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CRANKCASE CONSTRUCTION

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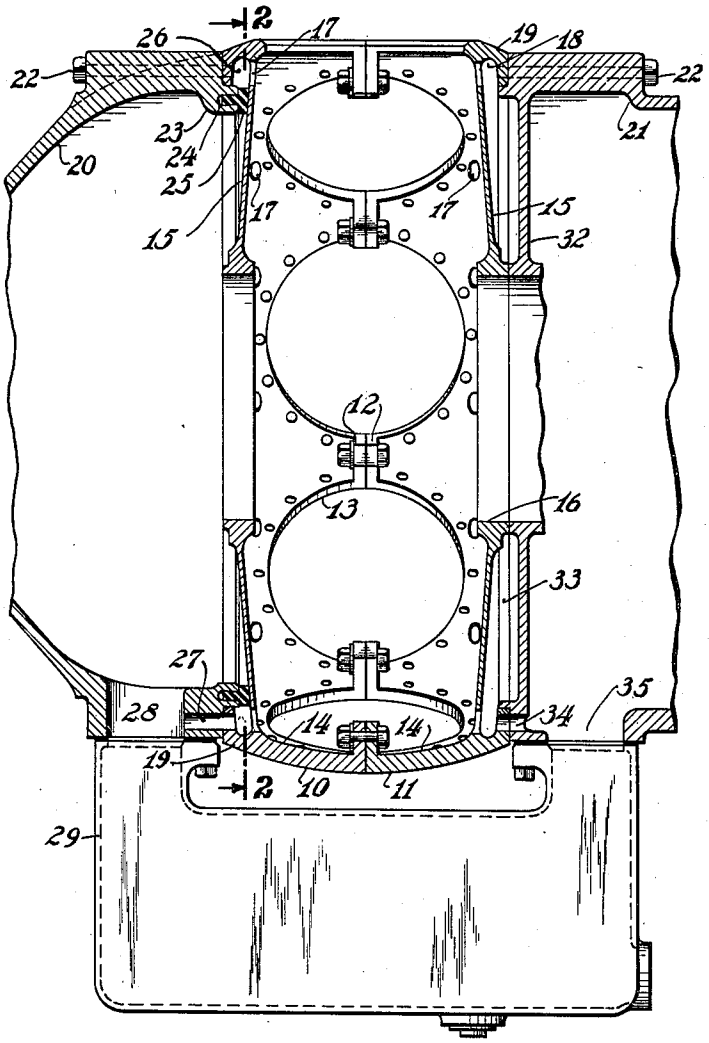


FIG. 1

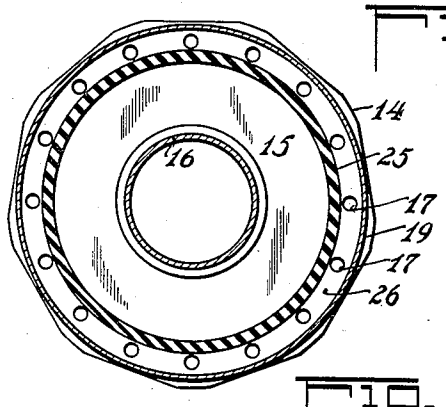


FIG. 2

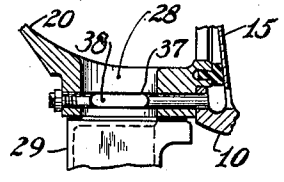


FIG. 3

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CRANKCASE CONSTRUCTION

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8 Claims. (Cl. 121—194)

This invention relates to internal combustion engines, and is particularly concerned with improvements in the crankcase construction of radial cylinder engines to the end that the scavenging of oil from the crankcase is improved.

In the more or less stabilized types of radial cylinder engines, the crankcase comprises a central crank compartment around which the engine cylinders are disposed, this central compartment being bounded at either end by bearing diaphragms which support the engine crankshaft. Ahead of and behind these diaphragms are crankcase sections which house auxiliary engine components such as valve gear, reduction gear, supercharger and gearing for cooperation with such units as starters, magnetos, generators, oil pumps and the like. Conventional practice has been to permit free communication between all compartments within the entire crankcase, but as the power of these engines has been stepped up, and as the flow of lubricating oil has also been stepped up to provide both improved bearing and cylinder wall lubrication and cooling for the parts within the engine, scavenging difficulties have arisen. It is an object of the present invention to provide a crankcase construction in which scavenging of lubricant from the crankcase is improved. A further object is to substantially isolate the several crankcase compartments from one another to the end that scavenge oil flow from each of the several compartments is independent from the others. This has one effect in preventing oil which has been excessively heated in one compartment, such as the crank compartment, from passing to the other cooler running compartments which, if permitted, causes an undue temperature rise in the other compartments. Still another object is to provide means by which surplus oil accumulating in the cranksection of the crankcase may be promptly and thoroughly scavenged therefrom for subsequent flow to the conventional cooling and reservoir facilities which form a part of the engine installation. Still another object is to provide definite channels for scavenge oil flow within an engine crankcase which shall direct the scavenge oil as desired without permitting its general diffusion throughout the entire crankcase.

Further objects will be apparent from a reading of the subjoined specification and claims, together with the accompanying drawing, in which:

Fig. 1 is a longitudinal section through the main portion of an engine crankcase;

Fig. 2 is a section, on a reduced scale, on the line 2—2 of Fig. 1; and

Fig. 3 is a fragmentary section of a portion of an alternate type of crankcase.

The showing in general depicts a central crankcase section which is similar in its structural provisions to that shown in Patent No. 2,189,600, issued February 6, 1940, in the name of Rudolph Daub. The cranksection of the crankcase comprises similar opposed halves 10 and 11 bolted together at flanges 12 between ports 13 through which the skirts of the cylinders project. The crankcase halves comprise a drum portion 14 upon which the cylinder decks are formed and from the outer edge of which a bearing diaphragm 15 extends inwardly to carry a bearing boss 16 within which the conventional crankshaft bearing may be secured. Circumferentially spaced holes or openings 17 are formed around the outer edge of the diaphragm 15, and these open to a groove 18 formed by a flange 19 integral with the crankcase half and which is produced by turning operations from the basic crankcase forging. The flange 19 on each crankcase half serves as an attachment annulus for the front and rear crankcase sections 20 and 21, the attachments being made by bolts 22 passing through the sections 20 and 21 and engaging tapped holes in the flange 19. The crankcase section 20 comprises a nose section to house valve gear and reduction gear for the engine, and this section carries an annular protrusion 23 having a groove 24 within which a resilient gasket 25 is disposed to bear upon the outer surface of the front diaphragm 15, by which a substantially closed annular conduit 26 is defined between the protrusion 23, the diaphragm 15, and the flange 19. The holes 17 open from the cranksection interior to this conduit to permit oil thrown from the crankshaft and its associated elements (not shown) to pass therethrough into the conduit 26. At the lowermost point of the conduit 26, a passage 27 is formed through the flange 19 and through a portion of the case 20, opening to an oil exit duct 28 which communicates with a sump 29 secured to the bottom of the engine. From this sump scavenged oil is withdrawn in the conventional manner to the reservoir, cooling and pump facilities. By the use of the protrusion 23 and its gasket 25, a maximum amount of space is left within the casing 20 for the accommodation of the necessary cam and reduction gearing.

The rear case 21 which normally houses the supercharger and accessory drive gears, is formed

with an inwardly projecting diaphragm 32 which at its inner end closely engages an end of the rear bearing boss 16 so that an annular conduit 33 is defined between the diaphragm 15 and 32 and the flange 19, this annular conduit, as in the case of the annular conduit 26, receiving crankcase oil through the holes 17 and discharging same through a passage 34 to an opening 35 in the case 21 which is open to the sump 29.

It will be noted that in connection with the case 21 no resilient gasket such as the gasket 25 has been shown—such a gasket could be used, if necessary, but in view of the substantial radial extent of the diaphragm 32, there is sufficient resilience therein to permit of a close fit of its inner part with the bearing boss 16 when the case 21 is securely bolted to the crankcase assembly 10, 11. In the assembly of the front case 20 to the main crankcase, the radial extent of the conduit 26 is so small as to necessitate the use of a resilient gasket 25 to form a sealing with the front bearing diaphragm 15, since there is relatively small elasticity in the protrusion 23 on the case 20.

It will be seen that by the construction shown, the bearing diaphragms 15 are free of structural attachments and thus become much more determinate from the standpoint of stresses imposed thereon, enabling the parts to be made of lighter weight.

In operation, the crank section of the case established by the crankcase halves 10 and 11 forms a substantially closed container out of communication with the accessory cases 20 and 21. Lubricating oil is fed to the moving parts within the case and is thrown therefrom by the whirling of the parts, the oil being atomized and hurled against the periphery of the case. The impeller action of the rotating parts is believed to cause the vapor pressure at the circumference to be greater than that toward the center; if this assumption is correct, the higher pressure drives the oil and vapor through holes 17 into the annular conduits 26 and 33 throughout the crankcase periphery. Since there is no turbulating influence in the conduits, the oil readily collects by gravity and flows into the sump, this flow being augmented by the pressure drop due to the reduction in pressure in the crankcase vapor from the crankcase periphery to the quiescent parts of the case interior. Further, crank section oil scavenging is divorced from turbulating influences caused by reduction gear and other parts rotating in the sections 20 and 21 which was not the case in prior practice where the vapors could pass at will between the crank section and the other sections. Although the showings herein contemplate blending scavenge oil from all sections in the sump 29, it is apparent that by using the construction of Fig. 3, shortly to be described, scavenge oil from the crank section may be returned through an independent oil cooler to the reservoir, by which heat rejection from the oil may be made more efficient. The temperature difference between coolant and hot crank section oil will be greater than the temperature difference between coolant and aggravated scavenge oil from all of the engine crankcase so that oil coolers smaller than those used in prior practice may be used.

In connection with the plurality of circumferentially disposed scavenge holes 17, these have been found effective in improving scavenging as distinct from prior practice in which scavenge openings in the case were concentrated largely in the lower portion thereof. This improvement was probably caused by the fact that crankshaft rotation distributes the oil in the case in a circumferential manner and at such velocity that the effect of gravity is negligible, wherefor the oil is removed from the crankcase just as effectively at an elevated part thereof as at a low part thereof.

In Fig. 3, we show an alternate construction for removing oil from the annular conduit 26 which comprises an open tube 37 let through the bottom part of the case 20 to communicate with the conduit 26, oil from said conduit 26 passing through the tube and spilling into the sump from the tube opening 38. A tube similar to 37 can be used in connection with the rear crankcase section 21. This alternate construction may be useful in testing the effectiveness of the scavenging system, by substituting a conventional tube for the element 37 and depositing that oil which passes through the conduits 26 and 33 into a sump separate and distinct from the sump 29, whereby the temperature and amount of oil scavenged from the crank section of the casing may be determined independently of the temperature and amount of oil scavenged from the front and rear crankcase sections 20 and 21.

While we have described our invention in detail in its present preferred embodiment, it will be obvious to those skilled in the art, after understanding our invention, that various changes and modifications may be made therein without departing from the spirit or scope thereof. We aim in the appended claims to cover all such modifications and changes.

We claim as our invention:

1. In a crankcase for a radial cylinder engine, in combination, a drum portion comprising cylinder decks, diaphragms extending inwardly near the ends of said portion to carry crankshaft bearings, said diaphragms having a plurality of openings around their outer edges, means cooperating with said diaphragms forming annular ducts of which the diaphragms constitute walls and with which said openings communicate, and conduits open to said annular ducts to withdraw oil passing thereto through said openings.

2. In a radial cylinder engine crankcase comprising a cylinder deck drum portion and bearing diaphragms near the drum portion ends, said diaphragms having a plurality of circumferentially spaced peripheral openings, integral inturned annular flanges exterior of and around the edges of the crankcase, said flanges overlying the diaphragm openings, and annular means joining the flanges and respective diaphragms to close annular passages exterior of the crankcase which are in free communication with the crankcase interior through said crankcase openings, said passages each having as walls, said annular means, one said flange and one said diaphragm.

3. In a radial cylinder engine crankcase, an annular cylinder deck member having a flange and a bearing diaphragm extending inwardly therefrom, and means secured to the flange defining an annular conduit around the diaphragm of which the diaphragm comprises one of the defining walls, the diaphragm having an opening to establish communication between the conduit and the crankcase interior.

4. In a radial cylinder engine crankcase comprising a flanged annular deck member having a bearing diaphragm extending inwardly thereof,

the diaphragm having peripheral openings, an auxiliary crankcase section secured at its edge to the deck member flange, and means carried by the auxiliary section engaging the diaphragm inwardly from its periphery to define therewith an annular passage.

5. In a radial cylinder engine crankcase comprising a flanged annular deck member having a bearing diaphragm extending inwardly thereof, the diaphragm having peripheral openings, an auxiliary crankcase section secured at its edge to the deck member flange, and means carried by the auxiliary section engaging the diaphragm inwardly from its periphery to define therewith an annular passage, that portion of said means which engages the diaphragm comprising a resilient gasket.

6. In a radial cylinder engine crankcase comprising a flanged annular deck member having a bearing diaphragm extending inwardly thereof, the diaphragm having peripheral openings, an auxiliary crankcase section secured at its edge to the deck member flange, and means carried by the auxiliary section engaging the diaphragm inwardly from the periphery to define therewith an annular passage, said diaphragm having an opening near its periphery from the crankcase to the passage.

7. In a circular crankcase, a cylinder deck having an inwardly extending wall, the wall having a plurality of circumferentially spaced openings therethrough at its outer edge adjacent the junction of the deck and wall, means rigid with the deck and wall forming an annular conduit into which said openings communicate, said conduit being disposed wholly on the side of said wall opposite to the crankcase, and means to drain said conduit.

8. In a circular crankcase, a cylinder deck having an inwardly extending wall, the wall having a plurality of circumferentially spaced openings therethrough at its outer edge adjacent the junction of the deck and wall, means rigid with the deck and wall forming an annular conduit into which said openings communicate, said conduit being disposed wholly on the side of said wall opposite to the crankcase, and means to drain said conduit, said rigid means including an auxiliary housing section secured to the crankcase.

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