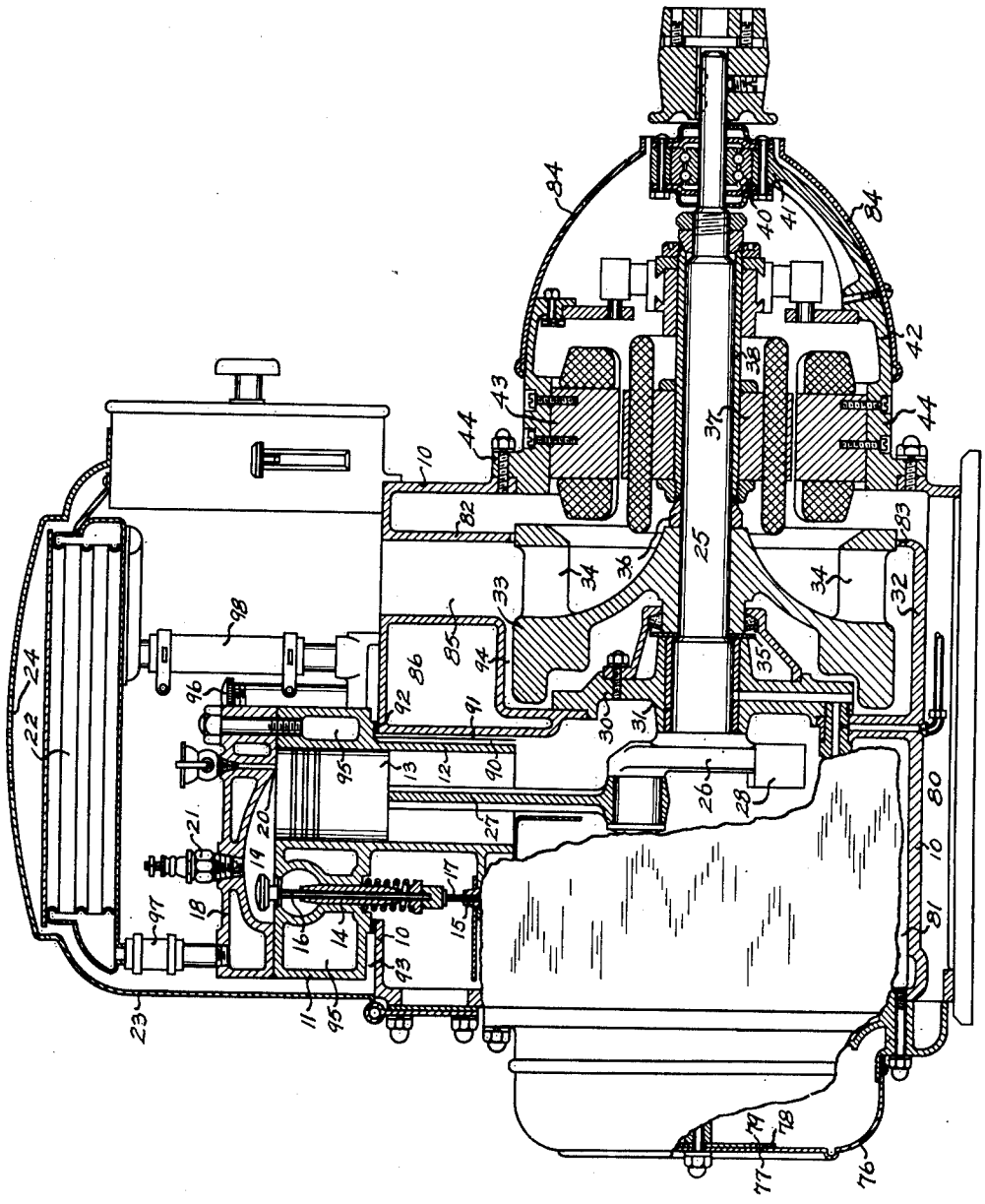
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POWER PLANT

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INVENTORS
CHARLES B. JAHNKE
ALFRED C. BOOCK
BY
ATTORNEY

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CHARLES B. JAHNKE AND ALFRED C. BOOCK, OF BELOIT, WISCONSIN, ASSIGNORS TO FAIRBANKS, MORSE & CO., OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS

POWER PLANT

Original application filed December 16, 1927, Serial No. 240,604. Divided and this application filed March 7, 1929. Serial No. 344,960.

This invention relates to improvements in power plants, and more particularly to means for cooling the parts of an internal combustion engine which is directly connected to a generator.

An object of the present invention is to provide a direct connected power plant which is neat and compact in arrangement and which is economical to construct and maintain.

A further object is the provision of an improved and efficient cooling system, comprising a means for cooling the engine by vapor, and comprising a novel arrangement of cooling fans and air ducts adapted to direct and confine a current of cooling air about the various parts of the engine and through a condenser. Further, this system attains the object of controlling the temperature of the lubricating oil in the crank case, and of the fuel oil in the supply tank.

Further objects and advantages will appear from the following detailed description of the parts and the accompanying drawing, which is a longitudinal section, partially in elevation, of a preferred form of power plant, to which the improvements are applied; and from a copending application filed December 16, 1927, and bearing Serial No. 240,604, of which the present subject matter is a division.

It will, of course, be understood that the present detailed description of the parts and the accompanying drawing relate to a single preferred executional embodiment of the invention and that substantial changes may be made in the described construction and arrangement of the parts, without departing from the spirit and full intendment of this invention.

The reference characters of the drawing are uniform with those appearing in the copending application of Serial No. 240,604, above mentioned. The same system of reference characters is used in order better to coordinate the subject matter of both the present and the parent application.

Referring by numerals to the drawings, 10 designates the crank case, which is preferably a casting serving as a frame for the assembly, and on which is mounted a cylinder casting 11. This comprises a cylinder 12 in which operates the power piston 13, which may be of any suitable form. The cylinder casting 11 is separate from, and carried by the crank case casting, and includes valve guides 14, and tappet guides 15. The guides serve to position and to determine the path of travel of valves 16 and tappets 17 respectively, both of which may be of any suitable, conventional type. Mounted upon the member 11, and formed separately therefrom, is the cylinder head 18 provided with a passageway or opening 19 in communication with the combustion space 20. The head 18 may be provided with an opening to receive a spark plug 21, or equivalent ignition device.

A condenser or radiator 22 is located, by preference, above the cylinder head 18, and is disposed horizontally in order to minimize the over-all height of the plant. The condenser 22 and the cylinder head 18, as well as other adjacent parts of the plant, may be surrounded and enclosed by a hinged cover 23. For convenience in lifting the cover, it is preferably made of a light material, such as sheet metal, and may be provided with a retaining device such as a spring clip, (not shown), to prevent any movement or vibration thereof during the operation of the engine. The top portion of the cover 23 consists of a screen 24. This permits the free passage of cool air through the top of cover 23, and serves as a guard for the parts enclosed thereby. The cover 23 not only directs the air through the condenser or radiator, but causes a sufficient circulation of air over the cylinder head to permit the use, if preferred, of an air cooled head. If desired, the cover 23 may be made heavy enough to serve as a support for the condenser. It is more desirable, however, to hinge the cover as shown, to give access to the top portion of the engine without disconnecting any parts.

Operating in the crank case, and projecting therethrough to the generator, is a crank shaft 25, on the inside end of which is a crank arm 26. The construction of the crank shaft and crank arm constitute this assembly as one of the so-called "overhung" type. A

connecting rod 27 serves as the operative connection between crank arm 26 and the piston 13. The crank is provided with a counterweight 28 which may be formed integrally therewith. By the use of a counterweight for balancing, the moment of reciprocating parts is balanced, both about the axis of the crank arm, and about the axis of the crank shaft.

The crank shaft 25 is supported and carried by a bearing plate 30 and a bearing 31. These serve also as bearing members for the generator, hereinafter described. The bearing plate 30 is fastened to the crank case or frame 10, which includes a member 32 within which the fly wheel 33 rotates. The fly wheel is keyed to the crank shaft, and is provided with a plurality of peripherally disposed, web-like members 34 which serve the purpose of fan blades to move the air for cooling purposes. The path of the cooling air is hereinafter described. Endwise movement of the fly wheel 33 is prevented by means of a plate 35 and a collar 36, in a manner which will be apparent from the drawings.

In the generator the armature is shown at 37. This may be of any suitable form and is preferably mounted on a sleeve 38, in a manner described in detail in a copending application, Serial No. 240,466, filed December 16, 1927.

An end bearing for the armature shaft, such as 40, may be carried by a member 41, formed by the generator case 42, which may, in turn, be attached to the crank case 10. Suitable pole pieces 43 are preferably attached to the flanged portion 44 of the generator case 42.

It will be seen from the drawings and description that the generator serves to complete the enclosure of one end of the crank case. Closure of the opposite end of the crank case is effected by a suitable cover such as 76.

Air for cooling the motor, and also the air for mixture with the fuel in the carburetor, is drawn through openings 77 in the end cover 76, and this flow of air is regulated by means of a pivoted shutter 78, provided with openings 79, which are so disposed as to register with the openings 77. Beneath the crank case proper, more particularly below the oil chamber, is an air duct 80, preferably disposed longitudinally of the engine and serving to connect the openings in end cover 76, with the fan blades 34 on the fly wheel. The generator end of the crank case 10 is preferably separated from the crank chamber 81 by means of plates 82 and 83, which form a housing for the fly wheel, and also establish the course of the cooling air at these points. Besides drawing air through the air duct 80, as described, some of the air for cooling and combustion may be introduced through the generator by means of the openings 84 in the generator case. All of the air drawn in through either of the two routes described is discharged upwardly through a passage 85, which is an air passage up through crank case 10. At 86 is indicated the fuel tank, which is preferably cast integrally with the main casting comprising the crank case 10, etc. This fuel tank is preferably of horseshoe shape so as partially to surround the cylinder casting 11, including the cylinder 12. As the air passes upwardly through the passage 85 it is carried past the adjacent wall of the fuel tank, and thus assists in keeping the fuel at a safe and uniform temperature. As the cooling air proceeds upwardly, past the fuel tank, its course is determined by the hinged cover 23, by which the air stream is compelled to pass upwardly and outwardly through the radiator or condenser 22.

In connection with the air circulating system, the present invention embodies means for cooling the lubricating oil and cooling the fuel supply in the tank 86. As described, the air in passing through the air duct 80, under the crank case, is brought into immediate cooling contact with the bottom of the crank chamber 81, in which is located the oil supply. This stream of air is thus utilized for cooling the oil in the crank chamber. The air duct 80 may be provided with ribs (not shown) extending longitudinally of the duct or passage. In addition, the bottom of the crank chamber 81 may be provided with internal, upwardly extending ribs (not shown) extending up into the body of lubricant in this chamber. In practice it is found that the passage of air beneath the crank chamber keeps the oil supply reasonably cool at all times. This cooled oil, in splashing up against the lower portion of the fuel tank 86, aids materially in maintaining the contents of the fuel tank at a safe temperature. Excessive cooling of the lubricating oil is prevented by control of the pivoted shutter 78, described above. The described apparatus contemplates the use of a combined splash and pressure lubricating system, but it will be seen that the cooling system for the oil is obviously adaptable to either system of lubrication alone.

In the above connection the shape and location of fuel tank 86 is of advantage in presenting a substantial surface to the cooling air stream. In other engines having a cast-in fuel tank, it has customarily been located either in the base or the sub-base, and away from the engine proper. In order to keep the temperature of the fuel at all times safely below the flash point, the tank may be insulated from the cylinder 12 by an air space 90, which may be divided by a heat insulating shield 91. The fuel tank is also heat insulated from the water jacket hereinafter described, by means of a narrow gasket 92, thereby providing a horizontal air space 93. The vertical wall of the fuel tank 86 is, by preference, used to form part of the air passage from the fly wheel 33 to the radiator 22.

If preferred, upwardly extending ribs (not shown) may be added to the outer wall of the fuel tank to increase further the cooling effect from this air stream. Additional cooling of the fuel tank may be obtained by providing openings, (not shown) in the webbed portion of the fly wheel 33, thereby causing air to circulate under that portion of the fuel tank which overhangs the fly wheel, as shown at 94. The cooling effect may still further be increased, by cooling ribs or fins (not shown) placed on the bottom wall of the fuel tank.

A further objection to prevailing forms of engines is found in the fact that a substantial difference in fuel mixture results from a variation in fuel level, affecting the total head on the fuel suction. In my arrangement the main fuel tank 86 is so located with respect to the cylinder of the engine that as the fuel level in tank 86 recedes, the heating effect of the cylinder will compensate for the lower level of the fuel. In practice it is found that the increase in volatility and decrease in viscosity due to this heating effect, practically balance the tendency toward a leaner mixture ordinarily caused by a receding fuel level. This construction eliminates the necessity of using a float chamber, with its expense, uncertainty and liability to stoppage and leakage.

The cooling system for the head and cylinder proper of the engine, is of the vapor type, comprising essentially a short cooling jacket 95, below which is located the air space 90, above described. The level of the liquid in the jacket is determined by the height of a filler opening 96, and this level is such that the jacket is not completely filled. During operation of the engine, vapor rises through tubes 97 up into the vapor condenser or radiator 22, where it is condensed and returned by gravity, either through the vapor riser tubes 97 or through an additional tube 98. The end of the radiator or condenser 22 opposite the vapor lead 97, may be provided with a small opening (not shown), leading to the atmosphere, in order to prevent the system from becoming air-bound. There is no tendency for vapor to escape through this opening because the capacity of the condenser is sufficient to condense all of the vapor before it reaches the opening. For this reason the system will very seldom require additional water or cooling fluid. It will be seen from the drawing that the location of the condenser above the cylinder head and cooling jacket eliminates the necessity of a pump for returning condensed liquid to the system. The system offers the further advantage of enabling the use of cooling media of various boiling points thus permitting an exact temperature control of the engine.

While we have shown and described the cylinder head as being jacketed, and vapor cooled, it will be understood that due to the volume of air delivered by the fly wheel fan, an air cooled head may equally well be employed.

It will be readily understood that the combined heating and cooling arrangement about the fuel tank, is effective in maintaining the fuel at a temperature to insure correct volatilization and burning. It will be further understood that the arrangement of the cooling conduits, such as 80, 85, the condenser 22, and other constructional features of the assembly, provide a neat and compact arrangement, which is easily accessible and economically constructed and maintained.

We claim as our invention:

1. In an internal combustion engine, a frame member comprising a crank case, an air conduit having a portion extending along and below the crank case, and a fuel tank above the crank case adapted partially to surround a power cylinder of the engine, said conduit having another portion extending laterally of the crank case and into adjacence with the fuel tank.

2. In an internal combustion engine having a power cylinder, an element forming a crank case and frame for the engine including an air conduit having a portion disposed to cool the crank case, and another portion extending parallel to the power cylinder, a fuel tank disposed above said crank case and cast integrally therewith, the fuel tank being adapted to be heated from the power cylinder of the engine and its heat content controlled by proximity to the air conduit.

3. In an internal combustion engine, a power cylinder, a frame member comprising a crank case and a fuel tank cast integrally with the frame, a power cylinder disposed partly within said casting, an air conduit extending partly along the crank case, and partly parallel to the cylinder, the fuel tank being disposed adjacent a portion of the air conduit and arranged to surround, partially, the power cylinder, and spaced therefrom, and a heat insulating means disposed within the space between said tank and cylinder.

4. In an internal combustion engine, a frame member comprising as a single casting, a crank case adapted to contain a lubricant, a fuel tank disposed above the crank case and located adjacent a power cylinder of the engine, said frame member having an air passage therein, beneath the crank case, whereby the lubricant therein is cooled by the air in said passage; a portion of said fuel tank extending into said crank case and adapted to be cooled by the lubricant.

5. In an internal combustion engine, a cast frame member comprising a crank case forming a crank chamber adapted to contain a supply of lubricant, and comprising a fuel tank disposed above the crank chamber and adapted partially to extend into the crank case; said frame member having an air pas-

sage below the crank case, adapted for the introduction of cooling air and adapted to cool the lubricant in the crank case and the contents of the fuel tank, said frame member comprising a second air passage formed in part by a wall of the fuel tank, and adapted thereby further to cool the contents of said tank.

6. In an internal combustion engine, a frame member comprising as an integral structure, a crank case, a fuel tank disposed above the crank case, a fly wheel enclosure, and air conduit extending along the crank case, into said enclosure, and an air conduit extending from said enclosure and along a wall of said fuel tank.

7. In an internal combustion engine, a cylinder, a frame member comprising a crank case and a fuel tank formed integrally therewith and disposed above the crank case, said frame member comprising an air conduit disposed beneath the crank case and comprising a combined fan and fly wheel housing adapted to direct the air from said conduit to points adjacent said fuel tank and adjacent the cylinder head.

8. In an internal combustion engine, a crank case adapted to contain a supply of lubricant, a fuel tank disposed above the crank case and adapted to enclose a portion of the crank chamber, the crank case having an air conduit disposed adjacent the supply of lubricant therein and adapted to cool the lubricant, a wall of said fuel tank being adapted to be cooled by lubricant from said crank case.

9. In an internal combustion engine, a fly wheel having fan elements thereon, a crank case and frame member comprising as an integral part thereof a fuel tank located above and extending partly within the crank case, said frame member having an air conduit formed below the crank case adapted to cool the fluid contents of the crank case, said frame member further comprising a second air conduit in communication with the first, and forming a housing for the fly wheel and fan elements, said second named conduit being adapted to deliver cooling air about and above the power cylinder and through a heat radiating means.

10. In an internal combustion engine, a frame member comprising a crank case and a fuel tank disposed above the crank case and adapted to be heated by a power cylinder of the engine, a combined fly wheel and fan disposed within said frame member and a housing for said fan associated with the frame member, a portion of the fuel tank extending above said fly wheel and fan, whereby the fuel tank is adapted to be cooled directly by said fan.

11. In an internal combustion engine having a power cylinder, a fuel tank located adjacent the power cylinder and adapted to be heated thereby, and means for directing a cooling fluid toward the fuel tank and adapted to limit the temperature thereof.

12. In an internal combustion engine, a power cylinder, a frame member comprising a crank case and a fuel tank cast integrally with the frame, said frame member having an air conduit adapted to deliver cooling air about and above the power cylinder, a cylinder jacket for cooling fluid, a radiating condenser disposed above said cooling jacket, and means for directing said cooling air current through said condenser.

13. In an internal combustion engine, a power cylinder, a frame member comprising a crank case and a fuel tank cast integrally with said frame, said frame member having air conduits adapted to direct cooling air about said crank case and fuel tank, a cylinder cooling jacket substantially shorter than said cylinder, means adapted to establish a level of cooling media below the top of said jacket, a condenser disposed above said jacket, and means for directing the cooling air current through said condenser.

CHARLES B. JAHNKE.
ALFRED C. BOOCK.