June 18, 1929. A. P. BRUSH ET AL 1,717,872

INTERNAL COMBUSTION ENGINE

Filed March 12, 1923 4 Sheets-Sheet 1

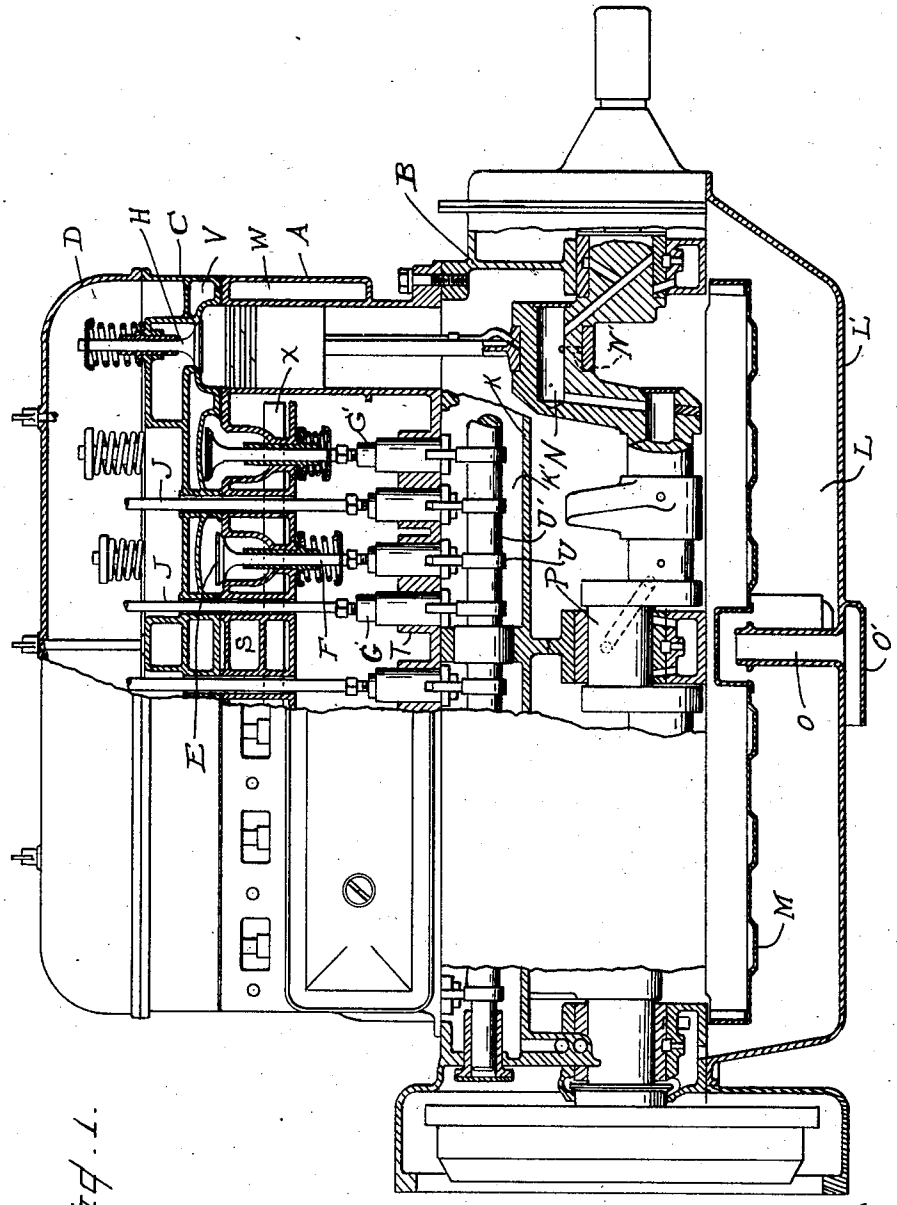

Fig. 1.

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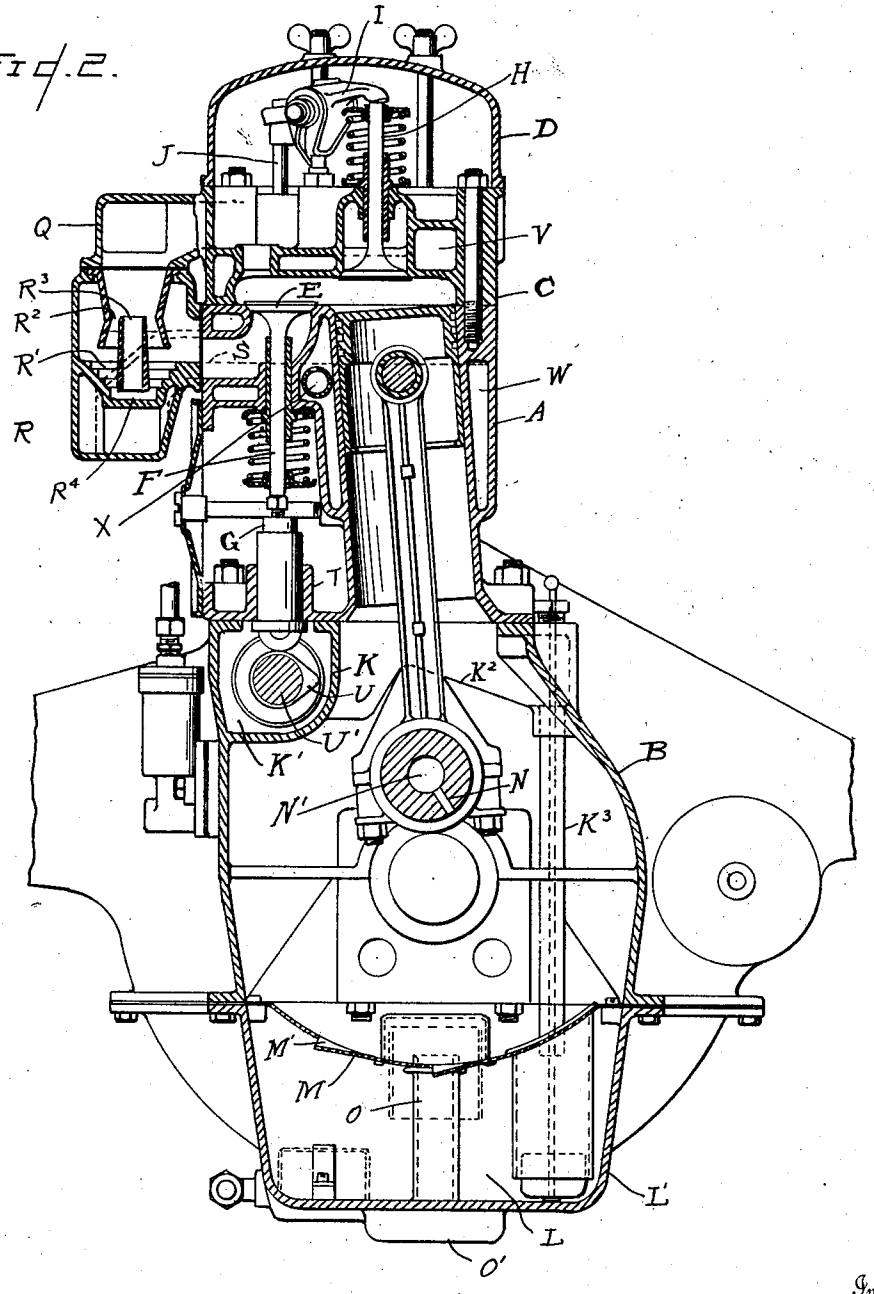
Fig. 2.



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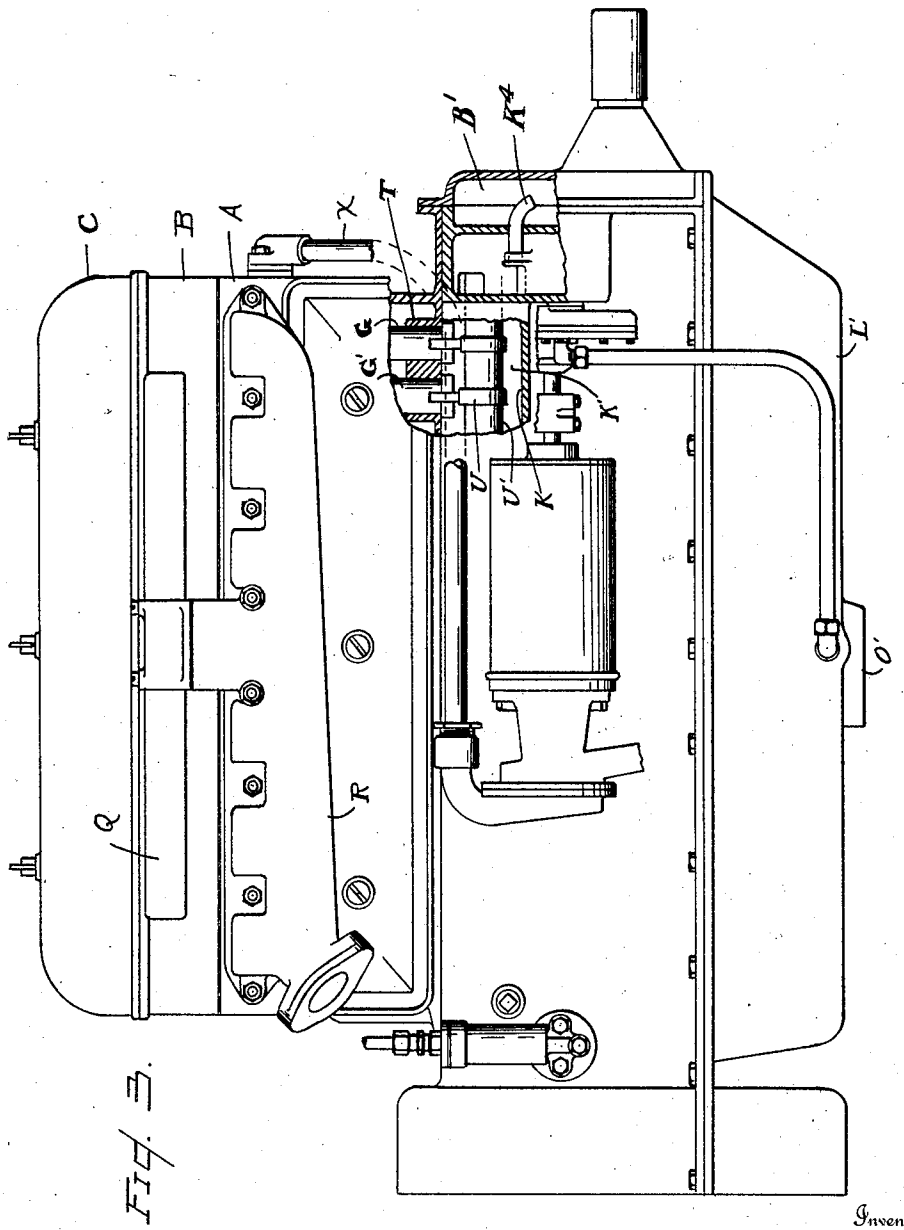

Fig. 3.

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Filed March 12, 1923 4 Sheets-Sheet 4

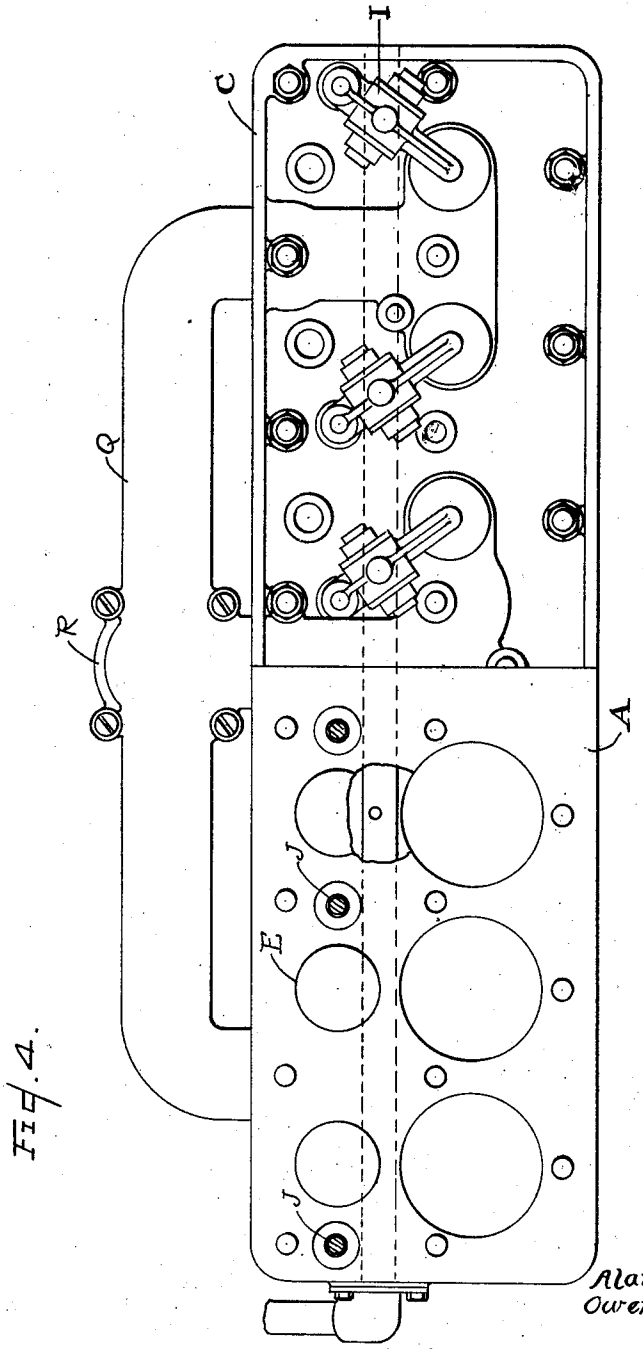

Fig. 4.

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UNITED STATES PATENT OFFICE.

ALANSON P. BRUSH AND OWEN M. NACKER, OF DETROIT, MICHIGAN.

INTERNAL-COMBUSTION ENGINE.

Application filed March 12, 1923. Serial No. 624,606.

The invention relates to internal combustion engines more particularly designed for use in connection with motor vehicles, and the invention consists in various features of construction as hereinafter set forth.

Among the objects of the invention are: first, to obtain a construction in which any desired size of valves may be selected without effecting the over-all length of the engine; second, to permit use of relatively small bore long stroke cylinders without effecting valve sizes; third, to provide for efficient lubrication including (*a*) flood lubrication of all the major parts of the engine with the exception of the valve stems and piston, (*b*) to accurately regulate piston lubrication; fourth, to provide for the location of the carburetor on either side of the engine block and at the same time to permit of conveniently hot spotting the intake manifold. The above objects, as well as other features of advantage, such as simplification of machining operations, ease in assembling, etc., are attained by the construction as follows:

In the drawings:

Figure 1 is a sectional side elevation of the engine;

Figure 2 is a transverse section therethrough;

Figure 3 is a side elevation;

Figure 4 is a plan view.

Our improved construction is adapted for multi-cylinder engines and more particularly for either four or six cylinder units. It is highly desirable to minimize the longitudinal dimension of such unit and at the same time to provide for ample space for the valves and their operating mechanism. This is facilitated by arranging the axes of the valves and the cylinders in angular relation, so that they diverge in a downward direction and provide a greater clearance between the crank shaft and cam shaft axes. Heretofore such angular downwardly diverging arrangement has been employed, but it is usual to arrange the plane of the cylinders at right angles to the meeting planes of the block and the crank case and cylinder heads respectively. This places the axes of the valve stems at an angle to such meeting planes, which complicates the machining operations. We have therefore devised a construction in which the axes of the valve stems are perpendicular to the transverse faces of the block, while the axes of the cylinders are arranged at the desired angle thereto, this constituting one novel feature of the invention.

To maintain flood lubrication for the cam shaft and valve gear and at the same time to accurately regulate cylinder lubrication, a division wall is arranged between the crank shaft and cam shaft. Provision is, however, made for gas communication between the chambers on opposite sides of the partition. The crank shaft is lubricated by a pressure system extending through a channel in the shaft to all of the bearings for the shaft and crank pins and the cylinder lubrication is solely from the throw-off from the crank pins. An excess of lubricant is constantly fed through the hollow crank shaft escaping through any suitable pressure regulating means (not shown), and this excess is then utilized for the flood lubrication of the cam shaft and associated mechanism, finally passing to the housing for the timing mechanism and returning to the oil sump.

In detail, A is the engine block which, as specifically shown, is for a six cylinder engine. B is the crank case, C the cylinder head, D a hood or cover for the valve rock arms above said head.

The exhaust valves E are preferably arranged to seat in the cylinder block with their stems F extending downward into direct engagement with the tappets G. The inlet valves H are, however, preferably seated in the head C and are operated through the medium of the rocker arms I and downwardly extending rods J, which latter engage the tappets G'. This arrangement secures compactness and minimum length of the engine block, while also providing for large valve areas.

As has been stated, the axes of the valve stems F and rods J are perpendicular to the meeting planes between the engine block and head and crank case respectively, which simplifies the machining of the block. On the other hand, the cylinder bores are at an angle to these meeting faces so as to provide the necessary clearance for the crank shaft from the cam shaft. This construction also permits of placing the cam shaft but slightly below the meeting plane between the crank case and block and for arranging it in a trough-shaped housing within the crank case open at the top but covered by the block.

The crank shaft and cam shaft are thus in separate compartments in the crank casing, but each is readily accessible when the cylinder block is removed.

Thus, as specifically shown, the partition wall K forms the trough K′ within which the cam shaft is located, which partition extends from end to end of the crank case. At substantially the longitudinal center of the crank case there is arranged a cross-over trough K^2 connecting with a downwardly extending conduit K^3 leading to the oil sump L. This permits the drainage of lubricant back into the sump in case the longitudinal axis of the engine is inclined so that the lubricant in the trough K′ flows toward one end thereof. The overflow being in the middle of the casing, it will maintain a medium level whichever way the engine is inclined. At the forward end of the crank case there is a housing B′ for the timing mechanism (not shown). Oil from the cam shaft compartment is permitted to pass out through the spout K^4 into housing B′ and from thence to the oil sump L.

At the bottom of the crank casing there is arranged a removable oil pan L′ containing the oil sump or reservoir. At the top of this pan and clamped between the same and the crank case is a trough-shaped cover or partition M which is of a radius to provide clearance for the sweep of the crank pins and connecting rods. The partition M serves to separate the lubricant in the sump from the revolving cranks so as to avoid danger of its being carried up by said cranks and splashed into the engine cylinders. This limits the lubrication of the cylinders to the amount that is thrown off from each crank pin bearing. University in the supply of lubricant is maintained by arranging radially inwardly extending ducts N communicating between the lubricating channel N′ in the crank pin and the pin bearing. This will direct the lubricant which is forced by pressure through the duct on to a portion of the bearing which is held by centrifugal action in relatively close contact with the pin regardless of the amount of clearance whether more than that originally provided or produced by wear. The partition M is provided with openings M′ which permit drainage of lubricant dropping on said partition back into the sump.

To further guard against over lubrication, a drainage connection O is arranged at the longitudinal center of the oil pan and at a point where it is shielded by the center bearing P for the crank shaft. This drainage conduit rises to a height which is substantially that of the partition M, so that it is only in case the lubricant should rise to a higher level that it is permitted to drain out. The lower end of the conduit O is protected by a horizontally extending shield O′, which prevents clogging with mud or dirt from the road. This drainage conduit also forms a breather connection which permits ingress and egress of air.

The intake and exhaust manifolds Q and R are preferably arranged on the same side of the block in superposed relation. In case, as is specifically shown, the carburetor is located upon the opposite side of the block, the explosive mixture is carried to the manifold through a cross passage S. This passage, instead of directly connecting to the intake manifold communicates with a chamber R′ formed in the exhaust manifold R but separate from the exhaust passage therein. Within the chamber R′ is arranged a venturi R^2 which is directed upward into the intake manifold. There is also an ejector tube R^3 extending into the throat of the venturi and downward to the bottom of the chamber R′, which latter is concave or conical and forms a hot spot which is subject to the heat of the exhaust gases. Thus any unvaporized fuel in the mixture passing through the cross-over and which falls out in the enlarged chamber R′ will drain upon the bottom or hot spot R^4 of this chamber and will be heated to assist in vaporization. The fuel is not, however, permitted to remain upon the hot spot, but is drawn upward through the ejector tube R^3 by the suction produced in the venturi and thus whether the engine is hot or cold the fuel will be commingled in the venturi and delivered into the intake manifold.

The tappets G and G′ are guided in bearings T formed integral with the block and project downward into the trough K′ into operative relation with their respective cams U on the cam shaft U′.

The cylinders and valve chambers in both the block and head are suitably water jacketed, as indicated at V and W. While the water jacket extends about all heated parts, certain portions, such for instance as the exhaust valve chambers, are heated to a much higher temperature than other parts. We have therefore provided means for directing the coolest water against such parts and with sufficient velocity to carry away any steam bubbles which may be generated. As shown, a conduit X extends longitudinally of the block through a portion of the water jacket adjacent to the exhaust passages and opposite each of these passages jet apertures are formed in this conduit and are directed against the heated surface. At the end of the block the conduit X is directly connected with the conduit X′ for the delivery of the cold water from the bottom, so that the maximum cooling effect is produced at the points where the greatest need for cooling exists.

Our improved construction is provided with all the usual parts, pistons, pitmen

rods, valve springs, etc., which it is believed is unnecessary to describe further in detail.

What we claim as our invention is:

1. In an internal combustion engine, the combination with a crank case having an oil sump in the bottom portion thereof, and a partition for separating said oil sump from the crank shaft compartment, of an overflow connection for said oil sump arranged substantially in the longitudinal center of the crank case and of a height to limit the level of the oil to substantially the height of said partition.

2. In an internal combustion engine, the combination with a crank shaft, the crank therein and bearings for said crank including a center bearing, the lower portion of said crank case forming an oil sump, and an overflow for said oil sump arranged centrally of said case and shielded by said center crank shaft bearing.

3. In an internal combustion engine, the combination with a crank case, a crank shaft therein and bearings for said crank shaft including a center bearing, of a partition in said crank case for separating the compartment for the revolving cranks from an oil sump in the lower portion of the case, and an overflow for the oil sump at substantially the height of said partition, said overflow being located beneath said central bearing for the crank shaft.

4. In an internal combustion engine, the combination with a crank case, and a partition for separating the said oil sump from the crank shaft compartment, of an overflow pipe for said oil sump extending upwardly from the bottom portion thereof and arranged substantially in the longitudinal center of the crank case and of a height to limit the level of the oil to substantially the height of said partition, said overflow pipe communicating directly with the exterior of said oil sump, and a shield carried by said sump, spaced from and positioned directly below said overflow pipe.

In testimony whereof we affix our signatures.

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OWEN M. NACKER.