Aug. 29, 1939. R. M. NARDONE 2,171,257

INTERNAL COMBUSTION ENGIN.

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Fig. 1

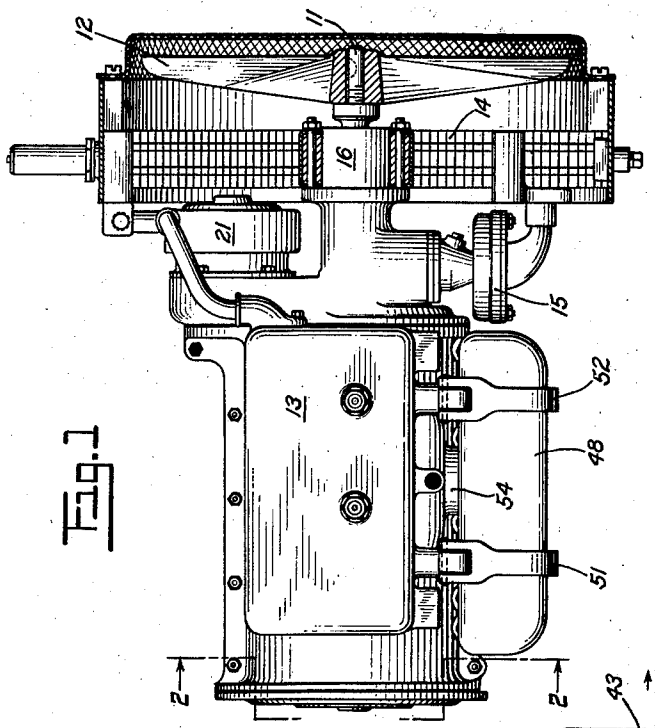


Fig. 2

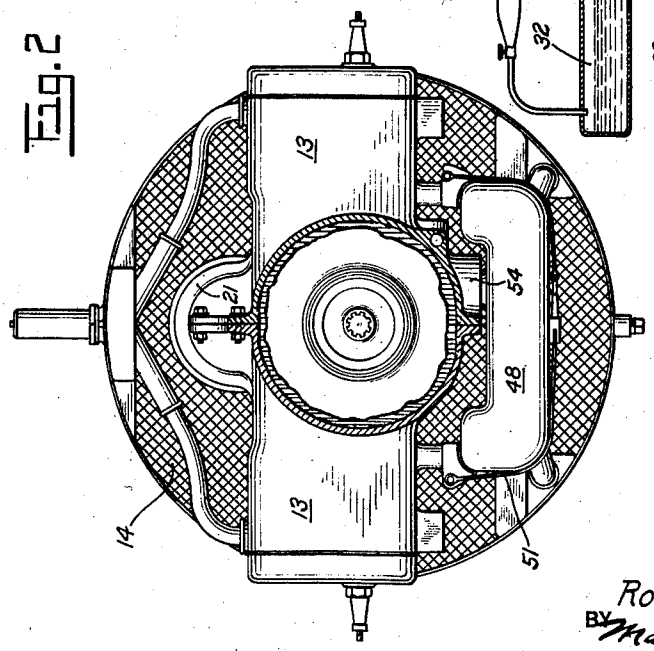
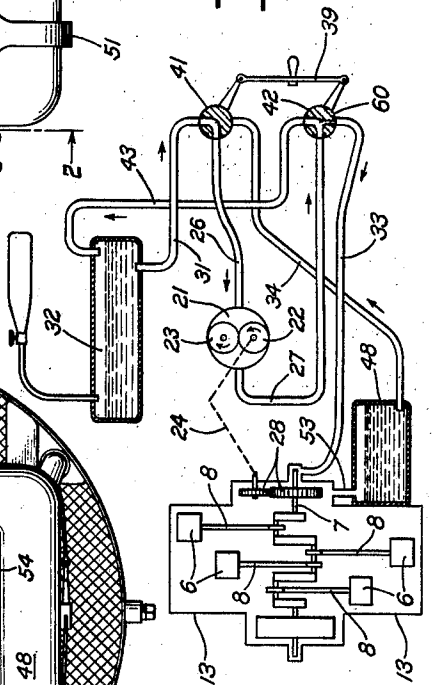


Fig. 3



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INTERNAL COMBUSTION ENGINE

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4 Claims. (Cl. 123—196)

This invention relates to internal combustion engines, and particularly to the starting, cooling and lubricating thereof.

An object of the invention is to provide improvements in respect to the starting, cooling and lubricating of an internal combustion engine.

A further object is to provide improvements in the construction and inter-relationship of the parts entering into the starting, cooling and lubricating processes, as well as in the said processes per se.

These and other objects of the invention will become apparent from inspection of the following specification when read with reference to the accompanying drawing wherein is illustrated the preferred embodiment of the invention. It is to be expressly understood, however, that the drawing is for the purpose of illustration only, and is not designed as a definition of the limits of the invention, reference being had to the appended claims for this purpose.

In the drawing:

Fig. 1 is a view in elevation of an engine constructed in accordance with the teaching of this invention;

Fig. 2 is a transverse view along the line 2—2 of Fig. 1; and

Fig. 3 is a diagrammatic view of the starting and lubricating features of the invention.

The engine is shown as of the type having a plurality of pistons 6 disposed on both sides of a crankshaft 7 to which they are drivably connected by the usual rods 8, and an equal number of pistons being similarly connected to the crankshaft from the opposite side thereof. To the forward end 11 of the crankshaft there is drivably secured a cooling fan 12, and intermediate said fan 12 and the engine block 13 (preferably in two sections housing the piston 6) there is provided a cellular type of radiator 14 to receive a suitable fluid which circulates (aided by pump 15) through the usual channels (not shown) in the cylinder block 13, and thereby takes heat from the said cylinders and pistons and other working parts of the engine, and conveys it to the cells and surfaces of the receptacle 14, from which it is carried off to the atmosphere both by radiation and by the convection currents induced by rotation of the fan 12. A novel feature, in this connection, is the mounting of the radiator directly upon a hub or bearing 16 which supports a portion of the crankshaft which is located intermediate the fan and engine block. By this means there are effected important gains, not only in space conserved, but also in the matter of efficiency of the cooling action of the fan and radiator. These gains are due partly to the increased rapidity of the circulation resulting from (*a*) the shortening of the distance from block to radiator, (*b*) the more efficient (annular) arrangement of the cells of the radiator which is made possible by the center support feature, and which provides greater radiating surface for a given cubic content, and (*c*) the greater volume of cooling air which can be drawn past the cooling surfaces by virtue of the novel arrangement of the fan in a position where it can be driven directly by the crankshaft, to rotate about the axis thereof, and to draw relatively cold air into the radiator rather than to draw relatively warm air from the radiator, as is the case when the fan is situated in the rear of the radiator.

Another feature of the invention is the use of a single energy converting device to perform two services, first the conversion of the potential energy of a reservoir of liquid (preferably lubricating oil) into kinetic energy for imparting initial rotary (starting) motion to the engine crankshaft, and secondly, to thereafter convert some of the kinetic energy of the crankshaft into pressure applicable to the lubricating fluid for the engine, to maintain such lubricant in positive circulation throughout the parts of the engine requiring constant lubrication. Such a device, as represented at 21 in the drawing has a pair of inter-meshed gears 22, 23 adapted to rotate within a chamber to which the fluid has ingress by way of conduit 26 and egress by way of conduit 27. A shaft (indicated schematically at 24 in Fig. 3) connects gear 22 with a gear train 28 to provide motion transmitting means between the said gear 22 and the crankshaft 7, whereby starting of the engine can be effected upon energization of the starting gears 22, 23; while pumping of the oil may thereafter proceed by virtue of the transmission of torque from the engine to the gears 22, 23 by way of the same gear train 28.

Energization of the device 21 may be initially brought by establishing communication between conduits 26 and 31, the latter leading from a suitable pressure reservoir 32 containing a quantity of fluid under sufficient head and/or pressure to turn gears 22, 23 against the static inertia of the engine crankshaft 7 and thus "start" the engine, it being understood that the ignition mechanism (not shown) is placed in operating condition prior to, or simultaneously with, actuation of linkage 39 to rotate the valves 41 and 42 in synchronism, to establish communication not only between conduits 26 and 31, but

also between conduits 27 and 43, the latter being the return path to the reservoir 32. This pressure reservoir 32 may be of conventional form corresponding, for example, to that shown at L^4 in Fig. 1 of the drawings constituting part of Patent No. 568,736 granted to A. B. Brown on October 6, 1896.

As soon as ignition of the fuel of the engine has produced sufficient energy to cause crankshaft 7 to develop power in excess of that supplied from unit 21, the operator may throw the valves by means of linkage 39 to the other position, wherein they cut off communication with the reservoir 32 and establish communication with the normal lubricating channels, including the conduit 33 leading to the crankshaft bearings, and the conduit 34 leading from the oil sump 48. This oil sump 48 is shown as of novel construction, and is chiefly characterized by the fact that it is a unit separate and detachable from the engine block 13, to which it is adjustably held by straps 51, 52, the only communicating path for return oil flow into the sump being through an aperture 53 in the base portion 54 of the engine block.

As above stated, the fluid in reservoir 32 is preferably lubricating oil. The use of such a fluid, in conjunction with the provision of a bleeder by-pass 60 in valve 42, insures positive lubrication of the moving parts during starting. That is, with valves 41 and 42 in the starting positions, some of the oil passing through valve 42, on its way back to the reservoir 32, will be diverted through by-pass 60 and conduit 33 to the crankshaft bearings, and thence to other moving parts, and back to the sump 48, where it will serve to replenish the supply of lubricant. During normal running, of course, no oil will be bled from the reservoir 32 in this fashion, as the by-pass 60 is inoperative in the normal position of valve 42.

What is claimed is:

1. In an internal combustion engine, the combination with a crankshaft of bearing containing supports for said crankshaft, a cylinder block housing said crankshaft, means for circulating lubricating fluid through said cylinder block, said means including an oil sump connected to said block, an oil pump drivably connected to said crankshaft, means including said oil pump for establishing communication between said oil sump and said bearing containing supports, and means including a liquid source of potential energy for initially energizing said oil pump to impart initial rotary movement to said crankshaft.

2. In an internal combustion engine, the combination with means for circulating lubricating fluid through said engine, of an oil pump drivably connected to said engine, a liquid source of potential energy for initially energizing said oil pump to impart initial rotary movement to said crankshaft, and means for bleeding liquid from said liquid source to lubricate said engine during starting of the engine.

3. In an internal combustion engine, the combination with means for circulating lubricating fluid through said engine, of an oil pump drivably connected to said engine, a liquid source of potential energy for initially energizing said oil pump to impart initial rotary movement to said crankshaft, and means for bleeding liquid from said liquid source to replenish the supply of lubricant in circulation.

4. In an internal combustion engine, the combination of means for circulating lubricating fluid through said engine, said means including an oil pump drivably connected to said engine, and a liquid source of potential energy for initially energizing said oil pump to impart initial rotary movement to said crankshaft.

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