

Jan. 4, 1966

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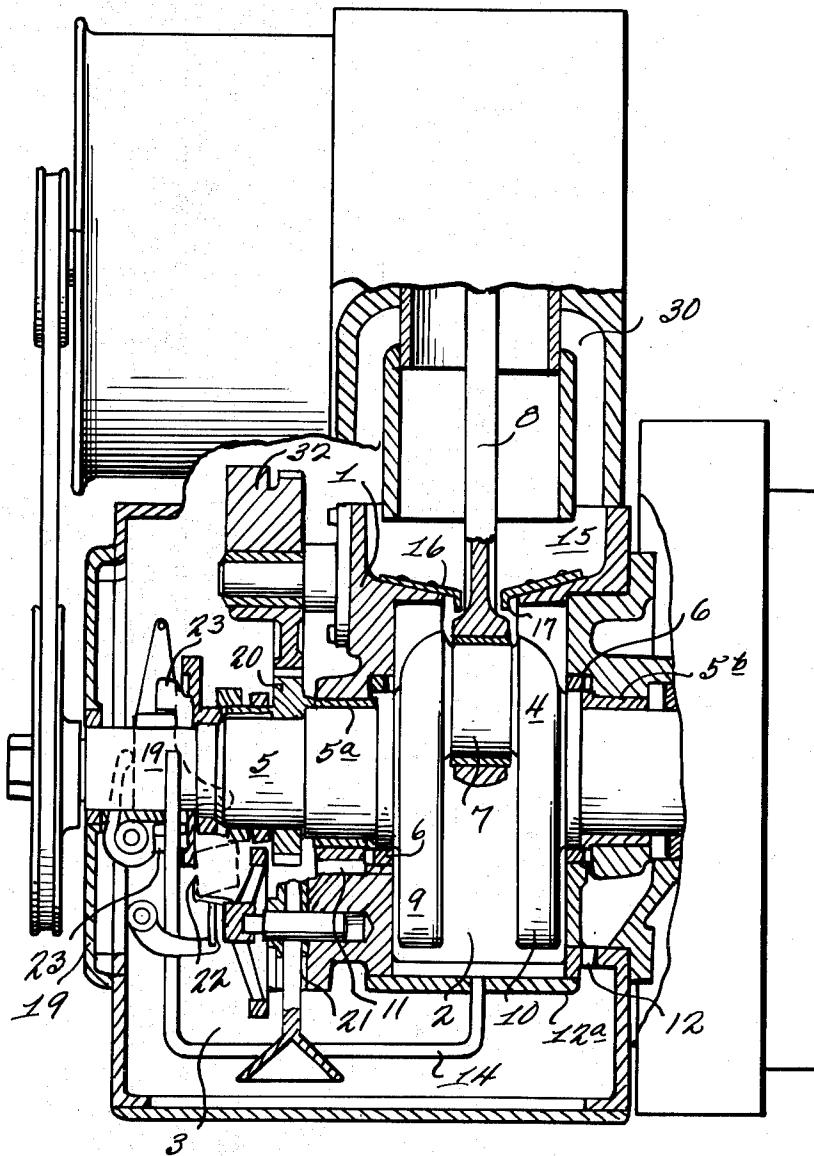
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TWO-STROKE INTERNAL COMBUSTION ENGINE

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4 Sheets-Sheet 1

Fig. 1



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FIG. 2

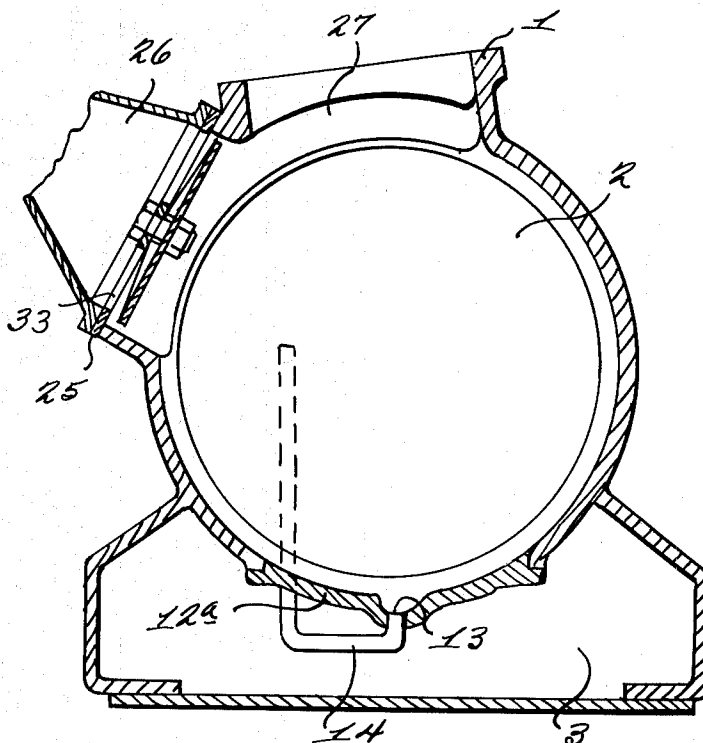
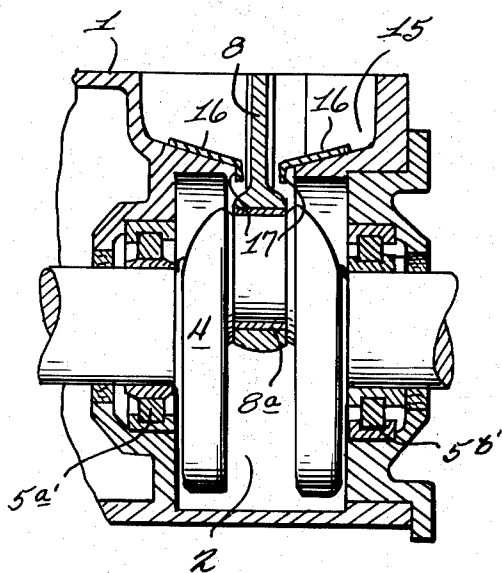


FIG. 3

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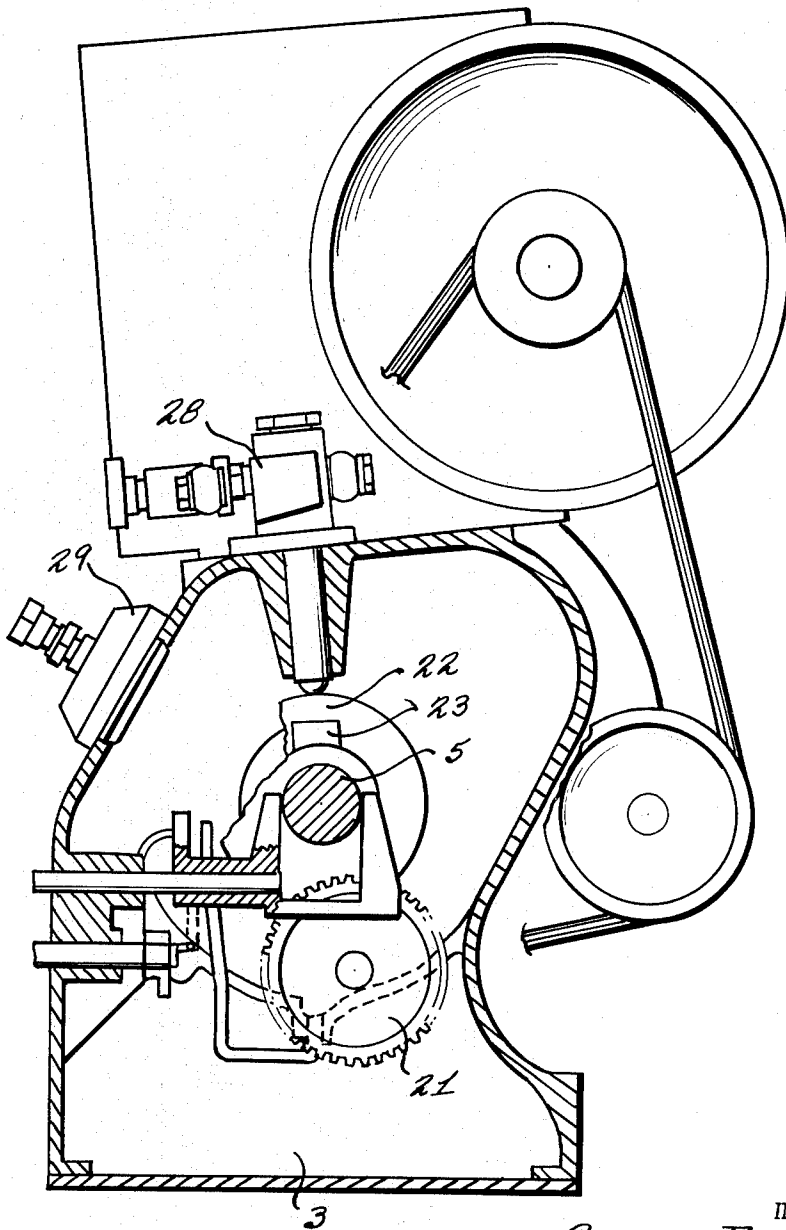
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FIG. 4



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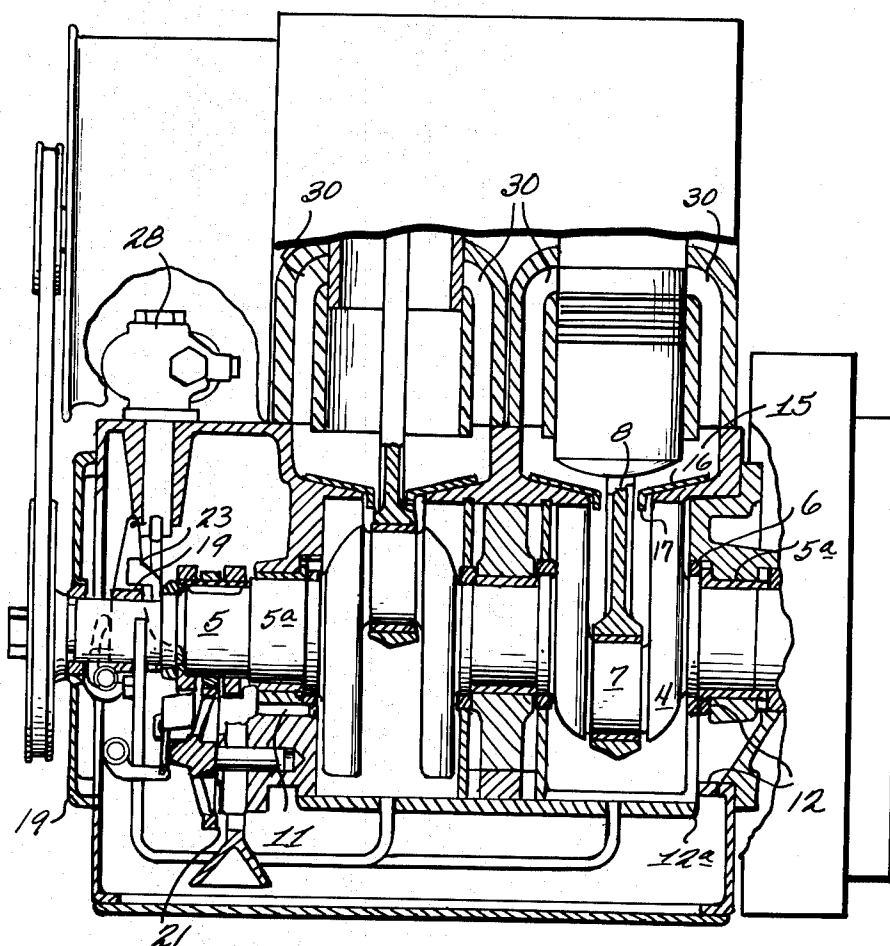
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TWO-STROKE INTERNAL COMBUSTION ENGINE

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Fig. 5



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TWO-STROKE INTERNAL COMBUSTION ENGINE

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6 Claims. (Cl. 123—73)

The present invention relates to a two-stroke internal combustion engine, and, more specifically, to a crankcase scavenged two-stroke internal combustion engine with a one-piece crankcase housing and a one or multi-sectional crank shaft. With heretofore known internal combustion engines of the above-mentioned type, the crankcase and the lubricating oil container form a coherent chamber not separated from each other by a partition. This arrangement causes a strong turbulence of the in-drawn air to be conveyed by the rotating crank portion of the crank shaft into the cylinder, whereby said air intermixes with the lubricant entering the crankcase. This, in turn, brings about not only a bothersome oil-smoke during the operation of the engine, but also causes a considerable consumption of lubricating oil.

It is, therefore, an object of the present invention to provide a crankcase scavenged two-stroke internal combustion engine with a one-piece crankcase, which will overcome the above-mentioned drawbacks.

It is another object of this invention to provide a crankcase scavenged two-stroke internal combustion engine with a one-piece crankcase which, while comprising fewer parts than heretofore known two-stroke cycle engines of the above-mentioned type, will also avoid bothersome formation of oil-smoke encountered with heretofore known engines of the type involved.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawings, in which:

FIGURE 1 represents a longitudinal section through a crankcase scavenged two-stroke cycle diesel engine;

FIGURE 2 illustrates on a scale slightly larger than that of FIGURE 1 a section through the crankcase and perpendicular to the crank shaft axis of the engine, however, with the crank shaft omitted therefrom;

FIGURE 3 is a longitudinal section through the crankcase of a two-stroke cycle engine.

FIG. 4 is a section through the control housing of the engine.

FIG. 5 represents a longitudinal section through a two-cylinder diesel engine according to the present invention.

The present invention is characterized primarily in that in the crankcase there are provided one or more crankcase chambers each of which comprises a crank shaft crank, and a lubricating oil container from which all of the engine parts are lubricated, said crankcase chamber or chambers and said lubricating oil container being separated from each other by a partition while the lubricating oil container advantageously extends below said crankcase chamber or chambers and beyond the same to one end of the internal combustion engine.

A particularly advantageous arrangement is obtained when a partition in form of a detachable lid is provided between the crankcase chamber or chambers and the lubricating oil container, said lid closing the crankcase chamber or chambers from below. In order to assure that as little oil as possible will enter the crankcase chamber or chambers, it is advantageous, between the crank shaft bearings and crankcase chamber or chambers to provide shaft seals which may be designed as fabric seals or

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labyrinth seals. Advantageously, discharge passages are provided for the lubricating oil escaping from the bearings, which discharge passages directly lead into the lubricating oil container.

Referring now to the drawing, FIGURE 1, in detail, the cast crankcase 1 comprises the crank chamber 2 and a lubricating oil container 3 which extends below said crank chamber 2 in axial direction up to a point in front of the crank chamber 2. The one-piece crank shaft 5 with cranks 4 is at its input end journaled in a friction bearing 5a, whereas at its output end it is journaled in a friction bearing 5b. Between the crank chamber 2 and the bearings 5a and 5b there are provided fabric seals 6. These seals 6 prevent the excessive lubricating oil escaping from the bearings from passing into the crank chamber 2, and furthermore prevent said lubricating oil from being whirled up by the crank pin 7 and by the crank webs 9 and 10, and thus prevent said oil from being intermixed with the air drawn into the crank chamber 2. Instead, the excessive bearing lubricating oil will, before being able to enter the crank chamber, be deviated and returned to the lubricating oil storage container 3. The connecting rod 8 of the one-cylinder internal combustion engine shown in the drawing is journaled on the crank pin 7.

In order to assure that the crank chamber 2 is accessible from below for connecting the connecting rod 8 to the crank pin 7, according to the present invention a detachable lid 12a is provided which at the same time closes the crank chamber 2 with regard to the lubricating oil container 3. This lid 12a is shaped so as to minimize dead corners within the crank chamber wherein oil might collect. Lid 12a has a trough 13 (see FIGURE 2) which is parallel to the crankshaft axis and into which the lubricating oil dripping off the connecting rod bearing may flow and collect. At the deepest portion of trough 13 there is provided an oil conveying conduit 14 which forms an angle at the input end of the crank shaft and whose opposite end extends upwardly to such an extent that its mouth will be located above the level of the axis of the crank shaft. The oil collected in trough 13 is, through conduit 14, returned to the lubricating oil container or reservoir 3 by means of the super-atmospheric pressure which is built up during the rotation of the crank shaft in the crank chamber.

In order to make sure that as little oil as possible escaping from the connecting rod bearing will pass into the cylinder chamber 15, two cover plates 16 are provided between said chamber 15 and the crankcase chamber 2 (see FIGURE 3). Said cover plates 16 are provided with a collar 17 which extends inwardly toward the connecting rod bearing and encircles the connecting rod 8, with sufficient clearance therefrom so as not to impede the movability of the rod.

Inasmuch as the arrangement is such that the oil reservoir 3 extends to that end face 18 of the crank shaft casing which is adjacent the input side (see FIGURE 1), it will be possible, in the intermediate space between the end face 18 and crank chamber 2, to arrange a speed governor 19, a drive wheel 20 for a lubricating oil pump 21, an injection pump, a fuel feeding pump, and a counter-running imbalance. Since the end of the discharge pipe 14 extends above the crank shaft axis the inner diameter of which, for purposes of avoiding scavenging losses, must not exceed 5% of the diameter of the bore of cylinder 15, a high oil level may exist in the lubricant reservoir 3. This high level will assure a good lubrication of the speed governor and the driving elements for the injection and fuel feeding pump.

The centrifugal speed governor 19 mounted on the input end of the crank shaft comprises a disc 22 rotating to-

gether with the crank shaft. Disc 22 carries two centrifugal weights 23 linked thereto and has its circumference designed as eccentric or cam. A push-rod engaging the circumference of disc 22 will serve to drive a fuel feed pump.

As shown in FIGURE 2, intake air is conveyed to the crank chamber 2 through a suction opening 26 when sub-atmospheric pressure prevails in the crank chamber 2. Under these pressure conditions, a dish-shaped disc 24 of valve 25 is adapted, due to the pressure on the spring discs 24, to be lifted away from the intake openings in valve 25 to permit the intake air to move into the crank chamber. From there, the drawn-in quantity of air will, during the further rotation of the crank shaft, be conveyed through air passages 27 to control slits in the cylinder wall (not shown).

As described above, the crank housing of the two-stroke cycle internal combustion engine with scavenged crank casing is provided with an oil collecting device. By means of this oil collecting device, the lubricating oil which ordinarily escapes from the connecting rod bearing and from the crank shaft bearing will be prevented from passing into the crankcase chamber, from where it would otherwise by mixture with the intake air passing therethrough, be drawn into the cylinder inner chamber resulting in a high rate of lubricating oil consumption and a soot-laden exhaust.

These disadvantages will be minimized by the present invention because according thereto the crankcase chamber is protected with regard to the cylinder inner chamber by a cover plate or orifice 16 which has a very small opening extending to the range of movement of the connecting rod. The marginal zone of this opening comprises a collar bent inwardly toward the crank shaft axis. The oil scavenged against the crankcase chamber wall will, by said collar, be prevented from passing through the orifice and can flow off into an oil container. FIG. 3 shows a longitudinal section through the crankcase scavenged two-stroke cycle internal combustion engine for illustrating this invention. The crank housing comprises the crank chamber 2 and the cylinder inner chamber 15. In the crank chamber 2 there is a crank 4 of crank shaft 5 which is journaled in bearings 5a' and 5b'. The connecting rod 8 is by means of bearing 8a journaled on crank shaft stud 7. Between the crank chamber 2 and the cylinder inner chamber 15 there are provided cover plates 16 with a collar 17 directed toward the crank shaft axis.

It is advantageous to design the crank housing as a tunnel housing with a fixed wall between crank housing and lubricating oil container so that it will not have a downwardly extending cover, while the connecting rod may be assembled through the lateral opening of the suction fan.

It is, of course, to be understood that the present invention is, by no means, limited to the particular constructions shown in the drawing, but also comprises any modifications within the scope of the appended claims.

Thus, the invention as described above is not limited to a one-cylinder internal combustion engine. It is also advantageously applicable to multi-cylinder internal combustion engines. With such engines, it is advantageous to have each individual cylinder associated with a crank chamber which latter, by means of a partition, is sealed with regard to the lubricating oil container and the other crank chambers. The present invention makes it possible to design a two-stroke cycle diesel engine which will have a minimum of parts and in addition thereto, will have the advantages normally obtained with four-stroke cycle diesel engines only with regard to the driving mechanism and the design of the crankcase.

A two cylinder internal combustion engine according to the present invention is illustrated for instance in FIG. 5. In this instance, the second cam 31 for the injection fuel pump 29 and the fuel delivery pump 28 has taken the place of the drive wheel for the imbalance 32. The cylinder

der is provided with inlet slots 30. The engine furthermore comprises inlet openings 33.

What I claim is:

1. A two stroke cycle internal combustion engine which comprises a cylinder, a piston in the cylinder, a crankcase, a crankshaft in the crankcase having a crankpin connected to the piston and also having line bearing portions, bearings in the crankcase receiving said line bearing portions, said crankcase including partition means sealingly engaging said crankshaft between said line bearing portions and said crankpin, a cover member extending between said partition means on the side of the crankshaft opposite said cylinder whereby said partition means and cover member define a chamber in which said crankpin operates, said engine including means for drawing its air for combustion through said chamber, said crankcase including a sump portion beneath said chamber and extending beyond said chamber at least on one side of said chamber and including a part extending upwardly on said one side of said chamber to at least the region of the crankshaft centerline, a drain tube leading from said chamber through said cover member into said extending portion of said sump to about the level of the centerline of the crankshaft whereby pressure in said chamber will cause oil to be discharged therefrom via said tube into said sump, and drain passages leading from the ends of said journal portions of the crankshaft adjacent said partition means into said sump portion of the crankcase to prevent oil from said journal portions from entering said chamber.

2. A two stroke cycle internal combustion engine which comprises a cylinder, a piston in the cylinder, a crankcase, a crankshaft in the crankcase having a crankpin connected to the piston and also having line bearing portions, bearings in the crankcase receiving said line bearing portions, said crankcase including partition means sealingly engaging said crankshaft between said line bearing portions and said crankpin, a cover member extending between said partition means on the side of the crankshaft opposite said cylinder whereby said partition means and cover member define a chamber in which said crankpin operates, said engine including means for drawing its air for combustion through said chamber, said crankcase including a sump portion beneath said chamber and extending beyond said chamber at least on one side of said chamber and including a part extending upwardly on said one side of said chamber to at least the region of the crankshaft centerline, a drain tube leading from said chamber through said cover member into said extending portion of said sump to about the level of the centerline of the crankshaft whereby pressure in said chamber will cause oil to be discharged therefrom through said tube into said sump, said cover member having a groove in the side toward said chamber for collecting oil and said tube communicating with said groove, and drain passages leading from the ends of said journal portions of the crankshaft adjacent said partition means into said sump portion of the crankcase to prevent oil from said journal portions from entering said chamber.

3. A two stroke cycle internal combustion engine which comprises a cylinder, a piston in the cylinder, a crankcase, a crankshaft in the crankcase having a crankpin connected to the piston and also having line bearing portions, bearings in the crankcase receiving said line bearing portions, said crankcase including partition means sealingly engaging said crankshaft between said line bearing portions and said crankpin, a cover member extending between said partition means on the side of the crankshaft opposite said cylinder whereby said partition means and cover member define a chamber in which said crankpin operates, said engine including means for drawing its air for combustion through said chamber, said crankcase including a sump portion beneath said chamber and extending beyond said chamber at least on one side of said chamber and including a part extending upwardly on said

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one side of said chamber to at least the region of the crankshaft centerline, a drain tube leading from said chamber through said cover member into said portion of said sump to about the level of the centerline of the crankshaft whereby pressure in said chamber will cause oil to be discharged therefrom through said tube into said sump, said cover member having a groove in the side toward said chamber for collecting oil and said tube communicating with said groove, said sump and said cover member being detachable from the engine to expose the crankpin portion of said crankshaft, and drain passages leading from the ends of said journal portions of the crankshaft adjacent said partition means into said sump portion of the crankcase to prevent oil from said journal portions from entering said chamber.

4. A two stroke cycle internal combustion engine according to claim 1 in which said engine includes auxiliary devices operated by the crankshaft and located in said part of said sump in the region of the end of said drain tube so as to be lubricated by oil discharged through said drain tube.

5. A two stroke cycle internal combustion engine which comprises a cylinder, a piston in the cylinder, a crankcase, a crankshaft in the crankcase having a crankpin connected to the piston and also having line bearing portions, bearings in the crankcase receiving said line bearing portions, said crankcase including partition means sealingly engaging said crankshaft between said line bearing portions and said crankpin, a cover member extending between said partition means on the side of the crankshaft opposite said cylinder whereby said partition means and cover member define a chamber in which said crankpin operates, said engine including means for drawing its air for combustion through said chamber, said crankcase including a sump portion beneath said chamber and including a part thereof extending upwardly on one side of said chamber to at least the region of the crankshaft centerline, a drain tube leading downwardly from said chamber through said cover member and then upwardly into said extending part of said sump portion whereby pressure in said chamber will cause oil to be discharged therefrom through said tube into said sump, and drain passages leading from the ends of said journal portions of the crankshaft adjacent said partition means into said sump portion of the crankcase to prevent oil from said journal portions from entering said chamber.

6. A two stroke cycle internal combustion engine which comprises a cylinder, a piston in the cylinder, a crankcase, a crankshaft in the crankcase having a crankpin connected to the piston and also having line bearing portions, bearings in the crankcase receiving said line

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bearing portions, said crankcase including partition means sealingly engaging said crankshaft between said line bearing portions and said crankpin, a cover member extending between said partition means on the side of the crankshaft opposite said cylinder whereby said partition means and cover member define a chamber in which said crankpin operates, said engine including means for drawing its air for combustion through said chamber, said crankcase including a sump portion beneath said chamber and including a part thereof extending upwardly on one side of said chamber to at least the region of the crankshaft centerline, a drain tube leading downwardly from said chamber through said cover member and then upwardly into said extending part of said sump portion to about the level of the centerline of the crankshaft whereby pressure in said chamber will cause oil to be discharged therefrom through said tube into said sump, and drain passages leading from the ends of said journal portions of the crankshaft adjacent said partition means into said sump portion of the crankcase to prevent oil from said journal portions from entering said chamber.

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