Aug. 20, 1935. F. G. HOBART 2,012,009

ENGINE CRANK CASE CONSTRUCTION

Filed April 25, 1932 4 Sheets-Sheet 1

Fig. 1.

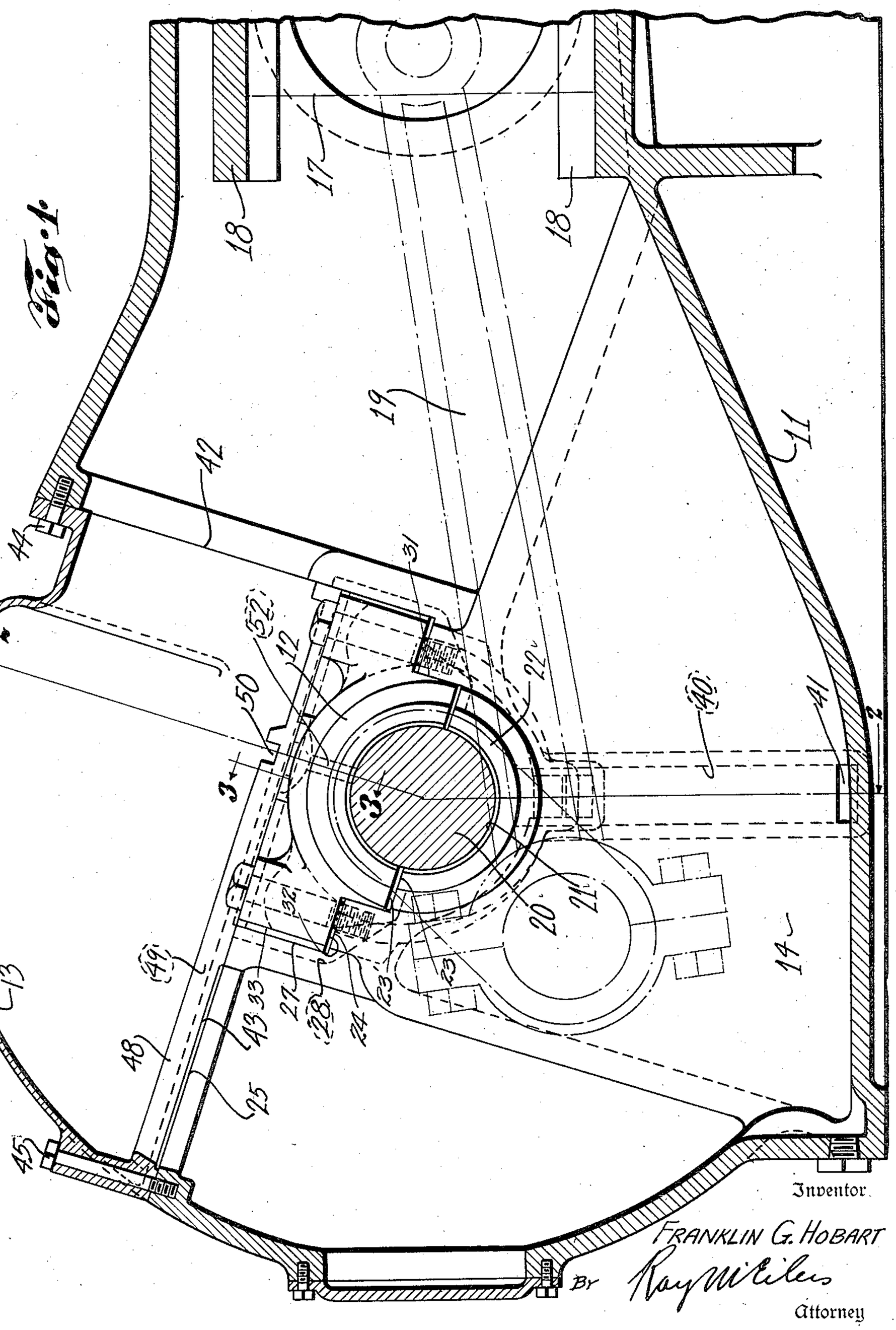

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Fig. 2.

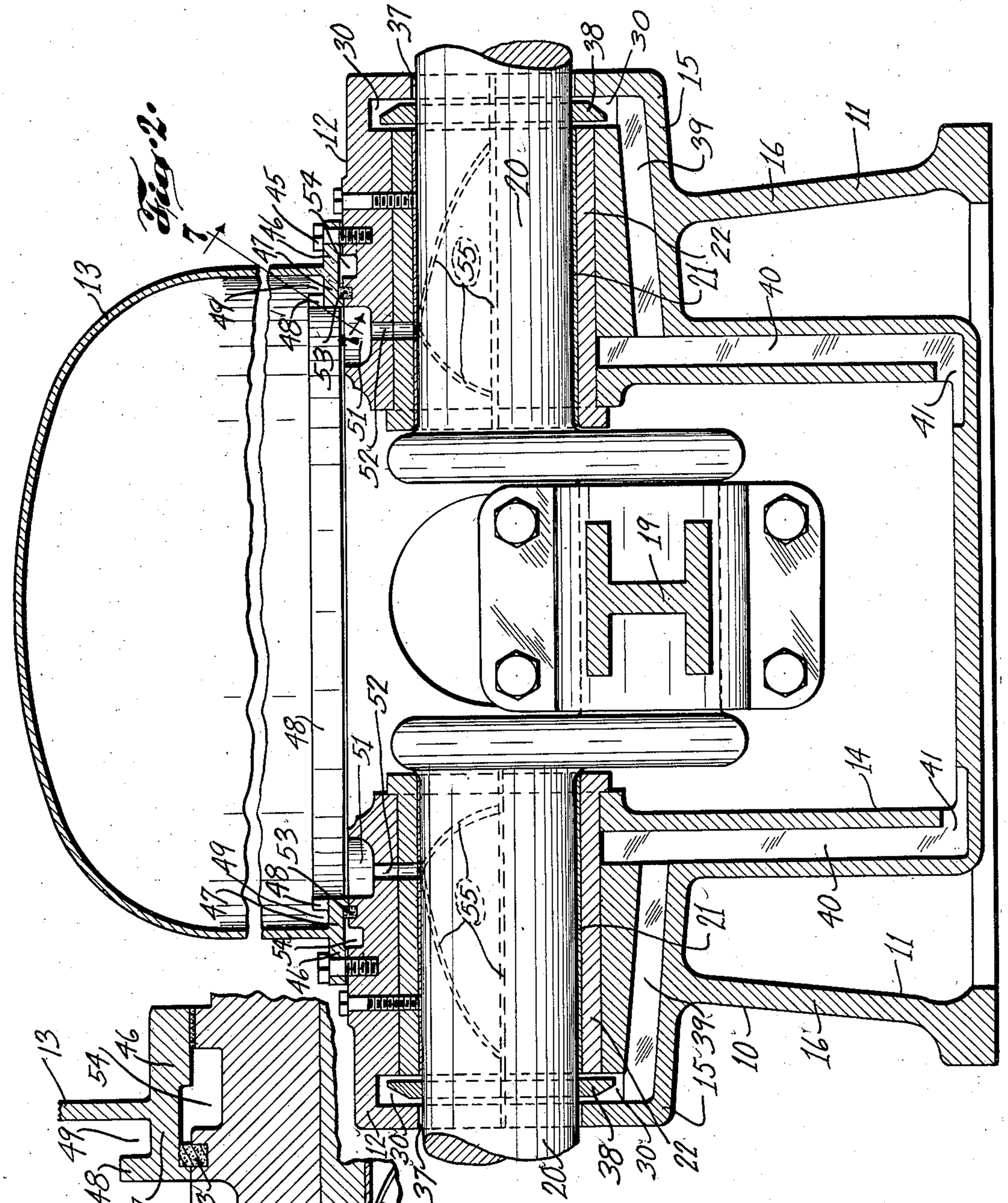

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Fig. 4.

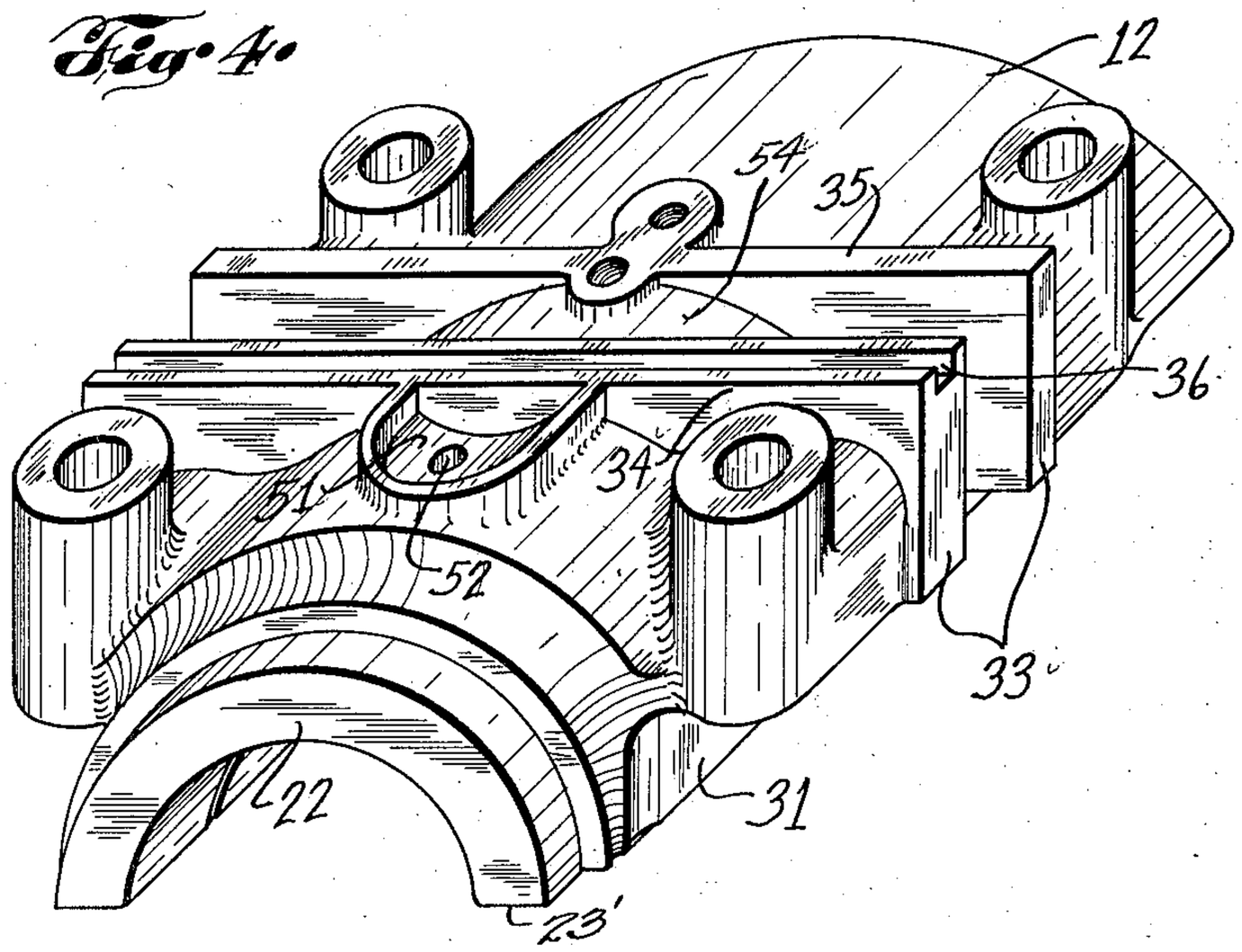
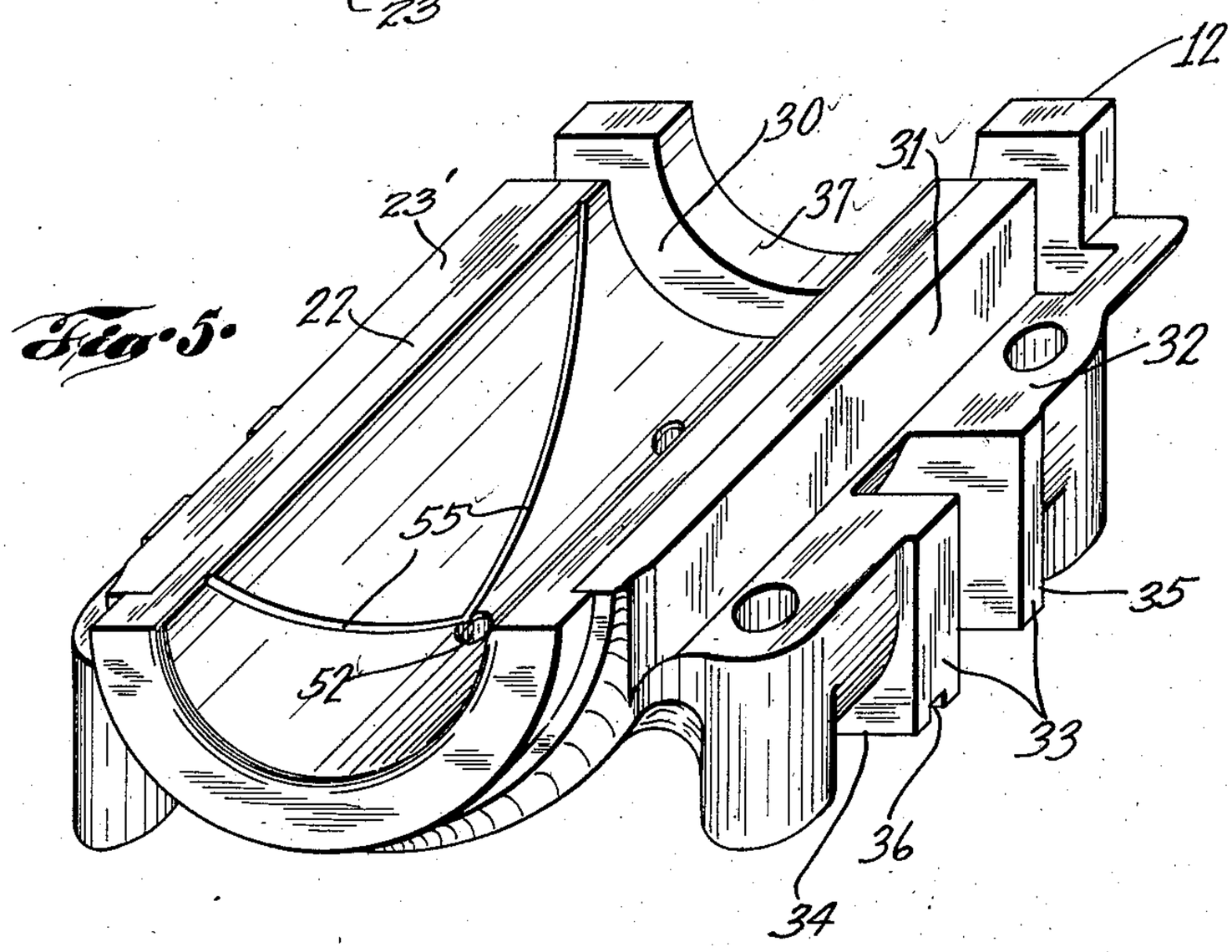


Fig. 5.



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ENGINE CRANK CASE CONSTRUCTION

Filed April 25, 1932 4 Sheets-Sheet 4

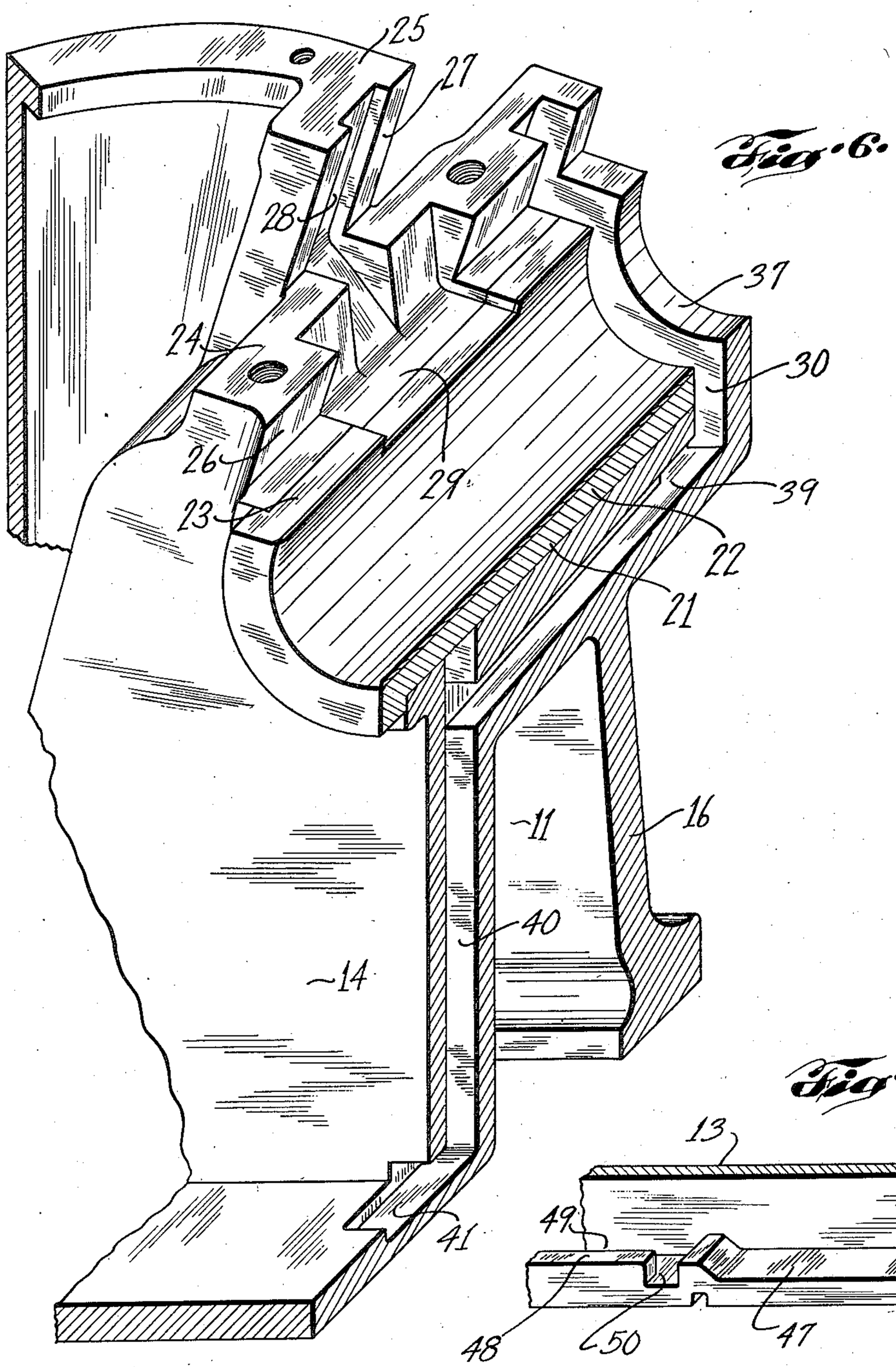

Fig. 6.

Fig. 7.

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2,012,009

ENGINE CRANK CASE CONSTRUCTION

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Application April 25, 1932, Serial No. 607,308

11 Claims. (Cl. 184—13)

This invention relates to improvements in engine crankcase construction, and more particularly to an improved arrangement for lubricating main engine bearings, preventing leakage of oil, and returning collected oil splash to a body of lubricant within the engine crankcase.

An object of the present invention is to provide an improved engine base or crankcase, consisting, in the preferred embodiment, of a lower portion or oil reservoir, a part of which forms the lower halves of the main bearings, to the base being assembled, a bearing cap, and a crankcase cover which, when assembled, will coact to constitute a novel arrangement of oiling and oil-return passages for lubricating the main bearings of an engine.

A further object is to provide an improved crankcase structure consisting of a lower case portion, a bearing cap, and a crankcase cover which is neat and compact, and forms an oil-tight structure when assembled.

An additional object of the invention is attained in improved and novel means for collecting lubricant elevated by splash, and distributing such lubricant, by gravity, to bearings located out of the direct path of splash or spray.

A still further object is attained in an improved arrangement for collecting and recirculating oil which may tend to be forced outwardly of engine shaft bearings, the arrangement also providing an oil seal precluding escape of gases and oil vapors through the oil return passages.

Further objects and advantages will appear from the following detailed description of a preferred embodiment of the invention, and from the accompanying drawings, in which:

Fig. 1 is a vertical section, taken endwise through a portion of a crankcase designed in accordance with the present invention; Fig. 2 is a vertical section along line 2—2 of Fig. 1; Fig. 3 is an enlarged cross section taken on line 3—3 of Fig. 1; Fig. 4 is a top perspective view of a bearing cap; Fig. 5 is a perspective view of the bearing cap of Fig. 4, shown in inverted position; Fig. 6 is a sectional perspective view of the bearing portion of the crankcase, and Fig. 7 is a sectional perspective view of a portion of the crankcase cover, as viewed along line 7—7 of Fig. 2.

Referring by numerals of reference to the drawings, 10 designates, generally, a preferred type of crankcase which includes, by preference, a lower case portion 11, which serves to carry bearing caps 12, and a cover 13. The portion 11 includes an oil reservoir 14, the lower halves 15 of the main crankshaft bearings, and outer walls 16 which encase and support the assembly.

The engine chosen to illustrate an embodiment of the present invention is of horizontal type, although certain of the principles of construction herein described are equally applicable to engines of vertical type. The cylinder and piston (not shown) may be of any suitable construction, such as usually employed in gas engines, the engine of Fig. 1 embodying a cross-head 17 to which the piston has preferably a rigid connection, and crosshead guides 18 formed, by preference, integrally with the crank case casting, which also constitutes the lower portions 11, together with the walls 16. As best appears from Fig. 1, the crosshead 17 is operatively associated with the usual connecting rod 19, engaging the crank shaft 20. While a single cylinder engine has been chosen for illustration, a number of principles herein disclosed are, as will appear, equally applicable to multi-cylinder engines, in which the crankshaft may be provided with a plurality of cranks or throws instead of the single throw arrangement selected for simplicity of illustration. The crankshaft is mounted at or near its opposite ends, in bearings, indicated generally at 21, (Fig. 2), the arrangement and construction of the bearings being, by preference, the same at the opposite ends of the crankshaft.

For illustration of the bearing construction attention is directed to Fig. 6 illustrating in perspective, a part of one of the lower bearing halves, as viewed toward the front of the engine or toward the left in Fig. 1. A liner of bearing metal 22 is preferably mounted, in any usual or suitable manner, within the casting constituting the case portion 11 which is characterized by three parallel, substantially horizontal stepped surfaces 23, 24 and 25. In assembly, the horizontal surfaces 23 serve to receive and cooperate with similar companion surfaces 23', (Figs. 1, 4 and 5) on the under portion of each upper bearing half or cap. The purpose and relation of the stepped surfaces 24 and 25 will hereinafter appear. Riser surfaces between the adjacent stepped portions, are indicated respectively at 26 and 27, surface 27 being provided with a grooved oil channel 28 having a vertical portion extending downwardly from the surface 25 to the plane of the surface 24, and thence sloping angularly into an undercut oil-receiving and distributing duct 29, all for a purpose more clearly hereinafter appearing. At or near the outer end of each of the bearing assemblies 21, there is formed by the two bearing halves, an annular oil-receiving recess 30, a portion of

which will appear in Fig. 6 and the location of which will best appear from Fig. 2. It will be understood that the opposite sides of each of the bearings is formed correspondingly to and symmetrically with the structure shown in Fig. 6, with the exception that surface **25** is not continued on the side of each lower bearing half, opposite the one side shown in Fig. 6.

Adapted to fit snugly between, so as to be engaged by the riser surfaces **26**, is a corresponding plane lateral surface **31** of the upper bearing half (Figs. 4 and 5), and an adjacent surface **32** serving to engage the surface **24** and substantially vertical surfaces **33**, mating with and abutting the surfaces **27** on the casting **11**. The surfaces **33** are formed by the end faces of a pair of transverse rib portions **34** and **35** (Fig. 4), there being formed in the upper surface of rib **34**, lengthwise thereof and transverse to the bearing, a gasket groove **36**. From the stepped construction of the upper and lower bearing halves it will be noted that alignment of the mating bearing members and surfaces is permanently assured and yet adjustment permitted by the use of shims (not shown) which may conveniently be disposed between the surfaces **24** and **32** at each side of each main bearing. Any necessary adjustment may, of course, be made by removing the bearing bolts, followed by selective removal of such shims, and again taking up the cap screws or bolts to reassemble the bearing halves in adjusted relation, according to prevailing practice. It will also appear that the upper bearing halves are provided with a half annular cavity **30**, forming a continuation of the corresponding annular space within the lower bearing halves.

As hereinafter appears, the main bearings are continuously supplied with oil. Since an excess of oil may at times, be provided, certain of the oil may find its way beyond the outer ends of the main bearings **21**, along the crankshaft **20**. Since the bearing members are provided beyond the annular recess **30**, with shaft openings **37**, provision is preferably made for preventing egress of oil, oil vapor and fog through the openings **37**. To this end I provide oil retaining rings **38**, preferably dimensioned to a size somewhat smaller than the annular recess **30**, in which each ring operates, so that, when the shaft **20** revolves, any oil which finds its way along the shaft to this point, will be arrested and thrown out by the ring into the passage **30**. Drain ducts are provided therefrom, as indicated at **39**, these being cored in the casting **11**, so as to slope, slightly, toward the central reservoir portion of the case, and each terminating in a vertical duct **40** leading, by preference, to the bottom of the oil reservoir **14**. An angular inner end **41** of each duct **40**, serves to direct the returned oil into the lowermost portion of the oil reservoir.

The arrangement of oil return ducts just described, offers a distinct advantage in that by discharging the returned oil at the lowermost portion of the case, the oil in any normal level in the case, serves as a liquid seal, preventing any egress of oil outwardly through the openings **37**, such as might occur in the event the ducts **39** opened directly into the case above the oil level therein.

It will appear that, as thus far described, the structure **11** including the lower portion of the crankcase, would present a top opening. The detachable cover **13** serving as a closure for such opening, serves with the lower case portion to maintain an oil-tight housing about the crankshaft and associated operating members. The casting **11** is characterized by a cover-engaging margin **42**, shown as disposed at a slight angle to the vertical, and a lower periphery or margin **43** at a right angle to the edge **42**, and disposed at a slight angle to the horizontal. The cover **13** may be secured in mating relation with the margin **42** as by cap screws or the like **44**, and held in assembly adjacent the reservoir portion of the case, as by screws **45**.

For the purpose herein described, the margin **43** of the cover will lie in the plane of and adjacent to the surface **25** (Fig. 6), forwardly of the main bearings. The surface **25** is, however, not continued rearwardly of the main bearings in the example shown.

Proceeding now to a more detailed description of the detachable cover **13**, this member is by preference and as shown, of dome-shaped construction, the lower or base engaging margin thereof being of inverted **T** shaped section, characterized by an outwardly extended flange **46**, an inwardly extended flange **47** provided with an upturned or angulate lip member **48**, the flange and lip **47—48** coacting to form an oil-trough **49** within the cover for a purpose hereinafter more clearly appearing. Preferably at diametrically opposite points, the lip **48** is notched as at **50** (Figs. 1 and 7), providing for drainage of oil therethrough from the trough **49** into oil-receiving pockets **51** in the upper bearing halves. Each of the pockets **51** is provided with a vertical drain opening **52** directed downwardly through the upper bearing portion to the shaft **20**.

Since the upper bearing halves are subject to vertical adjustment, within limits, for the purpose of taking up wear, and since the cover **13** is fixed in position as by engagement of the seating surfaces **25** by the margin **42**, it is desirable to provide a gasket or sealing material such as felt or the like, indicated at **53**, between the case **13** and the upper bearing halves. This gasket material is, in the present example, disposed along and carried within the groove **36**, in the transverse rib member **34**, (Fig. 4). Due to the compressibility of the gasket material, an oil-tight joint exists between the cover **13** and the bearing half, irrespective of any ordinary bearing adjustments or take-up.

In the event, however, some of the splashed oil should seep outwardly between the cover and bearing halves, and beyond the gasket **53**, such oil is entrapped in an oil drain groove **54** disposed over each bearing half, between the ribs **34** and **35**. Any oil which thus seeps past the gasket and finds its way into the groove or duct **54** is directed down the sides of the bearing half, thence into the vertical oil return groove **28** (Fig. 6), down the sloping portion thereof and into the undercut cavity **29**, at each side of the bearing, whence it is distributed along the journalled portion of shaft **20** for lubrication thereof. Details of the arrangement of gaskets **53**, oil pockets and ducts **51** and **54** and the oil return passage **52**, will even more clearly appear from the enlarged details of Fig. 3.

In operation, a level of oil is kept within the reservoir portion **14**, to such a height that it is agitated for spray lubrication purposes, by the crank throw and rod end dipping therein. The oil and oil spray is thus carried upwardly to the interior surface of cover **13**; the oil flows thence by gravity along the inner surface of the cover to collect in the peripheral trough **49**, proceeding thence, as above described, through the notch **50**,

(Fig. 7) into the oil pocket 51, thence through passage 52 and into the main bearing. Distribution over the surfaces to be lubricated is effected by appropriately disposed oil-distributing grooves 55, any excess of oil finding its way outwardly along the shaft, to be picked up by collecting ring 38, thrown into the annular passage 30 and thence returned through the drain channels 39, 40 and 41, to the oil reservoir 14.

Complete and copious lubrication of the bearings will obviously result from the foregoing arrangement, which serves, besides an oil-directing function, to prevent escape of any oil to the outside of the case, thus keeping the exterior of the engine dry and clean at all times, preventing waste of lubrication, and otherwise attaining the several objects set forth above.

It is, of course, to be understood that the present detailed description of parts and the accompanying drawings are presented only as pertaining to a preferred, exemplary embodiment of the invention, and that numerous changes may be made in the construction as described, without departing from the intended spirit and scope of the invention as defined by the claims hereto appended.

I claim as my invention:

1. In an engine, a casing including an oil reservoir in its lower portion, mechanism disposed to be oiled in part by splash, from a body of oil in the reservoir, a splash-oil-receiving closure having its margin seated upon the upper portion of the reservoir, an oil collecting channel in said closure, an oil-leakage trough covered by the margin of said closure, and oil passages from said channel and leakage trough, to parts of said mechanism.

2. In an engine, a casing including a lower oil containing portion, mechanism disposed therein to agitate a body of oil in said casing, a splash and gravity oil-circulating means including a splash-deflecting cover disposed in splash-receiving relation to the mechanism within the casing, a splash-oil-receiving channel disposed along the internal periphery of the cover, and another on the lower case portion beneath the cover, a gasket element between the cover and lower case portion, and located adjacent to and inwardly of the last named channel, conduits disposed for gravity flow of oil from said channels to parts of said mechanism, and oil ducts for returning oil from the gravity-lubricated parts of the mechanism to the lower portion of said casing.

3. A crankcase construction for engines employing splash lubrication, including an oil reservoir forming the lower portion of the case, a splash-receiving closure seated upon the reservoir and constituting the upper portion of the case, an oil channel formed peripherally within said closure, engine bearings, ducts from said channel to said bearings, a leakage channel extending along the seat for said closure, means for returning oil from the leakage channel to the bearings, and oil drains from said bearings having their discharge termini in the lower portion of the case.

4. In an engine crankcase, a lower case section, a bearing portion formed therein and having stepped lateral surfaces, a detachable companion bearing portion having similarly stepped surfaces, the stepped surfaces of the bearing portions interengaging in assembly, to prevent displacement of the portions, an upper case-closure section seated in part upon the detachable bearing portion, means securing the bearing portions into assembled relation, a pair of spaced projections formed on the detachable bearing portion, and providing plane seating surfaces for the closure section and an oil channel between the projections, and a duct from said channel to the bearing, formed by undercut portions of said stepped surfaces.

5. In an engine crankcase, a lower case portion forming lower bearing halves for a crankshaft, stepped surfaces laterally adjacent the lower bearing halves, an upper case-closure portion, a seat for said closure portion disposed above the lower bearing halves, companion or upper bearing halves having stepped surfaces adapted to interengage with those of the lower bearing halves, companion lateral abutments formed on the lower case portion adjacent the lower bearing halves and on the upper bearing halves, and an oil passage extending from said seat, between said abutments, and directed into the lower bearing halves.

6. In a crankcase structure, a lower case portion forming lower bearing elements, upper bearing elements interengaging the lower bearing elements, paired transverse ribs on the upper bearing elements, a recess along the outer surface of one of said ribs, a compressible sealing element occupying the recess, an oil channel between said ribs and directed into the bearing formed by said elements, and a cover for the lower case portion, having a flange seated on the compressible element, and overlying and serving as a cover for said oil channel.

7. In a crankcase structure for engine, a lower case portion forming lower bearing elements, upper bearing elements detachably secured to the lower bearing elements, an oil recess or cavity on each of the upper bearing elements, a cover for the lower case portion, overlying the bearing elements and arranged for deflecting splash oil from within the case into said recesses, additional oil recesses formed on the upper bearing elements outwardly of the first said recesses, cover-sealing members on the upper bearing elements between the oil recesses, and a passage from each of said recesses, to the bearing surfaces of said elements.

8. In an engine crankcase, an oil-collecting dome disposed within the path of splash oil from mechanism within the case, an inwardly extending peripheral oil trough formed in said dome, bearing elements carried by the case, oil pockets formed in the bearing elements, certain of the pockets being arranged to be supplied from the oil trough in the dome, said dome constituting a cover for the case and each of said trough and pockets, means for conducting oil, by gravity, from said trough and pockets to mechanism other than that lubricated by splash within the case, and sealing elements carried between the bearing elements and the dome, arranged to permit bearing adjustment while preserving the seal between the bearing elements and the dome, there being one of said pockets located on each bearing exteriorly adjacent the sealing elements, and adapted to return any seepage oil therefrom, to the bearings.

9. In an engine crankcase, in combination, a concave closure member having a flange seated in substantially fluid tight relation on the case, a sealing member cooperating with the flange, an internally projecting marginal trough carried by the flange, a leakage trough on the case structure laterally of the sealing member, each of said troughs having an opening therein for discharge of oil from the troughs, and conduits

for directing such oil to engine bearings and like parts to be lubricated.

10. In an engine crankcase, two detachably connected companion enclosure portions, a body of oil in one of said portions for splash lubrication of parts within the case, a splashed-oil-collecting channel carried by the other portion, a sealing member between the portions, and an oil-collecting and -drainage channel between said portions and disposed outwardly of said sealing member.

11. In a crankcase for a splash-lubricated engine, a lower oil-containing case portion, an upper hollowed case portion detachably secured thereto, an oil trough carried along the inner periphery of said upper portion, return channels from said trough to parts to be lubricated by gravity, a gasket between the case portions, a second oil-collecting trough disposed outwardly of the gasket, substantially between said portions, and passages from the second named trough, communicating with the interior of the lower case portion.

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