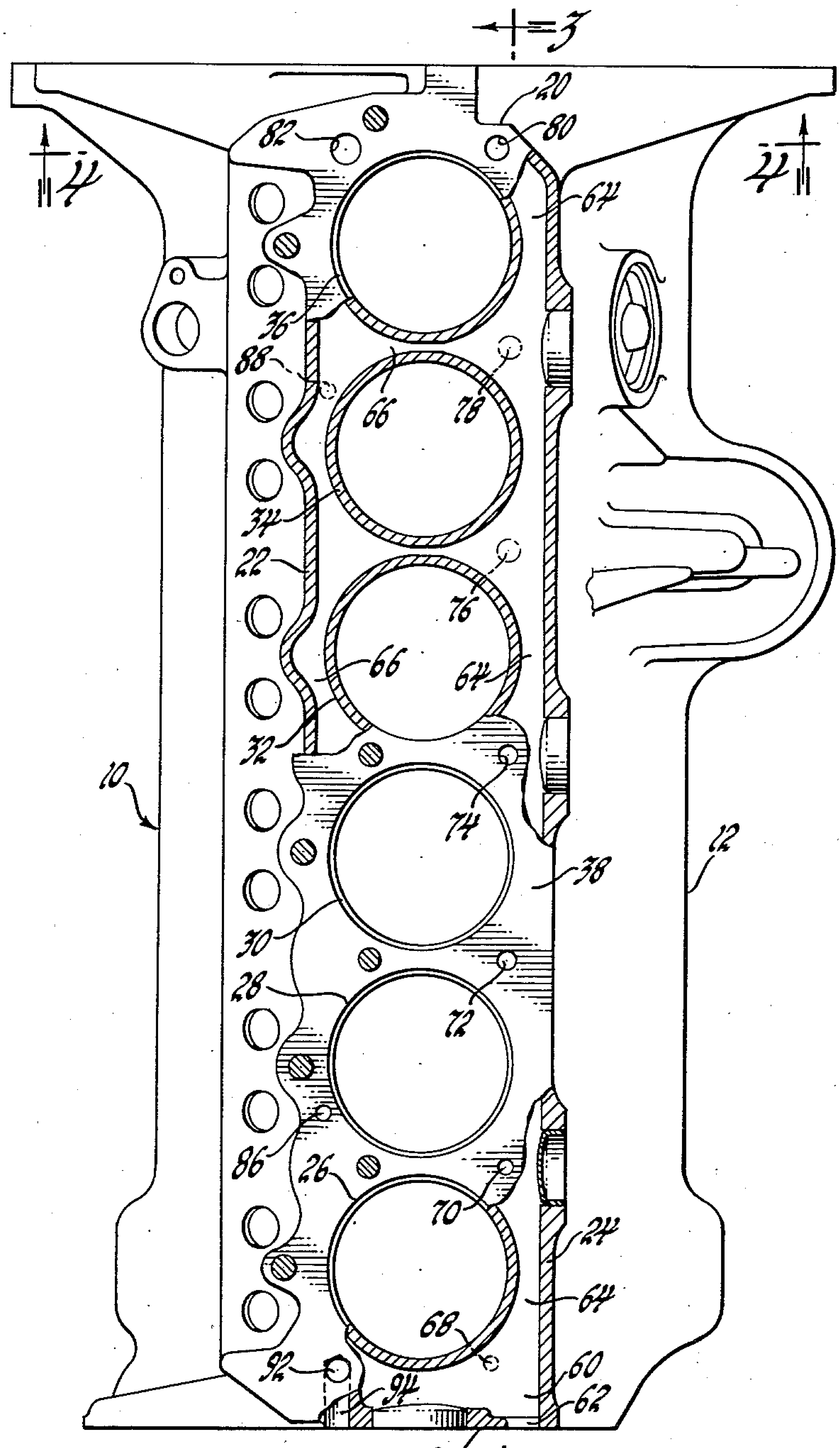

Fig. 2

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3 Sheets-Sheet 3

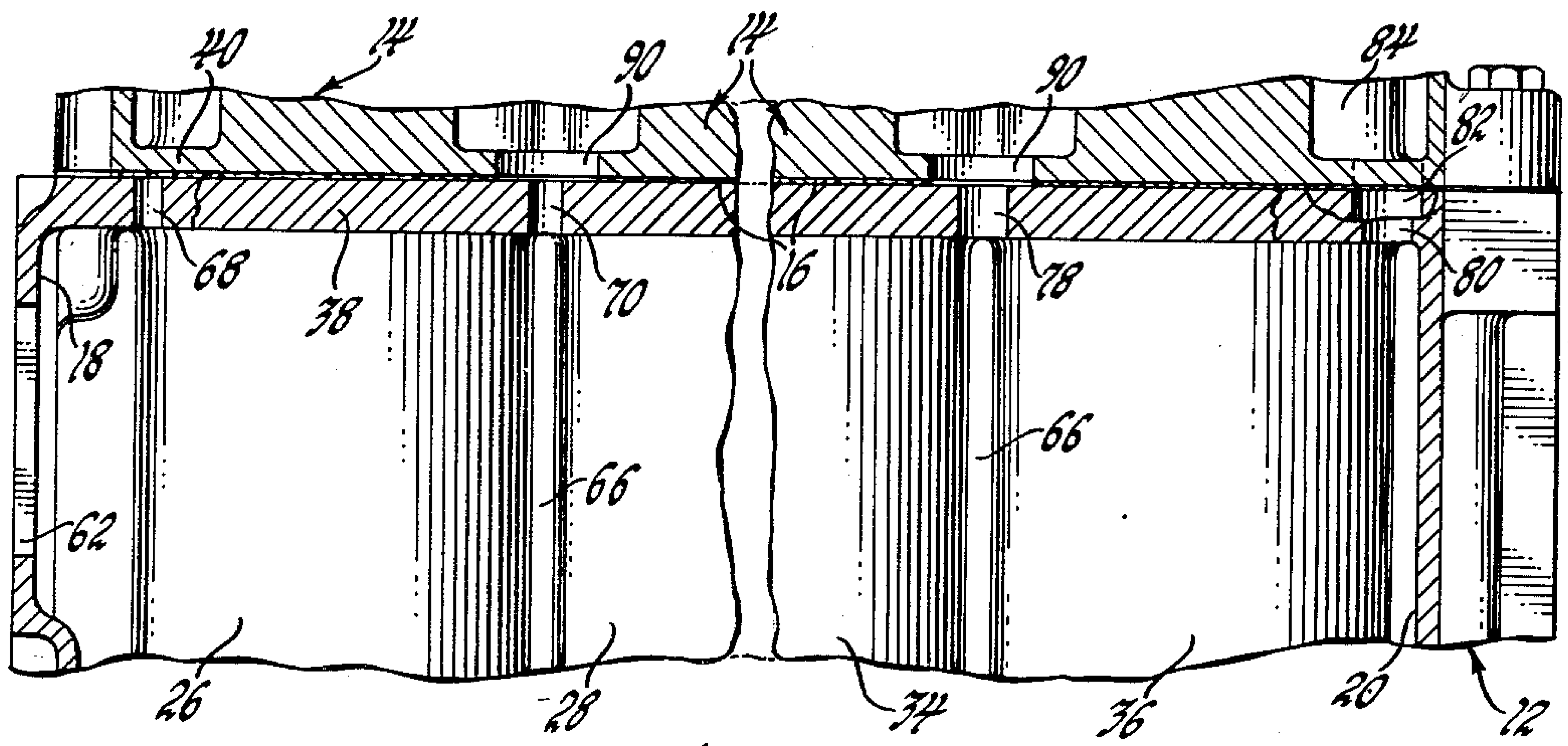

Fig.3

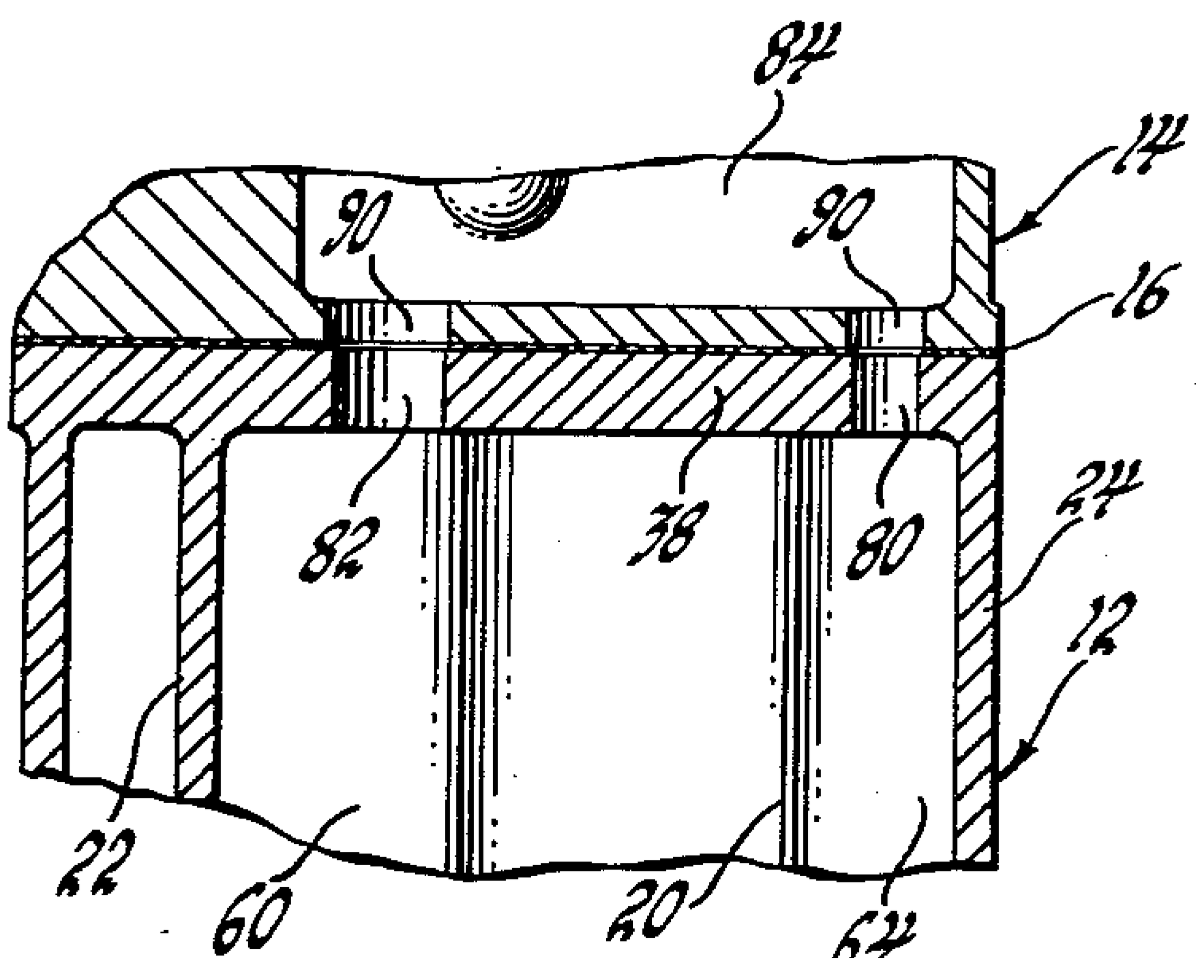

Fig.4

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ENGINE COOLANT DISTRIBUTION

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2 Claims. (Cl. 123—41.28)

The invention relates to the distribution passages for coolant in an internal combustion engine and more particularly to the passages in the engine block and head. In internal combustion engines of the multi-cylinder type, there have usually been problems encountered in obtaining uniform cooling of each of the engine cylinders as well as the valves and spark plugs. It has been common practice to circulate a coolant such as water in series relation past each cylinder in a bank of cylinders. The coolant has also been circulated in series adjacent the valves for each cylinder. This type of circulation results in the first cylinder encountered by the coolant being cooled to the greatest extent and the last cylinder being exposed to considerably warmer coolant and therefore being cooled to a lesser extent. Similar cooling results have been obtained in the engine head when the engine is of the valve-in-head type. This results in the last valves and the last cylinders being cooled running hotter than the first valves and first cylinders being cooled.

In attempts to overcome these objections, engines have been manufactured which distributed coolant to the cylinders and their associated valves in parallel relation so that, for example, the number one cylinder and the number one intake and exhaust valves are cooled by coolant which has not passed over the other cylinders and valves. While this has provided improved cooling results, it has been found in previously proposed systems that the cylinders and valves first cooled received a greater flow of coolant than the cylinder and associated valves last cooled. This resulted in stagnant hot spots at the rear of the engine. These hot spots are a clear indication of the lack of coolant flow to the rear of the engine.

It is now proposed to provide a coolant passage in the engine block with a passage section which leads directly from the coolant pump discharge to the rear end wall of the engine and alongside the cylinders forming an engine bank. This portion of the coolant passage should be relatively large in cross section area so that a sufficient quantity of coolant is moved to the rear of the engine at all times. It is also proposed to so calibrate the coolant passages from the block to the passages in the head that coolant is forced to move to the rear of the engine without absorbing an undue quantity of heat energy from the cylinders passed by the coolant during its flow to the rear wall. The block coolant passage is so arranged that the cylinders are substantially surrounded by coolant flowing from the cylinder wall upwardly to the engine head and cooling the portion of the combustion chamber formed by the head as well as the valves and spark plugs. The parallel flow coolant system is therefore improved in that the majority of the coolant which cools any one cylinder is transmitted to that portion of the engine head containing the valves and spark plugs for that cylinder and they are in turn cooled, with each cylinder and valve set being exposed to coolant of substantially the same temperature. This results in more uniform engine cooling throughout. The passage leading to the cylinder head coolant passages from the engine block coolant passages are graduated so that the smallest passage is adjacent the block coolant entry passage and the largest passage is at the opposite end of the block coolant passage. The graduated passages therefore aid in forcing the coolant to circulate all the way to the engine rear wall with a substantially undiminished coolant flow.

In the drawings:

Figure 1 is an end view of a portion of an engine embodying the invention and having parts broken away and in section.

Figure 2 is a view of the engine of Figure 1 having parts broken away and in section and taken in the direction of arrows 2—2 of Figure 1.

Figure 3 is a section view of the engine of Figure 1 taken in the direction of arrows 3—3 of Figure 2 and having parts broken away and in section.

Figure 4 is a section view of the engine of Figure 1 taken in the direction of arrows 4—4 of Figure 2 and having parts broken away and in section.

The engine **10** illustrated in the drawing is a six-cylinder in-line engine. The invention may also be applied to other engines such as V-block engines or opposed-cylinder engines. The engine **10** has an engine block **12** and a head **14** which is secured to the top of the block and separated therefrom by the conventional head gasket **16**. Block **12** has a front end wall **18**, a rear end wall **20**, and side walls **22** and **24**. A series of cylinders forming an engine cylinder bank is also provided intermediate these walls. Six cylinders are illustrated and identified as cylinders **26**, **28**, **30**, **32**, **34**, and **36**, respectively, from the front end wall to the rear end wall. The engine block is also provided with an upper wall **38** which receives the cylinder head lower wall **40**. The block lower wall **42** may define the upper portion of the engine crankcase. The engine is also provided with conventional elements including the crankshaft **44**, pistons **46**, and connecting rods **48**. A combustion chamber **50** is defined by each piston **46** and the head **14** and the inner wall of the associated cylinder. Each combustion chamber is provided with inlet and exhaust valves, the exhaust valve **52** being illustrated. A spark plug **54** is also provided for each combustion chamber. The valves are actuated by the conventional camshaft **56** and valve lifters **58**.

A block coolant passage **60** is provided intermediate the block walls and the cylinders. The engine water pump may be mounted so that its discharge passage corresponds to the coolant entry passage **62** formed in the front end wall **18**. This passage is preferably rectangular in shape and extends throughout a substantial portion of the cross section area of coolant passage **60**. The portion **64** of coolant passage **60** beyond entry **62** extends longitudinally of the engine block and adjacent one side of the cylinders to the inner surface of the rear wall **20**. Portion **64** is preferably uninterrupted and substantially straight so that coolant entering at **62** may be conducted with a minimum of flow resistance to the rear wall **20**. Passage **60** also is provided with branch portions **66** leading around each of the cylinders so that the outer surface of each cylinder wall is substantially surrounded by coolant.

The block upper wall **38** is provided with a series of apertures **68**, **70**, **72**, **74**, **76**, **78**, **80** and **82**, which are connected with coolant passage portion **64** so that they bleed off a portion of the coolant flowing through this passage and transmit it to the coolant passages **84** in the engine head. Apertures **86** and **88** are also provided in the block upper wall and connect with coolant passage branches **66** opposite coolant passage portion **64**. Apertures **68** through **82** are graduated in cross section area, with aperture **68** being the smallest and aperture **82** being the largest when coolant flow is from the front wall **18** toward rear wall **20**, so that coolant flowing through entry **62** and coolant passage **64** will maintain a substantial coolant flow throughout the length of the block. The coolant reaching the end wall **20** will have a substantial coolant flow through apertures **80** and **82** so that stagnant hot spots in this area are eliminated. Apertures **86** and **88** aid in maintaining coolant flow transversely of the block so that each of the cylinders is exposed to a substantial coolant flow.

The cylinder head is provided with apertures **90** which correspond to the apertures formed in the upper wall of the block and connect with the head inlet passages **84** so that a coolant parallel-flow arrangement is maintained. Gasket **16** is also formed to permit the head apertures and the block apertures to connect with each other in flow relation. If desired, the graduated passages may be formed in the lower wall **40** of the engine head rather than in the upper wall **38** of the block, or the passages may be graduated in both walls. The coolant received by the head through the apertures passes forwardly through the head and a portion of the coolant may be returned directly to the pump by means of aperture **92** and the connecting passage **94** formed in the block. Aperture **92** would then have a matching aperture in the head lower wall **40** which connects with coolant passage **84**. The coolant leaving the head may also be conducted to a radiator in the conventional manner, with a thermostat being positioned in the head outlet.

An engine coolant distribution system has been provided which will maintain more uniform coolant distribution, resulting in more uniform cooling of the cylinders and valves of a cylinder bank. The distribution system insures vehicle coolant flow along the entire length of the block and head in order to prevent the creation of hot spots in some sections of the engine.

What is claimed is:

1. In an engine block, a longitudinally extending coolant passage formed therein and extending substantially the entire length thereof, said block having a coolant passage entry formed in one end, said entry having a cross-section substantially equal to the minimum cross-section of said coolant passage, and a series of coolant outlet passages connecting with said coolant passage in series flow relation.

2. In an internal combustion engine, an engine block comprised of a bank of cylinders and end walls and side walls and upper and lower walls cooperating with said cylinders to define coolant passage means for conducting coolant to and from said cylinders, a cylinder head secured to said block and having a lower wall adjacent said block upper wall and having coolant passage means formed therein defined in part by said head lower wall, one of said adjacent walls having a series of apertures formed therein and the other of said adjacent walls having a corresponding series of apertures formed therein whereby said block coolant passage means and said head coolant passage means are connected in flow relation, one of said block end walls having a coolant entry aperture formed therein and aligned with said block coolant passage means to provide a substantially straight coolant flow to said other end wall through said block coolant passage means.

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