

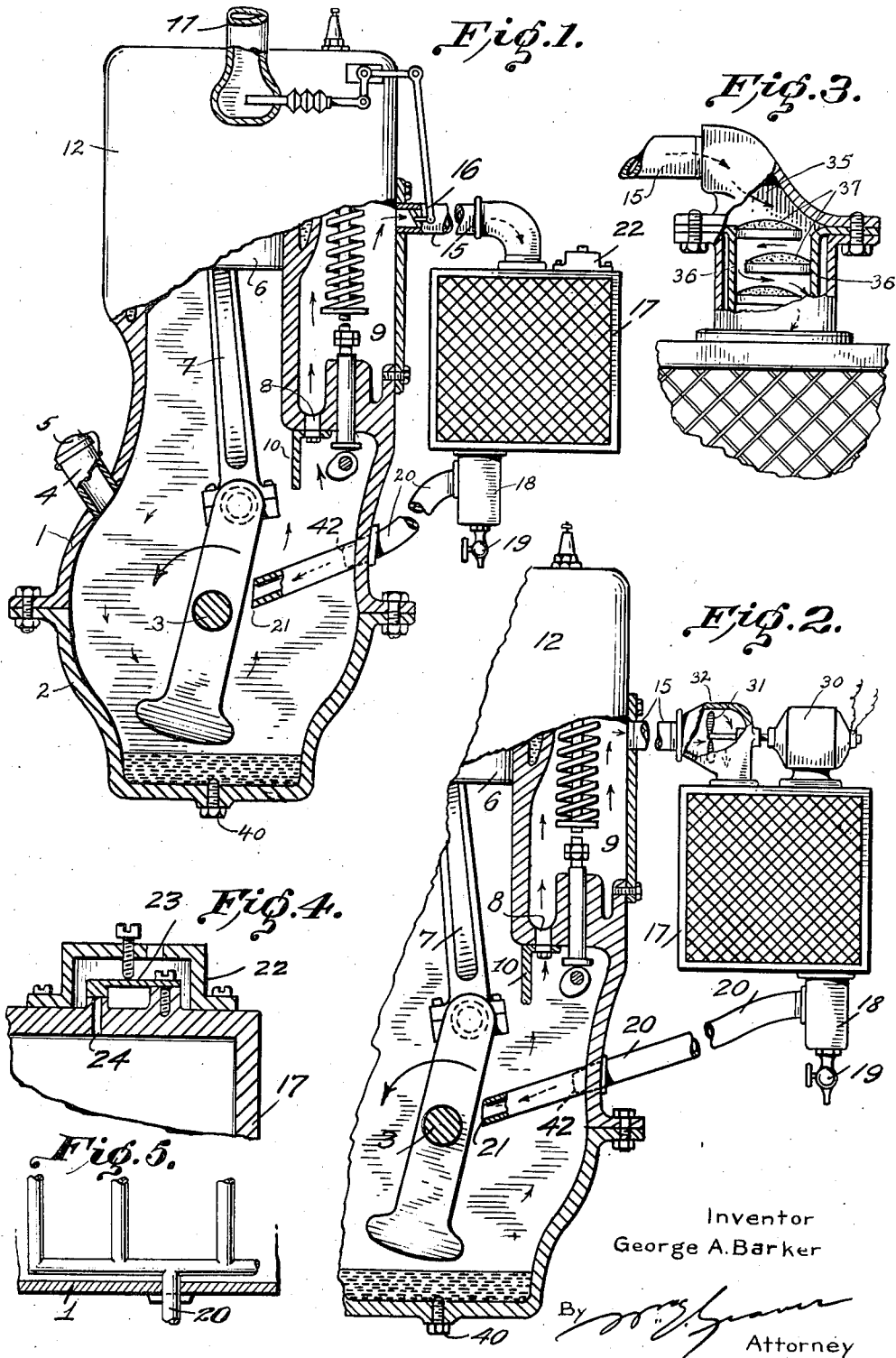
Jan. 28, 1936.

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2,029,216

CRANK CASE VENTILATION

Filed Nov. 15, 1934



UNITED STATES PATENT OFFICE

2,029,216

CRANK CASE VENTILATION

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Application November 15, 1934, Serial No. 753,235

15 Claims. (Cl. 123—171)

This invention relates to crankcase ventilation for air compressors, engines etc., particularly to those of the internal combustion type, but it is not limited to this class alone, and has for its object to provide a construction simple in parts and more efficient in use than those heretofore proposed.

With these and other objects in view the invention resides in the novel details of construction and combinations of parts disclosed more fully hereinafter and particularly pointed out in the claims.

Referring to the accompanying drawing forming a part of this specification and in which like numerals designate like parts in all the views,—

Fig. 1 is an end elevation of an engine, partly in section, to which this invention has been applied;

Fig. 2 is a similar view showing a modified form of the invention;

Fig. 3 is a detail view illustrating the insertion of a gas absorbing element in the ventilating circuit;

Fig. 4 is a detail view illustrating a device for permitting the relief of undesired high pressures from said circuit; and

Fig. 5 is a partial view substantially in horizontal section illustrating a branched conduit for delivering the treated air and oil vapors to the interior of the crankcase.

In heretofore known engines the breather pipe is located on the side of the crankcase and only extends a short distance into the interior thereof. The crankcase ventilation is dependent upon two conditions; first, the whirling motion of the air inside the crankcase, and second, the natural rise of air to the outlet, due to convection currents. In the first instance, because of the general shape and inherent arrangement of parts in the conventional engine, this whirling action is inadequate to draw in sufficient air to the low pressure area adjacent the crank shaft bearings, wherefore any air drawn in comes in contact only with the crankcase wall and particularly with the connecting rod bearings and does not reach the main crank shaft bearings. In the second case the height between the inlet pipe and exhaust pipe may be so small in some engines that obviously the benefit derived is very slight. However within the scope of this invention the inlet pipe may terminate a short distance within the crankcase as indicated by the dotted line at 42 and the circulation of the vapors from the crankcase may be accomplished by convection or by mechanical means as shown in Fig. 2. It is further con-

templated by the use of the shortened inlet pipe 42 to jet the inlet air to the low pressure area or to any other desired location. In other words my construction may operate by convection, impeller action, forced circulation or any combination thereof.

It is very evident that the crankcase ventilation system in prior use is inadequate especially in view of the present day tendency to increase the load and operating speed of engines. At slow speeds the ventilation and cooling of the crankcase and parts therein are of minor importance, but at increased speeds the temperature naturally rises and consequently the cooling at high speeds is not only very desirable but essential.

It is obvious that the high speed rotation of the crank shaft, counterweights etc. produces the same effect as impellers in centrifugal blowers. Hence with higher engine speeds the circulation of the air will be more rapid. It is apparent that the lowest pressure in the crankcase (during operation of the engine) is at the center of rotation of the crank assembly, or in the vicinity of the crank shaft which of course has the impeller action of the rotating crank assembly, and will be below atmospheric pressure. It is therefore readily seen that the logical location of the breather pipe would be such that its innermost end would be in close proximity to the center of rotation of the crank assembly where the crankcase pressure is below atmospheric, to positively establish a natural flow of air to this low pressure area. With such a location, the incoming air is in direct contact with the main bearings, crank shaft, and connecting rod bearings and will afford a very effective cooling of these parts. One or more breather pipes may be used according to the design of the engine. In the case of an eight cylinder in line engine, one breather pipe may be used for each main bearing, and for a radial engine only one breather pipe may be used effectively. Another method would be to use one breather pipe leading to the crankcase where it would be connected to branch pipes as shown in Fig. 5 leading to the main bearings or other desirable locations.

It can readily be seen that in an engine operating at a high speed there will be a considerable amount of air passing through the crankcase. With variations in temperature due to differences in geographic altitudes, the changing seasons of the year, etc., it may become necessary to circulate varying amounts of air through the crankcase to effect proper cooling. Therefore a portion of the ventilating circuit may be provided

with a valve to control the amount of air passing therethrough. Such a valve may be manually or automatically controlled, in the latter case the control could be by a thermostat regulated by the temperature of the cooling system as disclosed in my U. S. Letters Patent No. 1,968,119 granted July 31, 1934, entitled Ventilating system, or the regulation could be by a thermostat located within the crankcase.

Referring more particularly to the drawing, 1 indicates the upper portion of the crankcase and cylinder block assembly, 2 is the lower portion of the crankcase, 3 the crank shaft, 4 the filler pipe preferably having a tight fitting or sealed closure 5 for preventing escape of air or oil vapors from within the crankcase, 6 a piston, 7 a connecting rod, 8 a port connecting the upper portion of the crankcase with the valve spring housing 9, and 10 is a baffle plate used to direct the stream of circulating air within the crankcase. 11 is the outlet water pipe from the cooling jacket 12 of the engine cylinder.

As the shaft 3 rotates, the cranks will move in the direction indicated by the large arrow and cause a whirling of the air, oil mist, and oil vapors within the crankcase, setting up a movement thereof indicated by the smaller arrows. A portion of this air will be directed upwardly through the port 8 into the valve spring housing 9 and thence into a pipe 15 which may or may not be provided with a valve 16 therein, said pipe leading from the upper region of the valve spring housing into the upper portion of a heat exchange device generally indicated by the numeral 17, the lower portion of said device having associated therewith a condensation or drip chamber 18 with a valved drain 19 at the lower extremity thereof. To one side of the upper portion of this chamber is connected a pipe 20 which leads through the wall of the crankcase and has its outlet end 21 closely adjacent the shaft 3, well within the low pressure area of the crankcase. The heat exchange device 17 may be of any suitable type, such as a pipe coil, or pipe and fin radiator, whereby the air and oil vapors may be cooled in passing therethrough. Preferably at the top of this device there is provided a casing 22 covering a variably tensioned spring pressed closure 23 for a vent 24, the purpose of this construction being to permit the relief of any super-pressure beyond that desired in the ventilating circuit while at the same time preventing any ingress of outside air.

In the modification shown in Fig. 2 practically the same construction is employed, the difference being in the provision of a suitable source of power, such as the electric motor 30, for driving an impeller 31 disposed in an enlarged portion 32 of the pipe 15 in order to increase as desired the circulation of air and oil vapors in the ventilating circuit. It is obvious that the control of the motor 30 may be governed for example as by the thermostat in the outlet water pipe 11 and it is to be understood that the circulation of the vapors may be made such that they will be jetted into the crankcase with sufficient force to reach the low pressure area thereof, wherefore the delivery pipe 20 may terminate as at 42.

In Fig. 3 the pipe 15 is shown leading to a chamber 35 within which a support 36 carries a suitable substance 37 serving as a strainer or absorber or neutralizer for undesired products in the ventilation stream. For example, active carbon or silica gel, etc., could be used as absorbents. Sodium sulfate or sodium carbonate for

example could be used as neutralizing substances. The formation of sludge in the crank case is partially due to the products of combustion passing the piston and being absorbed by the lubricating oil. It will be seen that if the crankcase vapors may be removed and these products filtered from the vapors before returning to the crankcase the sludge will to a large extent be eliminated.

The operation of this ventilation system is as follows: The impeller action of the rotating crank shaft imparts an outward and rotary motion to the combined air and oil vapors in the crankcase, thereby creating a sub-atmospheric pressure in the central region adjacent the crank shaft, and a pressure above atmospheric in the outer region of the crankcase. The baffle plate 10 extending downward, intercepts a portion of the rotating air and directs it to and into the port 8 between the valve lifting assembly and the cylinder wall, from which port the air will enter the valve spring housing 9. Since the air is laden with oil vapor or oil mist, the valve spring assembly will be benefited by partial lubrication therefrom with attendant cooling of the valve stems. The air leaves the upper region of said housing, passing through the pipe 15, thence through the heat exchanger 17 and returns to the crankcase by pipe 20 discharging directly into the low pressure area adjacent the crank shaft 3, wherefore a considerable head is established between the extremities of the pipes 15 and 20. It is to be understood that this ventilation circuit is primarily a closed circuit in which the air is heated within the crankcase through operation of the engine and then cooled and/or tempered in passing through the heat exchanger, whereby the air is delivered to the crankcase at a temperature below that at which it leaves, and may be otherwise tempered as by coming in contact with substances such as indicated at 37. It is to be further understood that this invention is particularly adapted and intended for use during all operations of the engine; that is to say, when the engine is starting, idling or transmitting power to the apparatus with which the engine is associated, the impeller action of the rotating crank shaft produces the forced circulation just described. In the case of engines provided with a so-called dry sump, no drain outlet is necessary in the bottom of the crankcase, but in the case of engines having a lubricant reservoir in the sump, the plug 40 is provided so that when it is desired to change the oil said plug is removed to permit the draining of the crankcase, then reinserted, and fresh oil applied through the filler pipe 4. It is obvious that this ventilating system may be used with either a dry sump or one containing lubricant. The advantages of a sealed or closed ventilation system are to prevent the admission of foreign material, such as dust etc., into the crankcase, and due to the constant recirculation, the same vapors become inert and oxidation is prevented.

It is obvious that those skilled in the art may vary the details of construction and arrangements of parts within the scope of this invention without departing from the spirit thereof, and therefore it is not desired to be limited to the exact foregoing disclosure except as may be demanded by the claims.

What is claimed is:—

1. In an internal combustion engine having a rotatable crankshaft, the combination of a crankcase for containing lubricant; and conduit means for delivering a portion of the air and oil vapors from the high pressure area of the crankcase to

the low pressure area thereof, said means including means for cooling the delivered vapors.

2. In an engine having a rotatable crankshaft, the combination of a crankcase for containing lubricant; and means for delivering a portion of the air and oil vapors from the high pressure area of the crankcase to the low pressure area thereof, said means including a conduit disposed outside said crankcase.

3. In an internal combustion engine having a rotatable crankshaft, the combination of a crankcase for containing lubricant; means for delivering a portion of the air and oil vapors from the high pressure area of the crankcase to the low pressure area thereof; and means outside said crankcase for subjecting the delivered vapors to cooling temperatures.

4. In an internal combustion engine having a rotatable crankshaft, the combination of a crankcase provided with bearings for the crankshaft; a lubricant reservoir in said crankcase; and means for delivering a portion of the air and oil vapors from the high pressure area of the crankcase to the low pressure area thereof closely adjacent said bearings, said means including means for controlling the temperature of the vapors so delivered.

5. In an internal combustion engine having a rotatable crankshaft, the combination of a crankcase provided with bearings for the crankshaft; a lubricant reservoir in said crankcase; and means for cooling and delivering a portion of the air and oil vapors from the high pressure area of the crankcase to the low pressure area thereof, said means including a conduit terminating closely adjacent each of said bearings whereby to cool the latter.

6. In an internal combustion engine having a rotatable crankshaft, the combination of a crankcase; means for delivering a portion of the air and oil vapors from the high pressure area of the crankcase to the low pressure area thereof; and means for treating the delivered vapors to remove therefrom undesired products.

7. In a device for circulating the oil vapors in the crankcase of an internal combustion engine, means for exhausting the oil vapors from the high pressure area of the engine shaft; means for lowering the temperature of the exhausted medium; means for admitting the cooled vapors into the low pressure area of the engine shaft; and means for controlling the flow of the admitted medium in accordance with the temperature of the engine.

8. In a device for circulating the oil vapors in the crankcase of an internal combustion engine, means for exhausting the oil vapors from the high pressure area of the engine shaft; means for lowering the temperature of the exhausted medium; means for admitting the cooled vapors into the low pressure area of the engine shaft; and means for controllably increasing the flow of the admitted medium in accordance with the increase of temperature of the engine.

9. In combination with an engine provided with a substantially sealed crankcase, a circuit for the vapors of the crankcase, comprising a

closed conduit the ends of which are at the uppermost and lowermost portions of the conduit and in vapor conducting communication with substantially spaced upper and lower inner portions of the crankcase, said conduit disposed exterior of the crankcase whereby to modify the temperature of the vapor in the conduit and to establish circulation of the crankcase vapors by convection.

10. In an engine having a rotatable crankshaft the combination of a crankcase for containing lubricant; an outlet from said crankcase for the oil vapors; an inlet to said crankcase for the oil vapors, said inlet and said outlet connected by a conduit disposed outside said crankcase for modifying the temperature of the vapors therein before delivery through said inlet; and means in the conduit for establishing a forced circulation of the vapors therethrough sufficient to cause the vapors to be jetted into the crankcase to reach the low pressure area thereof.

11. In an engine having a rotatable crank shaft, the combination of a crankcase adapted to retain oil; means coacting with the rotating crank shaft during all operations of the engine for abstracting a portion of the air and oil vapors from the crankcase and treating the same; and conduit means for returning said portion to the crankcase.

12. In an engine having a rotatable crank shaft, the combination of a crankcase adapted to retain oil; means for abstracting a portion of the air and oil vapors from the crankcase and treating the same; and conduit means for returning said portion to the crankcase, the points of abstraction and return creating a substantial head for the circulation of said vapors by convection.

13. In an engine having a rotatable crank shaft, the combination of a crankcase adapted to retain oil; and means coacting with the rotating crank shaft during all operations of the engine for delivering a portion of the air and oil vapors from one pressure area of the crankcase to a different pressure area thereof, said means including a conduit disposed outside said crankcase.

14. In an engine having a rotatable crank shaft, the combination of a crankcase adapted to retain oil; and means coacting with the rotating crank shaft during all operations of the engine for delivering a portion of the air and oil vapors from one pressure area of the crankcase to substantially the same pressure area, thereof, said means including a conduit disposed outside said crankcase.

15. In an engine having a rotatable crank shaft the combination of a crankcase for containing lubricant; an outlet from said crankcase for the oil vapors; and an inlet to said crankcase for the oil vapors, said inlet and said outlet connected by a heat exchanging conduit disposed outside said crankcase, said crank shaft constituting means for circulating the oil vapors, the flow of vapors through said conduit existing throughout all operations of the engine.

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