A. F. MOHR.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED APR. 21, 1913.

1,200,007.

Patented Oct. 3, 1916

2 SHEETS—SHEET 1.

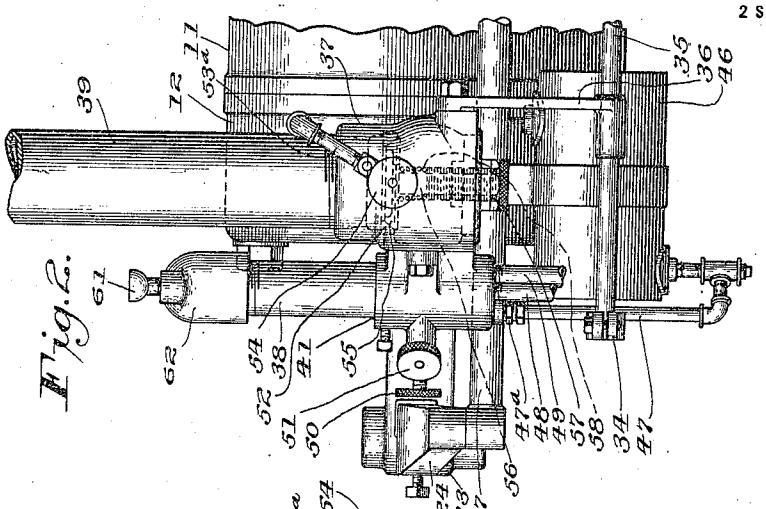

Fig. 2.

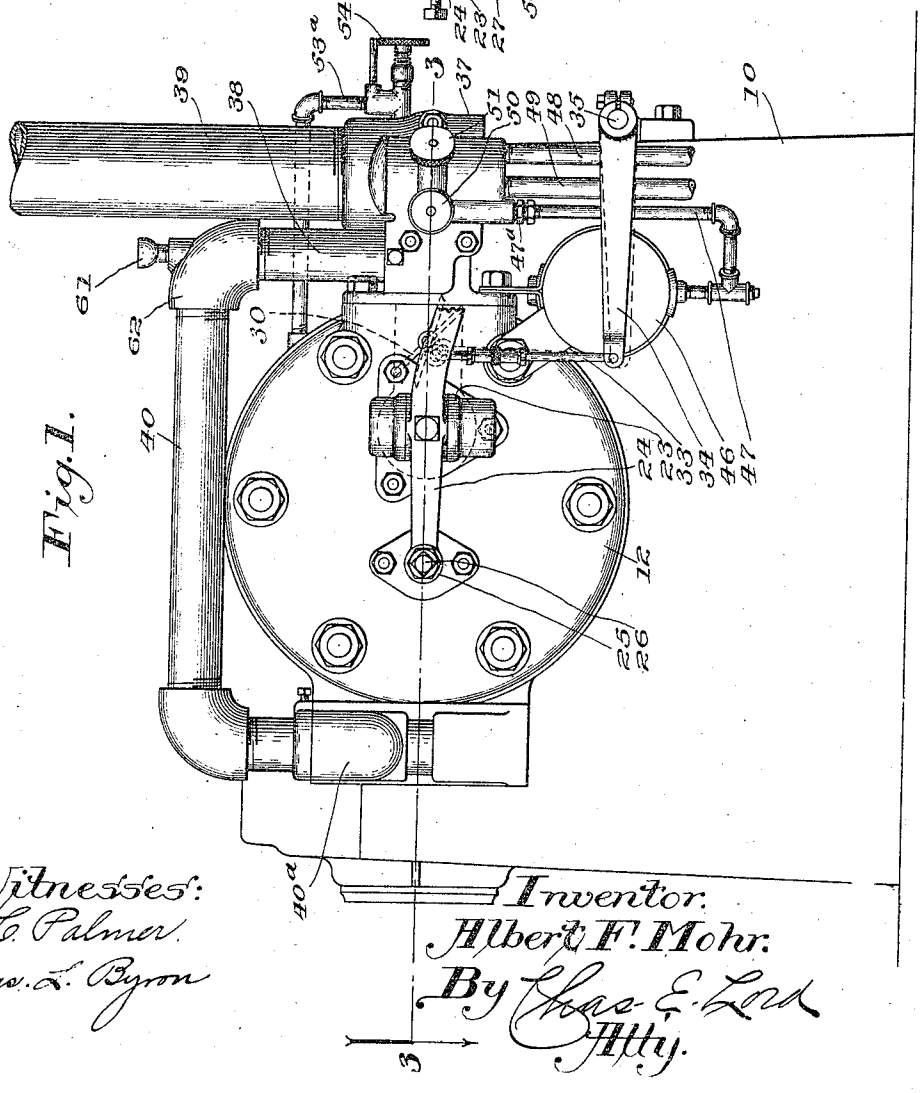

Fig. 1.

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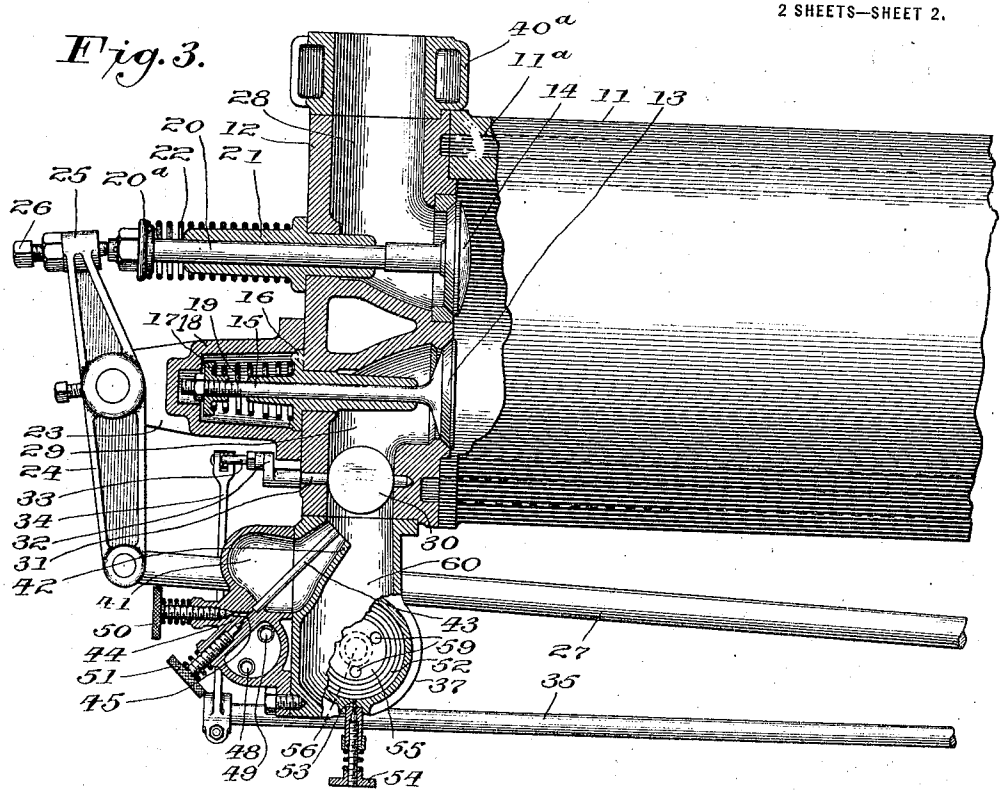
2 SHEETS—SHEET 2.

Fig. 3.



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UNITED STATES PATENT OFFICE.

ALBERT F. MOHR, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO INTERNATIONAL HARVESTER CORPORATION, A CORPORATION OF NEW JERSEY.

INTERNAL-COMBUSTION ENGINE.

1,200,007. Specification of Letters Patent. Patented Oct. 3, 1916.

Application filed April 21, 1913. Serial No. 762,615.

To all whom it may concern:

Be it known that I, ALBERT F. MOHR, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a full, clear, and exact specification.

This invention relates to internal combustion engines.

With the increasing demand for internal combustion engines adapted to burn the relatively heavy fuels, such, for instance, as kerosene and solar oil, engineers have given a great deal of attention to the design of carbureters or mixers for such engines. However, some features, such as the relation of the mixer to the combustion chamber and general coöperative arrangements of the various parts, have been, to a certain extent, overlooked. In the first place, it is necessary to have a good mixer which can deliver to the combustion chamber the proper mixture and the quantity of the explosive under all conditions to meet the requirements for successful commercial operation. It is a well known fact, that more attention has to be given to the supply and proportioning of the ingredients of an explosive mixture where some of the heavier hydrocarbons are used as fuels. Where such heavy fuel oils are used, taking kerosene for example, under certain operating conditions it is necessary to supply water therewith to prevent a too rapid flame propagation, the latter being the cause of knocking or pounding in the engine cylinder. The admission of water to the explosive mixture must, therefore, be properly controlled. Of great importance also is the control of the proper amount of air which forms part of the explosive mixture. As the heavy fuel burning engines are usually started on comparatively light oils, such as gasolene, for reasons well known, such engines should be properly equipped to supply both heavy and light fuels by means of some simple and compact arrangement. Again, in this type of engine where liquid fuel is used, such liquid fuel should be prevented from recondensing on its way to the combustion chamber after it has been vaporized.

It is therefore the object of my invention to control more properly the mixture and supply of fuel to internal combustion engines and to improve the general arrangement of the various parts thereof.

The invention is illustrated on the accompanying sheets of drawings in which—

Figure 1 is an end elevation of an internal combustion engine embodying my invention; Fig. 2 is a fragmentary side elevation of an end portion thereof; Fig. 3 is a fragmentary sectional view taken substantially in the plane of line 3—3 of Fig. 1.

The various novel features of my invention will be apparent from the description and drawings and will be particularly set forth in the appended claims.

Mounted upon a suitable base 10 is an internal combustion engine having a cylinder 11 with a head 12, in which is mounted an admission valve 13 and an exhaust valve 14. The stem 15 of the admission valve is slidably mounted in a guide 16, and one end of said stem is provided with a collar member 17 located within a casing 18. Surrounding the stem 15 and engaging portions of the guide 16 and collar 17 is a spring 19 tending to hold the inlet valve 13 closed. The stem 20 of the exhaust valve 14 is also guided in its movements by a guide member 21, and said stem 20 is provided with a collar member 20^a against which one end of a spring 22 engages, the other end of the spring engaging the guide member 21 and tending to hold the exhaust valve 14 in closed position. The casing 18 forms part of a tappet hanger 23 upon which is pivotally mounted a tappet arm 24 in one end 25 of which is an adjustable screw 26 which engages with one end of the valve stem 20 of the exhaust valve 14 for opening the same under certain conditions. To the other end of the tappet arm 24 is pivotally secured a rod 27 which is operated from a cam shaft (not shown) of the engine for properly timing and causing the opening of the exhaust valve 14, the spring 22 closing the exhaust valve 14 at the proper time. The cylinder head of the engine is provided with an exhaust passageway 28 and an inlet passageway 29, in the latter of which is a mixture throttling valve 30, the stem 31 thereof being mounted in opposite walls of said cylinder head. Secured to one end of the stem 31 is a throttle valve lever 32 which is connected to one end of a governor link 33, to the other end of which link is connected a lever 34, said lever being fastened

to a shaft 35 properly supported by a bracket 36 and connected to an engine governor (not shown). By means of this arrangement the mixture throttling valve 30 is controlled by the engine governor, the proper mixture being supplied to the engine under all conditions of operation.

Secured to one side of the cylinder head 12 is a carbureter or mixer 37 having a main or primary air intake conduit 38 and an auxiliary air intake conduit 39, the main or primary air inlet conduit including a pipe 40, one end 40^a of which is open and surrounds the exhaust passageway 28 leading from the cylinder 11. The other end of the main air intake 38 terminates in a passageway 41 within the mixer 37 and registers with the intake passageway 29 in the cylinder head 12. The passageway 41 is narrowed as it approaches the intake passageway 29 in the cylinder head 12 by a nozzle member 42 which surrounds a fuel supply conduit 43, the latter registering with a gasolene passageway 44 and kerosene passageway 45, the gasolene being drawn up from a supply tank 46 through a suitable pipe 47 and checked from backward flow by a valve 47^a, and kerosene being supplied from any suitable source through an intake pipe 48, the excess kerosene passing out through an overflow pipe 49. The gasolene passageway 44 and kerosene passageway 45 are provided with needle valves 50 and 51 respectively by means of which the supply through said passageways may be controlled. The auxiliary air intake conduit 39 is secured to the body portion of the mixer 37 in which is mounted a ring 52 having an opening 53 therethrough for the passage of water, which is supplied from the water jacket 11^a of the engine through a pipe 53^a, the supply of water being controlled by a needle valve 54. The ring 52 forms a seat for a valve 55 having a stem 56 slidably mounted in a screw socket member 57. A spring 58 is interposed between the valve 55 and screw socket member 57 tending to hold the valve 55 in a closed position, and to normally cover the opening 53 to prevent the supply of water therethrough. The screw 57 may be adjusted to vary the tension of the spring 58 and the force with which said valve is held closed. This poppet valve 55 is provided with a plurality of openings 59 to at all times permit a limited quantity of air to be drawn therethrough into the auxiliary air supply passageway 60 within the mixer 37, said passageway 60 also registering with the intake passageway 29 in the cylinder head 12.

In the operation of the engine the main air supply is through the intake conduit 38, the air passing therethrough being heated after the engine has been in operation for some time due to the fact that one portion 40^a of this main air intake surrounds the exhaust outlet of the engine. In starting the engine, the kerosene and water control needle valves 51 and 54 are turned off to prevent the supply of kerosene and water, and the needle valve 50 is opened to the desired amount to permit a flow of gasolene from the gasolene tank 46, the gasolene being drawn therefrom by the suction of the engine; or for starting purposes, gasolene can be supplied through a priming cup 61 secured to an elbow 62 which forms a part of the intake conduit 38. On the suction stroke of the engine the inlet valve 13 is opened and a quantity of gasolene, depending upon the demand, is drawn through the fuel conduit 43, and air is drawn through the main air passageway 41 and a limited amount through the passageway 60, the gasolene and air mixing just before and as said ingredients pass the mixture throttling valve 30 which is adjusted to the proper position and automatically controlled by the engine governor. After the cylinder walls of the combustion chamber have become sufficiently warm, the gasolene may gradually be turned off and the kerosene turned on. The air being supplied through the conduit 38 and passageway 41 now being heated thoroughly, vaporizes the kerosene which is supplied through the fuel conduit 43, and due to the fact that the distance between the nozzle member 42 or, in other words, the outlet of the fuel to the intake port of the combustion chamber is so short, the vaporized fuel is maintained in such state and is not recondensed. When the load on the engine is below 30 per cent. of its rated horse-power, sufficient quantities of kerosene and air are supplied through the passageway 41 and through the passageway 60, the air passing through the passageway 60 being limited in amount due to the fact that the valve 55 is closed at this time and that the only air which is permitted to enter the passageway 60 passes through the openings 59 in said valve.

As the load on the engine increases above 30 per cent, of its rated horse-power, the mixture throttling valve opens more and more, and a greater quantity of fuel and air are demanded. With this increase in load the suction of the engine increases, and when this increased load exceeds 30 per cent. of rated horse-power, the suction is sufficient to draw down the valve 55, thus drawing in a greater quantity of air through the auxiliary air inlet and causing water at the same time to be drawn into the passageway 60, the water regulating needle valve 54 having previously been opened, the air from both passageways, kerosene and water mixing just before and as said ingredients pass the mixture throttling valve 30 going to the combustion chamber where the explosive mixture

will be ignited and expanded for doing work. The increased amount of air and the supply of water through the passageway 60 are provided for all loads over 30 per cent. of the rated horse-power, the quantity increasing with increase in load. When the engine is operated on light loads, the compression within the combustion chamber is comparatively low and a relatively rich mixture is required for the proper operation of the engine. When the load increases above 30 per cent. of its rated horsepower, the compression is much higher, and with the higher compression a leaner mixture of fuel may be used to good advantage making the operation of the engine economical under all conditions. Water is supplied, not only for the purpose of rendering the explosive mixture more lean, but also for cooling purposes and to prevent a too rapid flame propagation, which is the cause of knocking or pounding in the engine cylinder.

It is evident that various modifications of the arrangement herein disclosed may be made, and it is my intention to cover all such modifications which do not involve a departure from the spirit and scope of my invention as set forth in the appended claims.

What I claim as new is:

1. In combination, an engine cylinder, a head therefor having a fuel passageway, a mixer having main and auxiliary air passageways registering independently and directly with the passageway in said head, fuel supply means in one of said passageways, and a throttling valve located in the passageway in said head.

2. In combination, an engine cylinder, a head therefor having a fuel passageway, a mixer having main and auxiliary air passageways registering independently with the passageway in said head, fuel supply means in said main passageway, and a throttling valve located in the passageway in said head.

3. In combination, an engine cylinder, a head therefor having a fuel passageway, a single mixer having main and auxiliary air passageways registering with the passageway in said head, fuel supply means in one of said passageways, water supply means in another of said passageways, and a throttling valve located in the passageway in said head.

4. In combination, an engine cylinder, a head therefor having a fuel passageway, a mixer having main and auxiliary air passageways registering directly therewith, fuel supply means in said main air passageway, water supply means associated with said auxiliary air passageway, and a throttling valve located in the passageway in said cylinder head.

5. In combination, an engine cylinder, a head therefor having a fuel inlet passageway, a single mixer having main and auxiliary passageways registering with the inlet passageway in said head, means for supplying relatively heavy and light fuels in the main air passageway, and a throttling valve located in the inlet passageway in said head.

6. In combination, an engine cylinder, a head therefor having a fuel inlet passageway and an exhaust passageway, a mixer having main and auxiliary passageways registering with the inlet passageway in said head, fuel supply means in one of said passageways, an air conduit associated with said exhaust passageway and terminating in said main air passageway, and a throttling valve located in the inlet passageway in said head.

7. In combination, an engine cylinder, a head therefor having a fuel passageway, a mixer having main and auxiliary air passageways, both entering the passageway in said head, fuel supply means in one of said passageways, a valve in said auxiliary passageway controlled by the suction of the engine for varying the richness of the mixture, and a mixture throttling valve located in the passageway in said cylinder head.

8. In combination, a cylinder, a head therefor having an inlet passageway, a mixer having a passageway terminating in a nozzle portion registering with the passageway in said cylinder head, fuel supply means within said nozzle shaped passageway, and a mixture throttling valve located in said cylinder head.

9. In combination, an engine cylinder, a head therefor having a fuel inlet passageway, main air supply means, fuel supply means associated therewith adjacent and directed into said cylinder head fuel inlet passageway, engine governor operated means located within the passageway of said cylinder head for controlling the passage of fuel, and supplemental air supply means controlled by the suction stroke of the engine.

10. In combination, an engine cylinder, a head therefor having a fuel inlet passageway, main air supply means, fuel supply means associated therewith adjacent and directed into said cylinder head fuel inlet passageway, an engine governor operated valve located within the passageway of said cylinder head for controlling the passage of fuel, and supplemental air supply means controlled by the suction stroke of the engine.

11. In combination, an engine cylinder, a head therefor having a fuel inlet passageway and an exhaust passageway, a mixer having main and auxiliary air passageways directly registering with the fuel inlet passageway in said cylinder head, fuel supply means within said main air passageway, a hot air connection associated with said exhaust passageway and terminating in said

main passageway, and a mixture throttling valve located in the passageway in said cylinder head for controlling the supply of fuel.

12. In combination, an engine cylinder, a head therefor having a fuel inlet passageway and an exhaust passageway, a mixer having main and auxiliary air passageways directly registering with the fuel inlet passageway in said cylinder head, fuel supply means within said main air passageway, a hot air connection associated with said exhaust passageway and terminating in said main passageway, a mixture throttling valve located in the passageway in said cylinder head for controlling the supply of fuel, and a valve controlled by the suction stroke of the engine within said auxiliary air passageway.

13. In combination, an engine cylinder having a water jacket, a cylinder head having a fuel inlet passageway and an exhaust passageway, a mixer associated with said head and having main and auxiliary air passageways registering with said fuel inlet passageway, fuel supply means in said main passageway, an air supply connection associated with said exhaust passageway and terminating in said main passageway, a water connection from the water jacket of said cylinder to said auxiliary air passageway, and means for controlling the supply of water and air to said auxiliary air passageway.

14. In combination, an engine cylinder having a water jacket, a cylinder head having a fuel inlet passageway and an exhaust passageway, a mixer associated with said head and having main and auxiliary air passageways registering with said fuel inlet passageway, fuel supply means in said main passageway, an air supply connection associated with said exhaust passageway and terminating in said main passageway, a water connection from the water jacket of said cylinder to said auxiliary air passageway, and means controlled by the suction stroke of the engine for controlling the water and air supply to said auxiliary air passageway.

15. In combination, an engine cylinder having a water jacket, a cylinder head having a fuel inlet passageway and an exhaust passageway, a mixer associated with said head and having main and auxiliary air passageways registering with said fuel inlet passageway, fuel supply means in said main passageway, an air supply connection associated with said exhaust passageway and terminating in said main passageway, a water connection from the water jacket of said cylinder to said auxiliary air passageway, means controlled by the suction stroke of the engine for controlling the water and air supply to said auxiliary air passageway, and a mixture throttling valve located in the passageway in said cylinder head.

Chicago, Ill., Apr. 4, 1913.

In testimony whereof I affix my signature, in the presence of two witnesses.

ALBERT F. MOHR.

Witnesses:
R. F. WEBER,
G. L. WIEDEMANN.