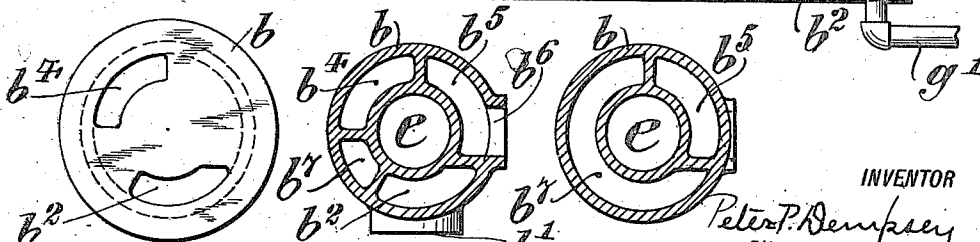
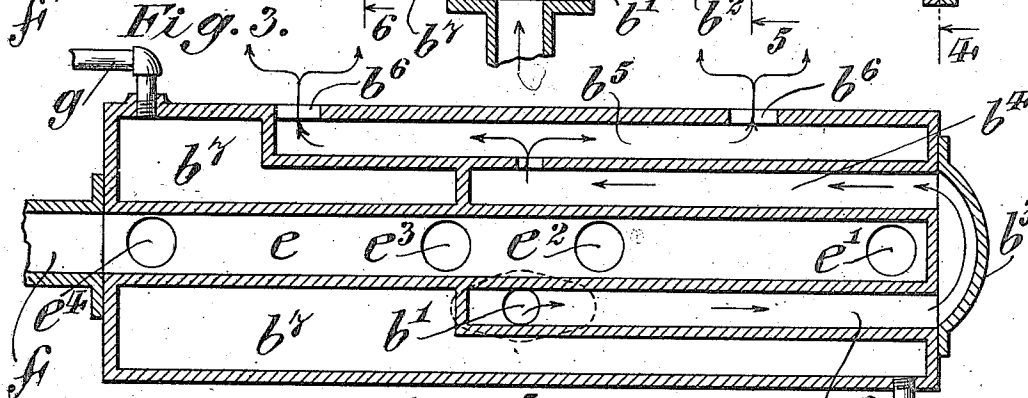
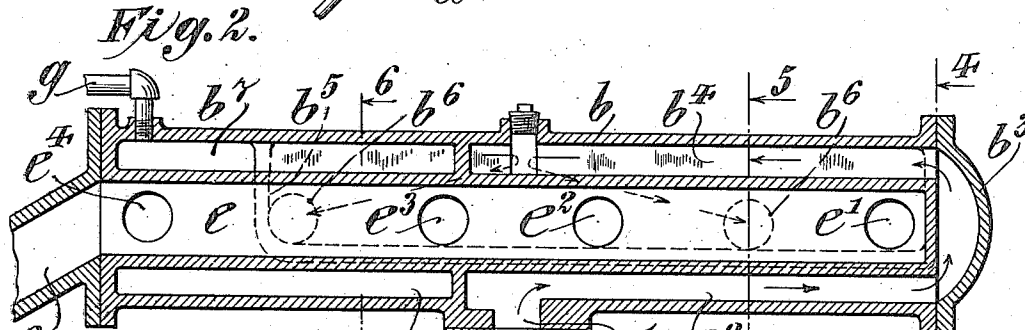
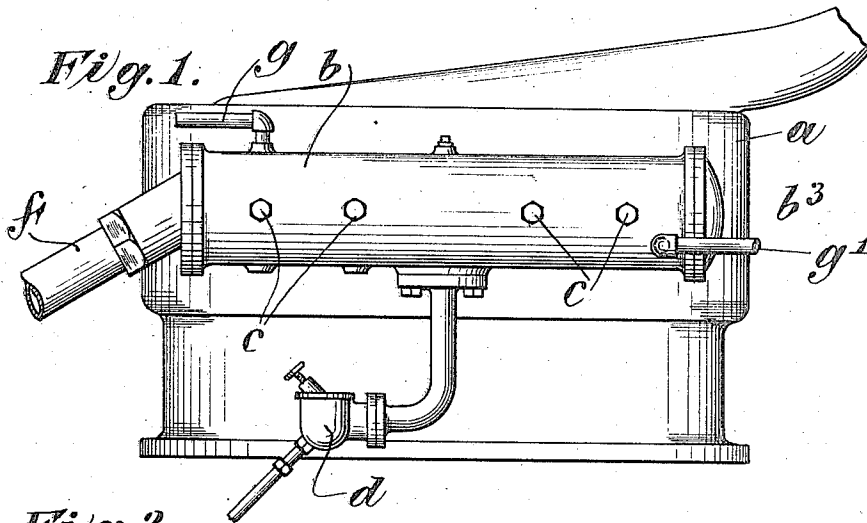


P. P. DEMPSEY.
INTERNAL COMBUSTION ENGINE.
APPLICATION FILED APR. 28, 1916.

1,256,116.

Patented Feb. 12, 1918.



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INTERNAL-COMBUSTION ENGINE.

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To all whom it may concern:

Be it known that I, PETER P. DEMPSEY, a citizen of the United States, residing in the borough of Manhattan of the city of New York, in the State of New York, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification, reference being had to the accompanying drawings, forming a part hereof.

This invention relates to internal combustion engines and is concerned particularly with the provision therefor of heating devices whereby heavier hydrocarbons, such as kerosene, can be successfully used as a fuel. The invention is further concerned with the construction of the heater. It has been proposed to heat a hydrocarbon mixture during its passage from the carbureter into the cylinder by means of the exhaust gases or by means of water from the engine jacket, but the devices for abstracting the heat from such sources have not been of such character as to give that uniform heating which is required for a hydrocarbon gas in order that the gas while converted into a true vapor shall not be heated so excessively as to be cracked. In accordance with the present invention, there is embodied in a heater for the hydrocarbon mixture means for using the heat from the exhaust gases and means for tempering this heat to the desired degree by means of water which may or may not be included in the usual water circulating system. The improved heater is so constructed that a constant amount of heat is supplied to the mixture at all portions and an even temperature maintained throughout in spite of the uneven temperature or unequal amount of heat caused in the heater by the exhaust gases at various points. In accordance with the invention the heater has a central passage into which the several cylinders discharge and the cooling water is led through the heater in a direction opposite to that from which the exhaust gases pass. Further, the volume of this water is proportioned throughout the heater to the sensible heat of the exhaust gases at the various portions. The mixture itself is passed through the heater along channels so disposed with respect to the exhaust gases and the cooling water as to insure the abstraction of suffi-

cient heat to form the mixture into a true gas and maintain it at a temperature below the point at which it would crack. The invention will be described more particularly hereinafter with reference to the accompanying drawings, in which—

Figure 1 is a somewhat conventional view in side elevation of a four-cylinder internal combustion motor to which the improved heater is applied.

Fig. 2 is a view in vertical section through the heater shown in Fig. 1.

Fig. 3 is a sectional view showing a development of the heater.

Fig. 4 is a view in end elevation of the heater taken along the plane indicated by the line 4—4 of Fig. 2 and looking in the direction of the arrows.

Fig. 5 is a sectional view through the heater taken along the plane indicated by the line 5—5 of Fig. 2 and looking in the direction of the arrows.

Fig. 6 is a sectional view taken through the heater along the plane indicated by the line 6—6 of Fig. 2 and looking in the direction of the arrows.

The internal combustion motor *a* to which the improved heater is applied may be of any approved construction and have any number of cylinders, the only requisite being that it be a motor operated by a hydrocarbon fuel. To the inlet manifold of this engine is secured at one side thereof the improved heater *b*, as by means of bolts *c*. This heater communicates with a carbureter *d* of any suitable construction in which the explosive mixture is formed. Since the invention is concerned particularly with the use of the heavier hydrocarbon fractions, and particularly kerosene, the advantages of the heater will be better understood with reference to the difficulties of converting such a heavier hydrocarbon into a true gas at a temperature below its cracking point prior to its introduction into the cylinder.

The heater *b* is preferably formed as a substantially cylindrical chamber through which extends centrally an exhaust passage *e* into which discharges the exhaust ports *e'*, *e''*, *e'''* and *e''''* of the cylinders of a four-cylinder motor, the gases eventually finding their way out through one end of the chamber to the pipe *f*. Cooling water is introduced at one end of the jacket of the chamber

through a pipe *g* and is discharged therefrom at the other end through a pipe *g'*, the flow of water, it is to be understood, being in a direction opposite to that in which the exhaust gases flow through the central pipe *e*. From the development of the heater shown in Fig. 3 it will be evident that the greatest volume of water is to be found nearest the discharge end of the chamber at which point the total sensible heat of the exhaust gases from the four cylinders will be greatest. In fact, for a portion of the length of the heater, the water occupies the entire space between the exhaust pipe *e* and the outer wall. At some point, preferably about midway of the heater, there is provided an inlet port *b'* for the mixture received from the carbureter *d* and from this port the gases are directed away from the discharge end of the exhaust *e* along an arcuate channel *b²* immediately surrounding the cooler end of the exhaust passage to the end cap *b³* at the closed end of the heater. From the chamber formed by the cap *b³* the gases are diverted in their travel and are directed along another channel *b⁴* which is formed in juxtaposition to the exhaust pipe *e*, and led to a point about midway of the heater where they pass into still another channel *b⁵* from which they may be distributed conveniently to the inlet manifold of the cylinders, as through inlet ports *b⁶*. The direction taken by the gases at all times is indicated clearly by the arrows in Fig. 3. Between the channels *b²* and *b⁴* for the mixture there is interposed an arcuate water channel *b⁷* which is disposed immediately outside of the exhaust pipe *e* for reasons which will appear. Except for the space within the heater taken up by the passages *b²*, *b⁴* and *b⁵* for the mixture, water channels are provided, the volume and surfaces of which decrease steadily from the inlet end *g* to the outlet end *g'*.

The purely structural features of the improved heater having been considered, the theory underlying the disposition of the various channels and the apportionment of the several mediums at various portions of the heater must be emphasized in order that the spirit of the invention may be understood. The sensible heat from the exhaust gases at the discharge end of the heater will be, approximately, four times the amount of heat at the extreme inner end of the exhaust pipe *e*, since this inner end, it might be said, is subject only to the heat of the exhaust from the port *e'*, whereas the discharge end of the exhaust pipe is subject to the heat received from the four exhaust ports *e'*, *e²*, *e³* and *e⁴*. Accordingly, if the mixture were passed around the exhaust pipe merely with a view to abstracting heat therefrom, it would receive the different quantities of heat at different portions of

the heater and would also be heated to such a temperature as would cause it to crack. Under these circumstances, the heater has been jacketed, in order that the temperature of the gas might be maintained below a point at which it would crack and the heat of the exhaust be abstracted by the cooling medium to a degree sufficient to equalize the heat distributed thereby at various portions of the heater. To this end, the water jacket in the heater is formed so that the relatively cool water will pass into the jacket from the pipe *g* at the hottest end of the exhaust pipe *e* and in sufficient quantity to abstract that degree of heat from the exhaust gases necessary to maintain the temperature of the exhaust pipe about even throughout its length. As this cold water passes from the heater toward the cooler end of the exhaust pipe *e*, its quantity is lessened by directing it along those channels which are left by the gas passages *b²*, *b⁴* and *b⁵*. Likewise, the cooling surface presented to the exhaust pipe by the water jacket is lessened as the water passes toward the cooler end of the exhaust, since by reason of the constantly diminishing quantity of heat distributed by the exhaust, a correspondingly diminishing quantity of water is sufficient to maintain it at the desired even temperature throughout. In this way, the mixture which enters the port *b'* is subjected to heat from the exhaust gases at the cooler end of the exhaust pipe *e* and to the heat which the cooling water has abstracted from the exhaust gases. By the improved construction of the heater the quantity of heat offered to the explosive mixture is about the same throughout the length of its passages *b²*, *b⁴* and *b⁵* and the temperature of the gases is maintained about even and at least at a point below that at which the hydrocarbon gas would crack.

While the improved heater has been described with some degree of particularity in order that the principle involved may be better understood, it is evident that other rearrangements of the various channels and passages may be made without departing from the spirit of the invention and that the desired apportioned cooling and heating even as between the water, the mixture and the exhaust gases may be secured by such mechanical rearrangements. The scope of the invention is to be ascertained from the appended claims.

I claim as my invention:

1. In combination with an internal combustion engine and a carbureter therefor, a heater for the mixture disposed between the carbureter and the engine having a passage therethrough for the exhaust gases, separate inlet and outlet passages for a cooling medium to lead the medium in its flow in a direction opposite to the direction of flow

of the gases and a passage for the mixture juxtaposed to the passage for the exhaust gases.

2. In combination with an internal combustion engine and a carbureter therefor, a heater for the mixture disposed between the carbureter and the engine having a passage therethrough for the exhaust gases, and separate passages for a cooling medium, the cross-sectional area of which decreases from the inlet end toward the outlet end, the inlet for the cooling medium being disposed at the hotter end of the heater whereby the effective cooling volume throughout is proportioned to the sensible heat of the exhaust gases along the exhaust passage.

3. In combination with an internal combustion engine and a carbureter therefor, a cylindrical heater for the mixture disposed between the carbureter and the engine having a central exhaust passage therethrough, water cooling channels formed around the exhaust passage, inlet and outlet ducts for the water at the ends of the water channels and so disposed with respect to the exhaust passage as to cause the flow of water in a direction opposite to the flow of the exhaust

gases, and a passage for the mixture juxtaposed to the passage for the exhaust gases.

4. In combination with an internal combustion engine and a carbureter therefor, a cylindrical heater for the mixture disposed between the carbureter and the engine and having a central exhaust passage therethrough, water and gas passages formed concentric with the exhaust passage, the gas passage extending throughout only a portion of the length of the heater, inlet and outlet ducts for the water formed at the ends of the water channels and so disposed with respect to the exhaust gases as to cause a flow of water in a direction opposite to the direction of flow of the exhaust gases, the cross-sectional area of the water channels decreasing from the inlet end to the outlet end whereby the volume of water is proportioned to the sensible heat of the exhaust gases, and a common distributing gas passage formed alongside of the heater to distribute the gas to the cylinders.

This specification signed this 11th day of April, A. D. 1916.

PETER DEMPSEY.