

March 9, 1937.

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2,073,096

LUBRICATING SYSTEM FOR INTERNAL COMBUSTION ENGINES

Original Filed Aug. 22, 1932 4 Sheets-Sheet 1

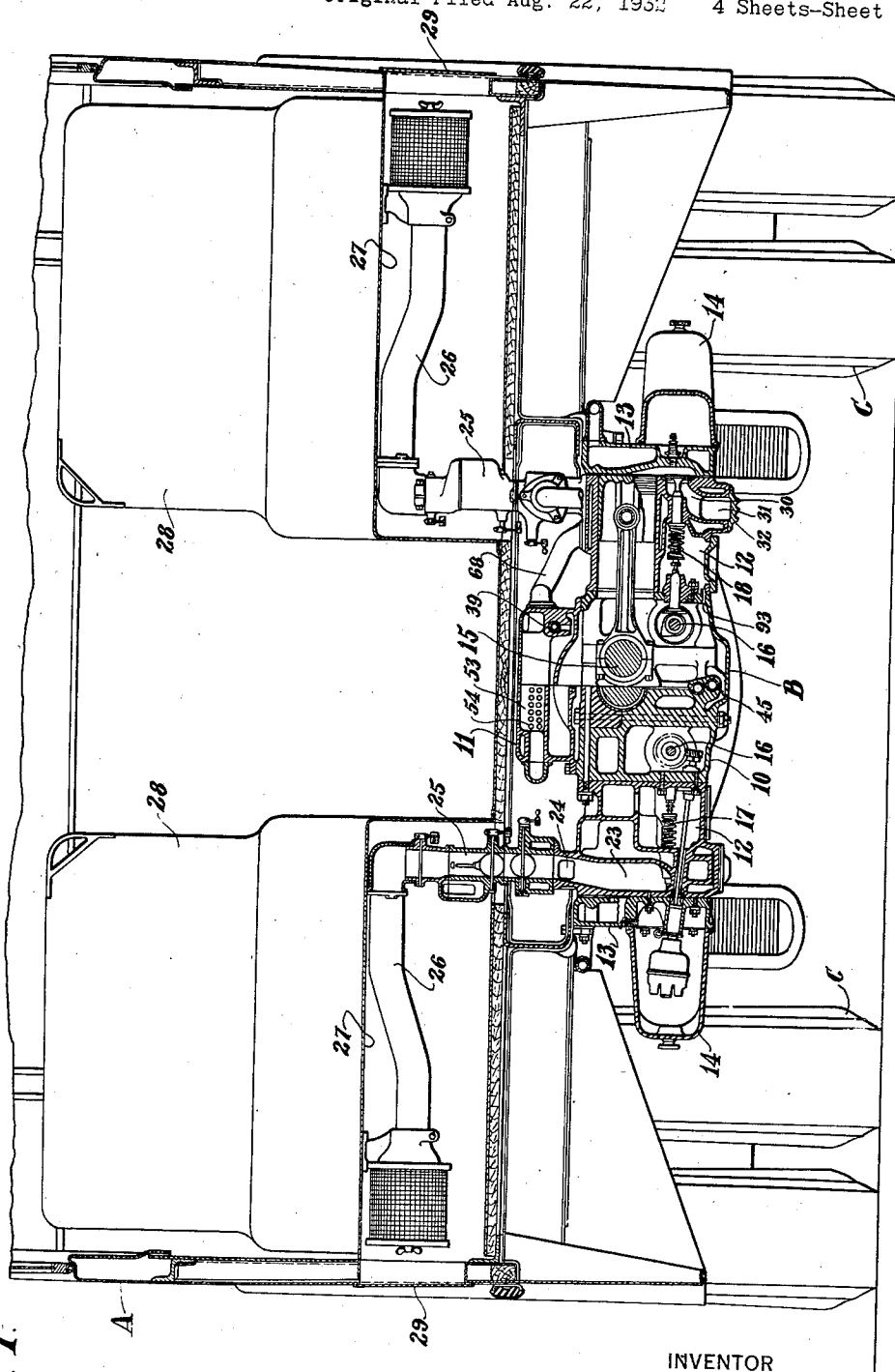


Fig. 1

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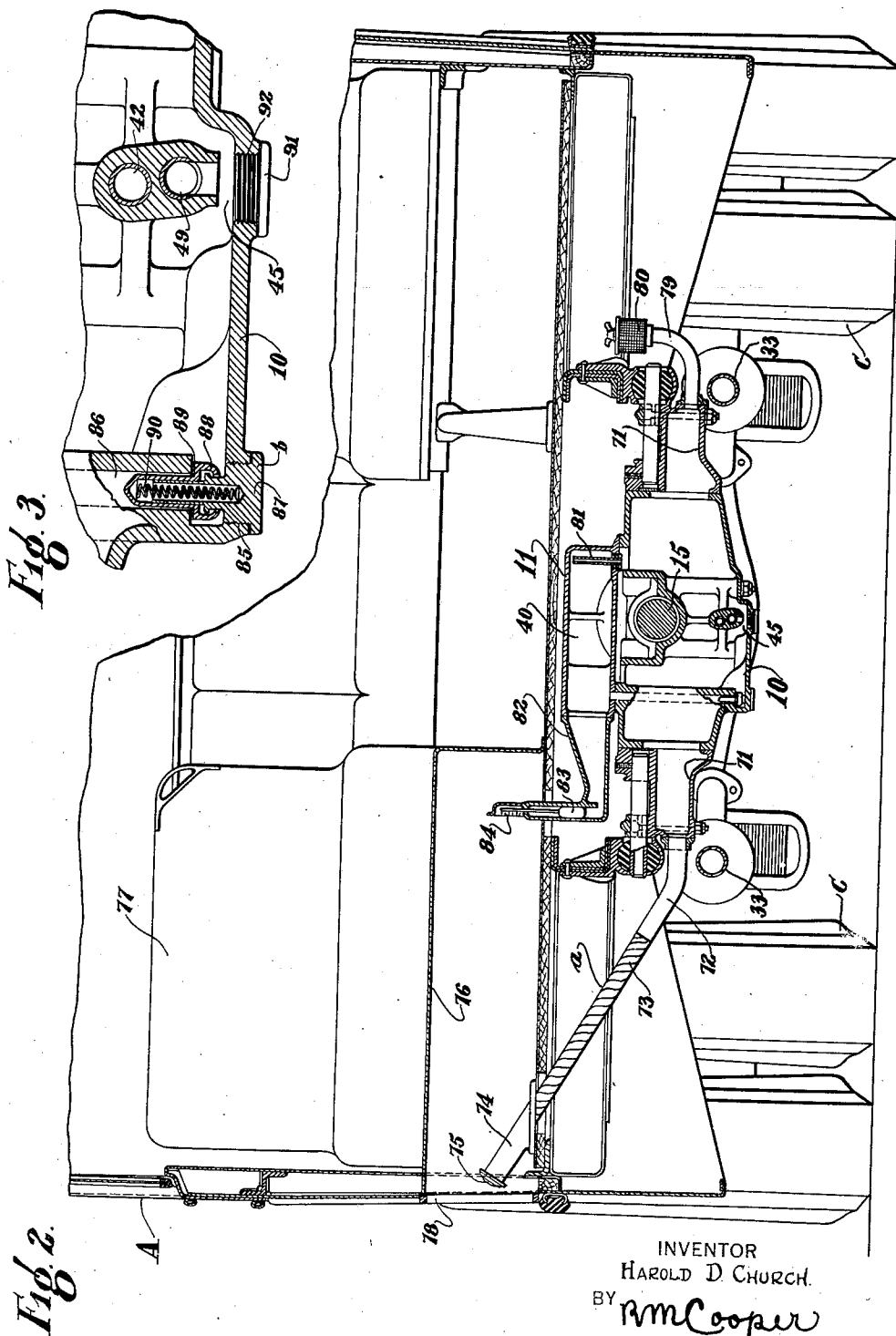
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Original Filed Aug. 22, 1932 4 Sheets-Sheet 2



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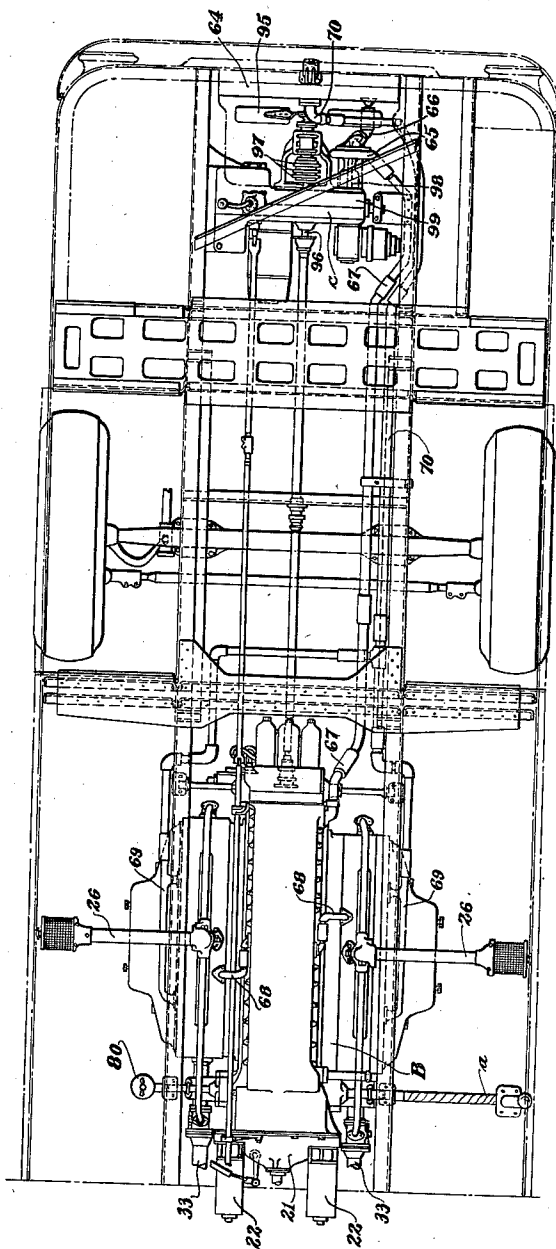
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Original Filed Aug. 22, 1932 4 Sheets-Sheet 3

Fig. 4.



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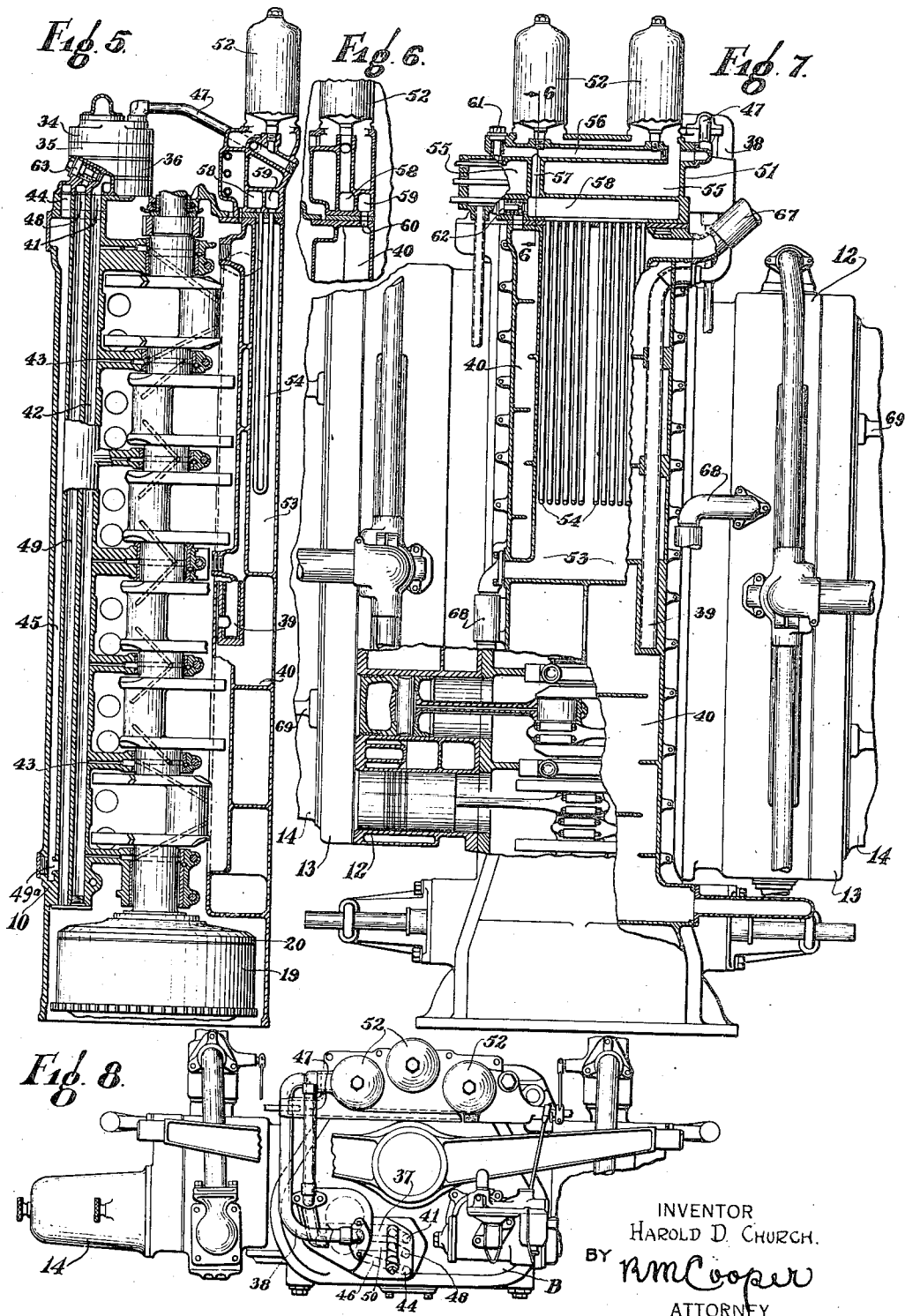
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LUBRICATING SYSTEM FOR INTERNAL COMBUSTION ENGINES

Original Filed Aug. 22, 1932 4 Sheets-Sheet 4



UNITED STATES PATENT OFFICE

2,073,096

LUBRICATING SYSTEM FOR INTERNAL COMBUSTION ENGINES

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Original application August 22, 1932, Serial No.
629,774. Divided and this application April
19, 1933, Serial No. 666,847

5 Claims. (Cl. 184—6)

This invention relates to lubricating systems for internal combustion engines, and is a division of applicant's prior application Serial Number 629,774, filed August 22, 1932.

It is an object of the invention to provide an improved lubricating system of the type which comprises cleaning and cooling apparatus.

It is a further object of the invention to provide a lubricating system for an engine of the horizontally disposed cylinder type which lends itself to the construction of an engine of small vertical depth.

It is a further object of the invention to provide an improved lubricating system of the type which comprises means for maintaining the oil in the crank case at a low level.

Other objects will appear in the following description when read in connection with the accompanying drawings, in which:—

Figure 1 is a fragmentary cross section of a motor bus equipped with an engine embodying the present invention, the section of the engine being composite, and consisting of a portion at one side taken through the cylinders of the engine and a portion at the other side taken intermediate two of the cylinders of the engine.

Figure 2 is a transverse sectional view of the bus taken through the rear supports of the engine and looking towards the rear of the bus.

Figure 3 is an enlargement of a portion of the section of the engine shown in Figure 2, certain of the parts shown in full lines in Figure 2 being shown in section in Figure 3.

Figure 4 is a plan view of the forward portion of the understructure of the bus, certain parts not related to the invention being removed.

Figure 5 is a fragmentary vertical section of the engine taken through the longitudinal center line of the engine.

Figure 6 is a fragmentary vertical section of the engine taken on a line corresponding with line 6—6 of Figure 7.

Figure 7 is a plan view of the engine, certain parts being broken away in order to show the internal construction.

Figure 8 is a fragmentary front elevation of the engine.

Referring to the drawings, the letter A indicates the body of a motor bus of the street car type, and the letter B an engine for propelling the bus. The engine B is mounted midway between the front and rear sets of wheels, and drives the rear wheels C through a driving mechanism similar in general construction to that employed in a conventional automobile.

Generally described, the engine B comprises a crank case 10, a crank case cover 11, a pair of horizontally disposed cylinder blocks 12, cylinder heads 13, cylinder head covers 14, a crank shaft 15, a pair of cam shafts 16, and inlet and exhaust valves 17 and 18. Included within the engine assembly is a conventional type clutch mounted with a casing 19 attached to the engine flywheel 20, and mounted upon a casing 21 attached to the rear of the crank case 10 are two electrical motors 22 for starting the engine.

The cylinder blocks 12 are provided with separate fuel induction systems of the down draft type. The system for each cylinder block comprises canals 23 formed in the block, a manifold 24 mounted on the upper side of the block, a carburetor 25 mounted on the upper surface of the manifold, and a breather pipe 26 extending laterally from the carburetor. The carburetors 25 extend above the floor of the bus, and are located in rectangular housings 27 disposed beneath two seats 28 located at opposite sides of the bus. The housings 27 also enclose the breathing pipes 26 which extend to the sides of the bus contiguous to screened openings 29.

The cylinder blocks 12 are also provided with separate exhaust systems, the system for each block comprising conduits 30 leading from the combustion chambers to the lower portion of the block, an exhaust manifold 31 formed by casting a canal in the block and enclosing the cavity by a cover plate 32, and an exhaust conduit 33 leading toward the rear of the bus.

The lubricating system for the engine B (see Figures 5, 6, 7 and 8) comprises a set of three gear pumps 34, 35 and 36, located at the forward end of the camshaft at the right hand side of the engine and operatively connected thereto. The pump 34 communicates at its intake side through a duct 37 and pipes 38 and 39 with a supply reservoir 40 formed in the crank case cover 11, and at its discharge side is connected through a duct 41 with a manifold 42 which communicates with ducts 43 leading to the various bearings of the engine. The pump 35 communicates at its intake side through a duct 44 with the forward end of an oil receiving reservoir 45 formed in the bottom of the crank case, and at its discharge side is connected through a duct 46 with a pipe 47. The pump 36 communicates at its intake side through a duct 48 and a pipe 49, with the rear end of the oil receiving reservoir 45, and at its discharge side through a duct 50 with the aforementioned pipe 47.

The pipe 47 leads upward to an oil cleaning

and cooling system, which system comprises a block 51 located at the forward end of the crank case cover 11, filters 52 communicating with chambers and conduits formed in the block 51, a water chamber 53 formed in the cylinder head cover 11, and cooling pipes 54 extending from the block into the cooling chamber 53 and connecting upper and lower chambers in the block. The pipe 47 communicates at its upper end with a chamber 55 in the block 51, which chamber communicates with the outer compartments of the filters 52. The inner compartments of the filters, which are separated from the outer compartments by conventional filtering elements, communicate with a conduit 56 in the block 51, which communicates through a duct 57 and a chamber 58 with the lower end of the cooling tubes 54. The upper ends of the cooling tubes 54 open into a chamber 59 located above the chamber 58, which chamber communicates through an opening 60 with the interior of the supply reservoir 40.

Mounted within the block 51 at the end of the conduit 56 is a spring pressed valve 61, which controls a passage between the conduit 56 and the chamber 55, and is designed to permit the oil to pass directly from the chamber 55 to the conduit 56 should the filtering elements of the filters become clogged. Mounted at the end of the chamber 58 is a second spring pressed valve 62 which controls a passage between the chamber 58 and the interior of the supply reservoir 40. This valve is adapted to open and allow the oil from the chamber 58 to flow directly into the reservoir 40 in case the cooling tubes become obstructed.

In addition to the valves 61 and 62, the lubricating system includes a spring pressed valve 63 controlling a passage between the duct 41 leading into the manifold 42 and the duct 48 leading into the pump 36. This valve is designed to allow oil from the duct 41 to flow into the duct 48 leading to the pump 36, should the pressure created in the duct 41 and the manifold 42 become excessive.

During operation of the engine the pump 34 draws oil from the supply reservoir 40 through the duct 37 and the pipes 38 and 39 delivering it through the duct 41, manifold 42, and ducts 43 to the bearings of the engine. The oil discharged through the bearings of the engine collects in the bottom of the crank case from whence it is drawn into the pumps 35 and 36 through the pipe 49, duct 48, and duct 44, and delivered through ducts 46 and 50, and pipe 47 to the chamber 55 in the block 51. From the chamber 55 the oil passes into the outer chambers of the filters 52 and from the outer chambers through the filter elements into the inner chambers. From the filters the oil is delivered into the conduit 56, and from the conduit 56 to the conduit 57, and thence into the chamber 58. From the chamber 58 it passes through cooling tubes 54 into the upper chamber 59, and then through the opening 60 into the supply reservoir 40. The cooling water for the chamber 53 is delivered thereto from a radiator 64 mounted at the forward end of the bus by means of a pump 65 (see Figures 4 and 7), hereafter described, connected with the radiator by a conduit 66 and with the chamber 53 by a pipe 67. From the chamber 53 the cooling water passes through pipes 68 into passages formed in the engine to cool the same, and from the cooling water passages in the engine through conduits 69 and a conduit 70 back to the radiator.

The relative capacities of the pumps 35 and 36 are such that either one of the pumps acting

alone is capable of drawing a greater volume of oil from the reservoir 45 than is delivered thereto by the pump 34. As a result, the oil in the reservoir 45 is maintained at a low level notwithstanding inclination of the engine resulting in drainage of the oil to one end of the reservoir.

Extending from opposite sides of the crank case 10 (see Figure 2) are two tubular members 71 which support the rear portion of the engine. These members communicate with the crank case, and the member upon the right hand side of the bus is provided with a conduit *a* through which oil is supplied to the engine, which conduit consists of a pipe 72, a flexible hose 73, and a filler neck 74 provided with a removable cap 75. The filler neck 74 is mounted above the floor in the outer end of a rectangular housing 76 located beneath a seat 77 at the right hand side of the bus, and is rendered accessible for supplying oil to the engine by means of a door 78 mounted in the side of the bus. Extending upwardly from the tubular member 71 at the opposite side of the bus, there is a breather pipe 79 terminating in an air filter 80.

Mounted in the lower wall of the reservoir 40 there is a breather tube 81 communicating at its upper end with the reservoir 40 and at its lower end with the interior of the crank case. The purpose of the tube 81 is to provide a passage through which air drawn from the crank case and delivered to the reservoir 40 can escape back into the crank case. By virtue of this expedient, a saving in lubricant is realized as a result of the oil-laden air not being permitted to escape to atmosphere.

Protruding from the side of the crank case cover 11 and communicating with the reservoir 40 there is a cored member 82 which extends upwardly through the floor into the housing 76. Mounted within the vertical arm of the member 82 there is a float 83 provided with a scale 84, which scale is visible from the side of the bus when the door 78 closing the end of the housing 76 is open, and which is provided to indicate the level of the oil in the reservoir 40.

Means for completely draining the engine of oil (see Figures 2 and 3) is provided in the form of a cap *b* screwed into an aperture 85 in the bottom of the crank case, and serving both to close the aperture 85 and the lower end of a superadjacent duct 86 communicating with the supply reservoir 40. The cap *b* comprises a threaded member 87 screwed into the opening 85 in the bottom of the crank case, a plunger 88 mounted on an extension of the member 87 and carrying a gasket 89 and spring 90, the latter of which acts to urge the plunger 88 in an upward direction to close the lower end of the duct 86. A secondary means for draining the reservoir 45 is provided through a plug 91 screwed into an opening 92 formed in the bottom of the crank case.

Returning at this point in the description to the reservoir 45, this reservoir (see Figure 1) communicates through ducts 93 with the portions of the cylinder blocks which enclose the inner ends of the valves, and forms in conjunction therewith a joint reservoir, which when the engine and bus are in a level position can hold all of the oil employed in the engine without flooding the combustion chambers or cylinders. One object of providing the joint reservoir with a capacity as described is to permit the engine to be filled with oil, when not running, without danger of flooding the combustion chambers and cylinders. A further object is to avoid flooding

the combustion chambers and cylinders with oil in consequence of the engine having stood idle for a sufficient time for the oil in the upper portion of the system to have drained into the joint reservoir through the pumps 34, 35 and 36. During running of the engine, flooding of the combustion chambers and cylinders is prevented by the action of the pumps 35 and 36 which maintain the oil in the reservoir 45 at a low level.

Mounted at the forward end of the bus there is an assembly c which comprises the instrumentalities generally associated with an automotive engine and a portion of the shifting mechanism for the speed change mechanism of the bus. This assembly comprises the previously mentioned water pump 65 for producing circulation of the cooling water and a fan 95 for producing a flow of air through the radiator 64. The fan 95 is driven from a shaft 96 connected to the engine crank shaft by means of belts 97. The drive shaft 98 of the water pump 65 is driven from the shaft 96 by means of a chain mounted within the housing 99 of the assembly c.

Although the foregoing description is necessarily of a detailed character, in order that the invention may be completely set forth it is to be understood that the specific terminology is not intended to be restrictive or confining, and that various rearrangements of the parts and modifications in structural details may be resorted to without departing from the scope or spirit of the invention as claimed.

What I claim is:

1. An internal combustion engine constructed with horizontally disposed cylinders, and comprising a circulatory water cooling system and a dry sump lubricating system, said lubricating system comprising a shallow supply reservoir located in the upper portion of said engine, a shallow receiving reservoir located in the bottom of said engine, a cooling chamber of shallow depth located in the upper portion of said engine at one side of said supply reservoir and inter-connected with the cooling water system of said engine in such a manner that the cooling water is caused to flow therethrough, oil cooling tubes extending into said cooling chamber, means for delivering oil from said supply reservoir to the bearings of said engine, and means for returning to said supply reservoir by way of said oil cooling tubes the oil passing through said bearings and collecting in said receiving reservoir, said last named means having a greater capacity than said first named means and being operative during operation of the engine to maintain said receiving reservoir substantially dry of oil.

2. An internal combustion engine constructed with horizontally disposed cylinders, and comprising a circulatory water cooling system and a dry sump lubricating system, said lubricating system comprising a shallow supply reservoir located in the upper portion of said engine, a shallow receiving reservoir located in the bottom of said engine, oil cleaning apparatus mounted at one side of said engine, a cooling chamber of small depth located in the upper portion of said engine at one side of said supply reservoir and inter-connected with the cooling water system of said engine in such a manner that the

cooling water is caused to flow therethrough, cooling tubes extending into said cooling chamber, means for delivering oil from said supply reservoir to the bearings of said engine, and means for returning to said supply reservoir by way of said cleaning apparatus and said cooling tubes the oil passing through said bearings and collecting in said receiving reservoir, said last named means having a greater capacity than said first named means and being operative during operation of the engine to maintain said receiving reservoir substantially dry of oil.

3. In an internal combustion engine, a lubricating system comprising a supply reservoir formed in the upper portion of said engine, a receiving reservoir located in the bottom of said engine, means for delivering oil from said supply reservoir to the bearings of said engine, means for returning to said supply reservoir the oil passing through said bearings and collecting in said receiving reservoir, a conduit leading from said supply reservoir into said receiving reservoir, means for simultaneously draining said supply reservoir and said receiving reservoir comprising a plug mounted in an aperture in the bottom of said receiving reservoir and engaging and sealing the lower end of said conduit.

4. An internal combustion engine constructed with horizontally disposed cylinders and comprising a circulatory water cooling system, a circulatory dry sump lubricating system, and heat exchange apparatus for cooling the oil in said lubricating system by the water in said water cooling system located in the upper portion of said engine and connected with the water cooling system in such a manner that cooling water is caused to flow therethrough, said lubricating system comprising a supply reservoir located in the upper portion of said engine, a receiving reservoir located in the bottom of said engine, means for delivering oil from said supply reservoir to the bearings of said engine, and means for returning to said supply reservoir by way of said heat exchange apparatus the oil passing through said bearings and collecting in said receiving reservoir.

5. An internal combustion engine constructed with horizontally disposed cylinders and comprising a circulatory water cooling system, a circulatory dry sump lubricating system, and heat exchange apparatus for cooling the oil in said lubricating system by the water in said water cooling system located in the upper portion of said engine and connected with the water cooling system in such a manner that cooling water is caused to flow therethrough, said lubricating system comprising a supply reservoir located in the upper portion of said engine, a receiving reservoir located in the bottom of said engine, oil cleaning apparatus located intermediate the upper and lower planes of said engine, means for delivering oil from said supply reservoir to the bearings of said engine, and means for returning to said supply reservoir by way of said heat exchange apparatus and said cleaning apparatus the oil passing through said bearings and collecting in said receiving reservoir.

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