Feb. 26, 1924. 1,484,808

G. W. BARTLETT

CHARGE FORMING AND CONTROLLING MECHANISM FOR INTERNAL COMBUSTION ENGINES

Filed Jan. 15, 1921 5 Sheets-Sheet 1

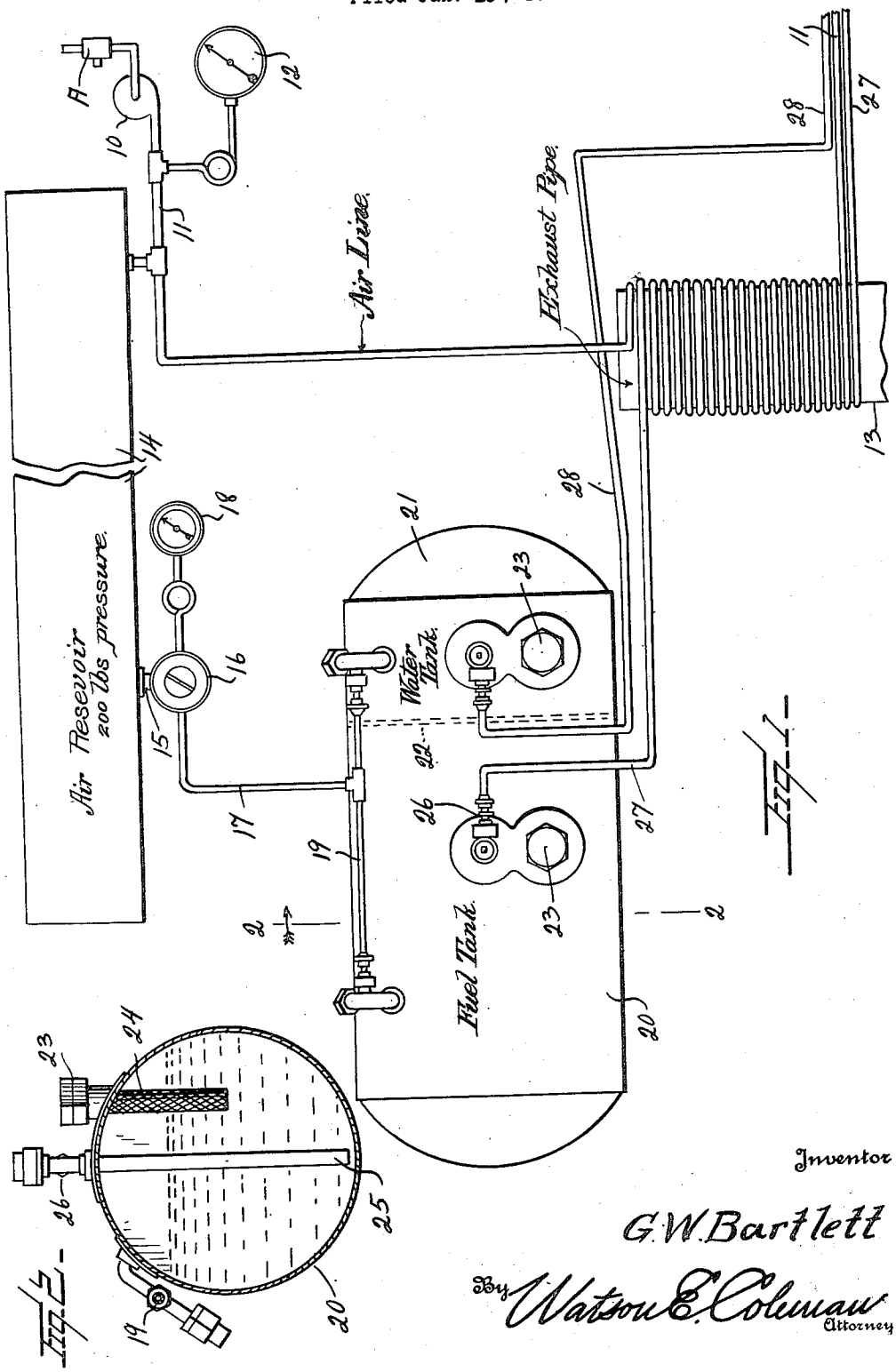


Fig. 1.

Fig. 2.

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Filed Jan. 15, 1921 5 Sheets-Sheet 2

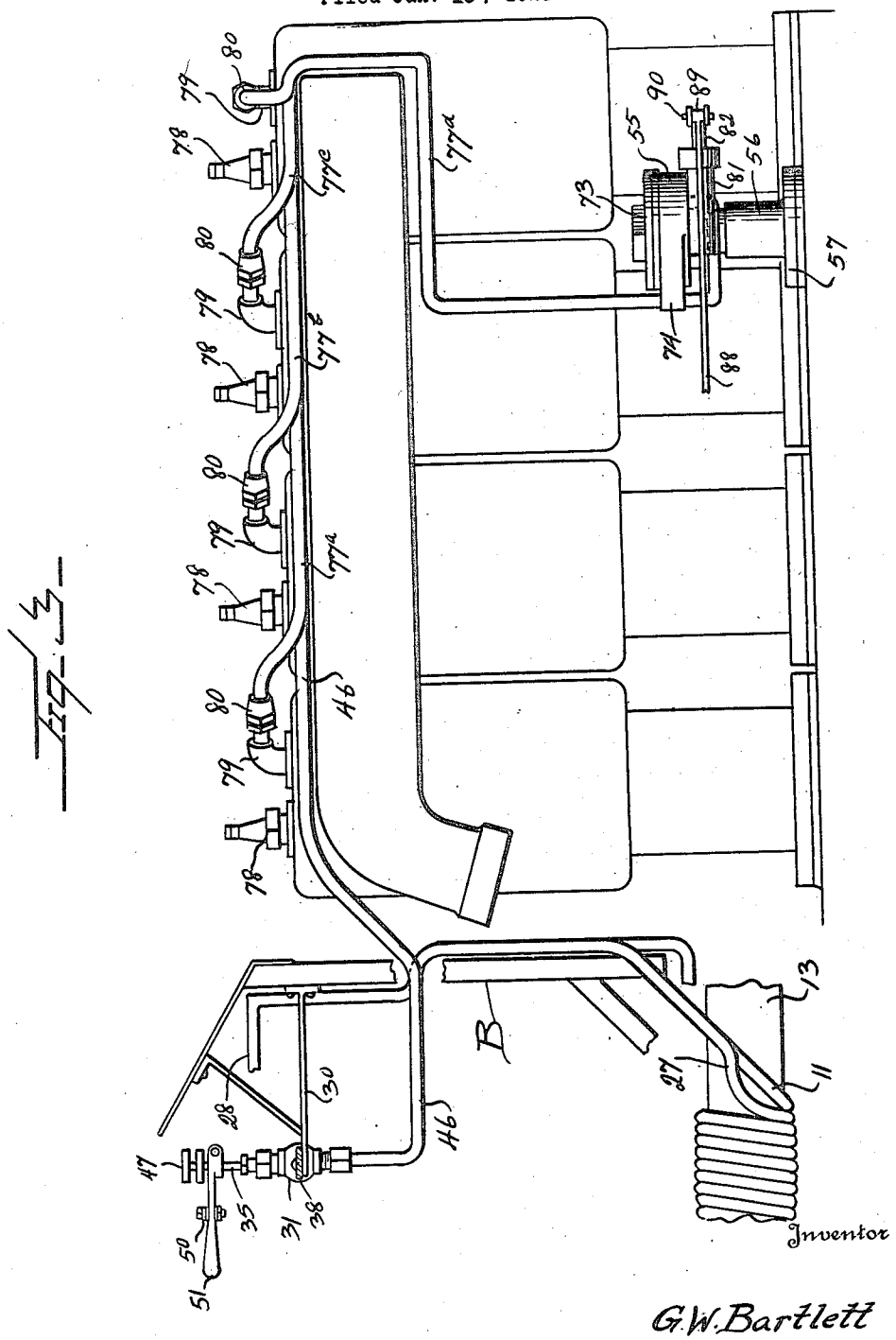


Fig. 4.

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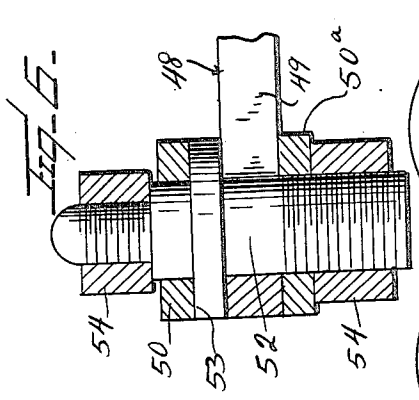
Attorney

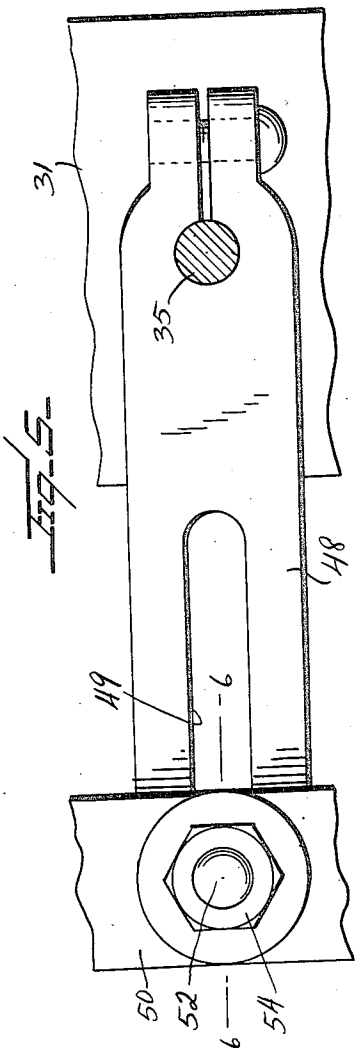
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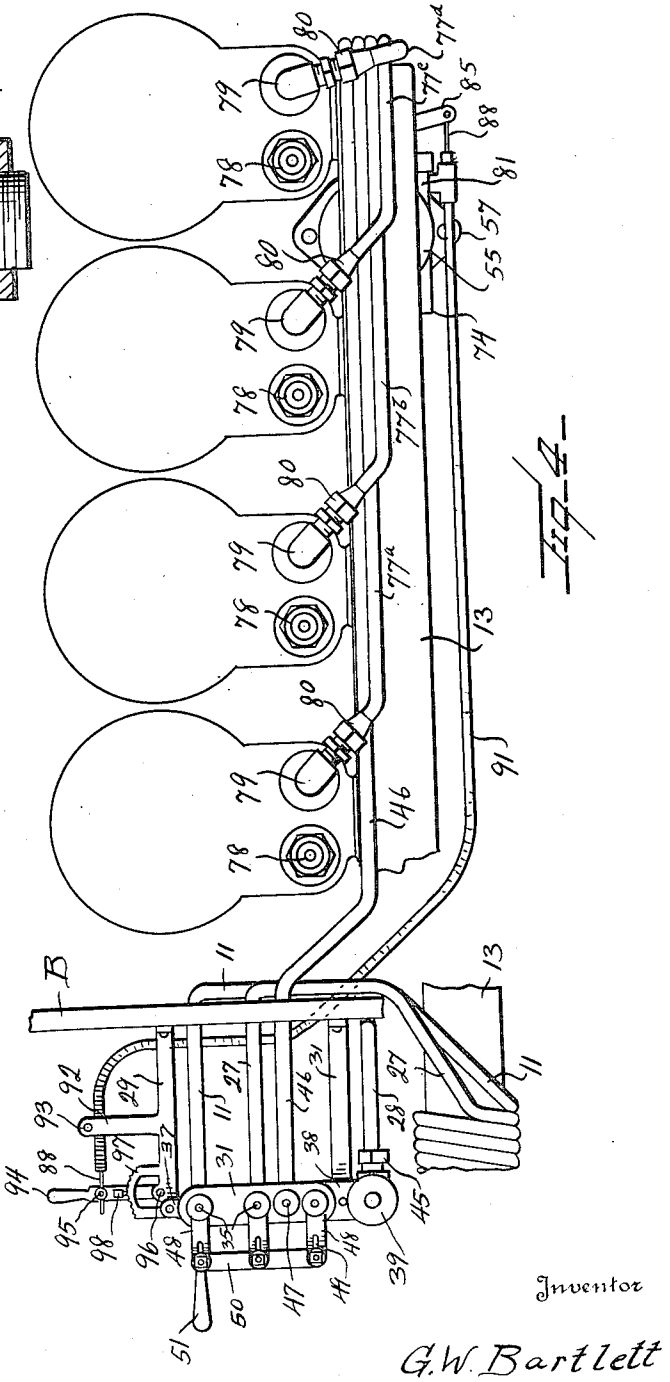
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CHARGE FORMING AND CONTROLLING MECHANISM FOR INTERNAL COMBUSTION ENGINES

Filed Jan. 15, 1921 5 Sheets-Sheet 3







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CHARGE FORMING AND CONTROLLING MECHANISM FOR INTERNAL COMBUSTION ENGINES

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Fig. 7.

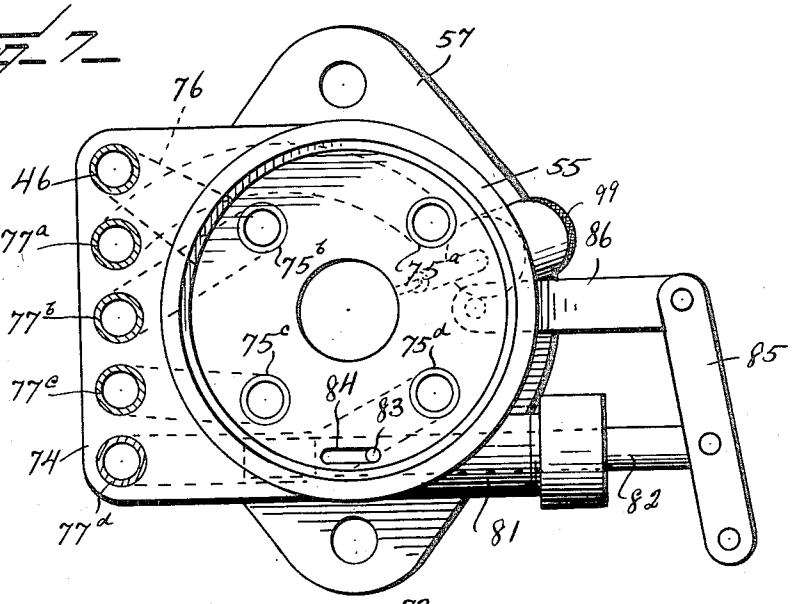


Fig. 8.

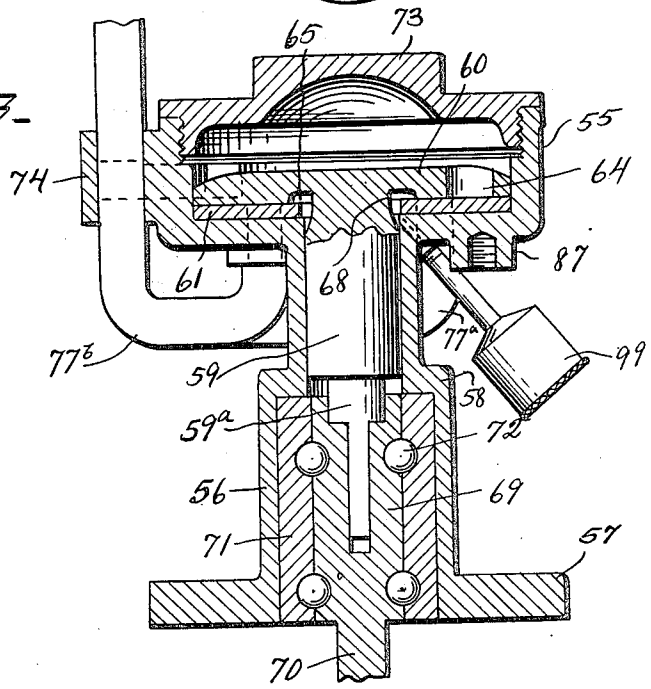
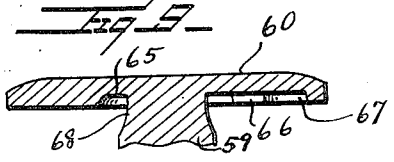


Fig. 9.



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CHARGE FORMING AND CONTROLLING MECHANISM FOR INTERNAL COMBUSTION ENGINES

Filed Jan. 15, 1921 5 Sheets-Sheet 5

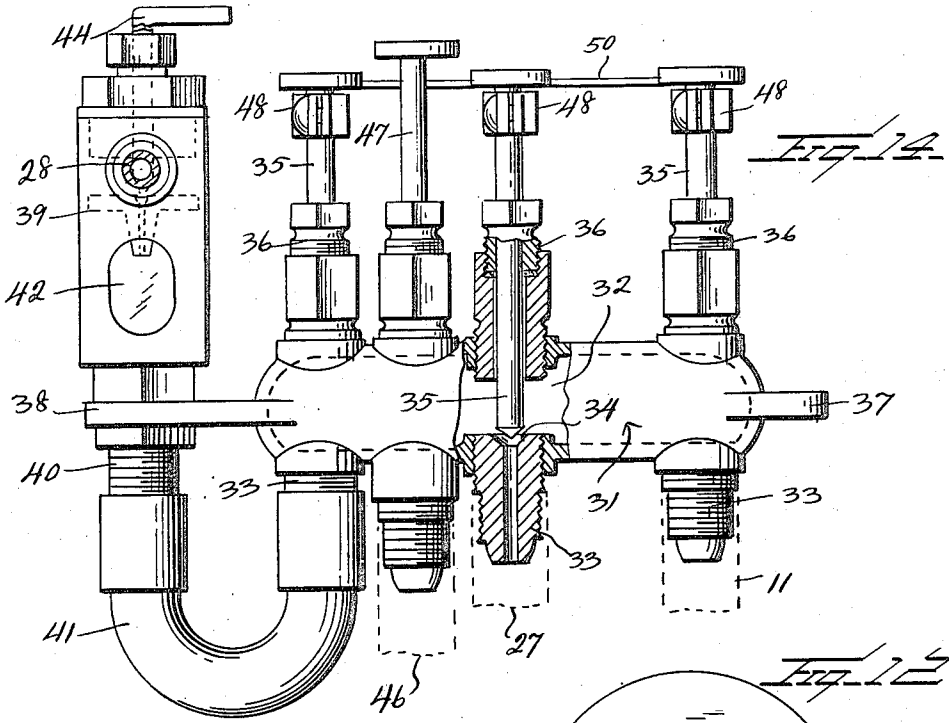


Fig. 14.

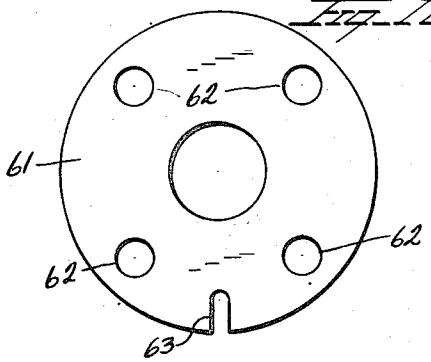


Fig. 12.

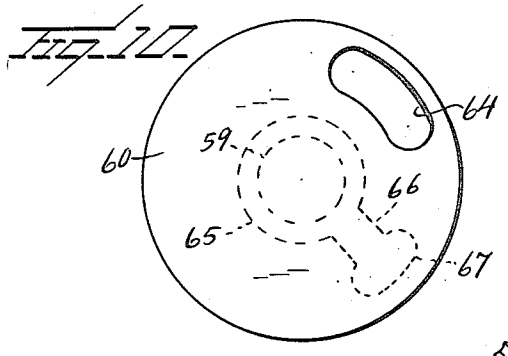


Fig. 10.

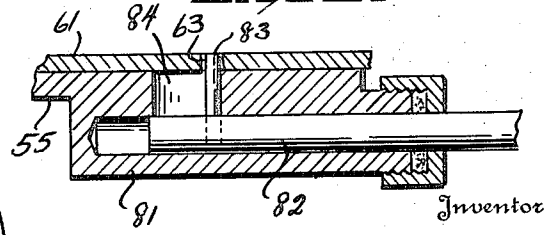


Fig. 13.

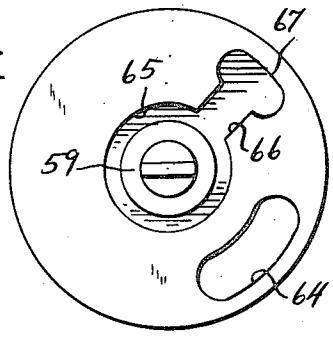


Fig. 11.

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Patented Feb. 26, 1924.

1,484,808

UNITED STATES PATENT OFFICE.

GEORGE WILTON BARTLETT, OF TACOMA, WASHINGTON, ASSIGNOR OF ONE-HALF TO HERMAN C. CRONKRITE, OF TACOMA, WASHINGTON.

CHARGE FORMING AND CONTROLLING MECHANISM FOR INTERNAL-COMBUSTION ENGINES.

Application filed January 15, 1921. Serial No. 437,515.

To all whom it may concern:

Be it known that I, GEORGE WILTON BARTLETT, a citizen of the United States, residing at Tacoma, in the county of Pierce and State of Washington, have invented certain new and useful Improvements in Charge Forming and Controlling Mechanism for Internal-Combustion Engines, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to means for forming charges for internal combustion engines, and particularly to appliances of this character designed to make it possible to use low grade fuel oils with internal combustion engines.

The general object of the present invention is to form and deliver to the cylinders of an Otto cycle engine a combustible mixture, the basic element of which is fuel oil of low volatility.

To accomplish this end a combination of physical processes is required in general as follows: Fuel oil of low volatility is selected because of its relatively low cost. In order to keep the temperature of combustion within practical limits and to avoid carbonization in the engine, water is necessary to the combustible charge. It is desirable to avoid carbonization but it is absolutely essential to avoid prohibitive temperatures and pressures. In order that the low grade fuel oil and the water may be carried through the mixer, distributer and piping of my system, it is necessary to use air under pressure as a propellant for the fuel and water and furthermore to thin the mixture, the air forming a vehicle for carrying the finely divided liquid elements through the system in the form of a vapor or fog. In order to assist the air in making possible its function as a propellant, it is necessary that the air and fuel be heated so as to reduce the viscosity of the fuel to a point where it will flow readily and where it will properly atomize. The elements of the charge must, of course, be brought together and in the process of bringing them together it is necessary that the elements should be atomized. It is, therefore, necessary to bring the elements together in such a way as to secure as intimate a mixture as possible. For this purpose a mixing valve or chamber of peculiar form and construction is provided.

Though the charge leaving the mixer is in the form of a mixture, yet it is not sufficiently finely divided or atomized as to secure complete combustion when the charge is burned in the cylinders. It is, therefore, necessary to provide a mechanism which will complete the mixing of the components of the charge and completely atomize the charge and then measure it out to the individual cylinders.

Other objects have to do with the details of construction and arrangement of parts and will appear more fully hereafter.

My invention is illustrated in the accompanying drawings, wherein:—

Figure 1 is a diagrammatic view of that portion of my apparatus whereby the various components of the fuel charge are forced under pressure to the mixing chamber;

Figure 2 is a sectional view on the line 2—2 of Figure 1 through the fuel tank;

Figure 3 is an elevation of the engine block showing my improved charge forming mechanism applied thereto;

Figure 4 is a top plan view of the structure shown in Figure 3;

Figure 5 is a fragmentary top plan view of one of the levers 48 and its corresponding link;

Figure 6 is a section on the line 6—6 of Figure 5;

Figure 7 is a top plan view of the distributing valve casing with the cover and valve removed, the pipes leading thereto being in section;

Figure 8 is a vertical longitudinal section of the distributing valve;

Figure 9 is a sectional view through the distributing valve head;

Figure 10 is a top plan view of the distributing valve head;

Figure 11 is an under side plan view of the same;

Figure 12 is a top plan view of the throttle valve disk;

Figure 13 is a fragmentary longitudinal section through a portion of the casing of the distributing valve showing the throttle actuating rod;

Figure 14 is a side elevation of the mixing chamber and its valves, the mixing chamber and one of the valves being partly in section.

In Figure 1, I have illustrated diagrammatically the means for feeding the several elements of the charge to the mixing chamber and before describing the mixing chamber and its connections to the several cylinders, I will describe the manner in which these several elements of the charge are fed to the mixing chamber.

In Figure 1, 10 designates an air pump of any suitable character which, it is to be understood, is driven from and by the engine. I have illustrated this air pump diagrammatically, as the particular construction of the pump has no bearing on the present invention. This pump is connected to the engine through the intermediary of an automatic cut-out A, and from the pump extends a pipe 11 by which air is conveyed from the pump. In the length of this pipe 11 there is disposed a high pressure gauge 12 of any usual or suitable construction whereby the pressure of the air as it comes from the pump and in pipe 11 may be indicated. This air pipe 11 extends to any suitable part of the exhaust pipe 13 and is then carried around this exhaust pipe, as illustrated, and is carried from the exhaust pipe to the mixing chamber, as will be later stated.

Connected to the pipe 11 to take air therefrom is an air tank 14 designed to sustain a 200-pound pressure and having an outlet 15 with a reducing valve therein of any suitable or ordinary description, designated 16, and connected to a pipe 17 designed to carry relatively low pressure. This pipe 17 is connected to a low pressure gauge 18 of any suitable character, and the pipe 17 is connected at one end to a header 19. It will be seen that I form a charge in accordance with my invention by forcing air under high pressure, water and low grade fuel under pressure and in proper proportions to a mixing chamber, the air and fuel being heated prior to the introduction to the mixing chamber to a degree which will cause the fuel to flow and be readily atomized. The fuel, air and water as they enter the mixing chamber are atomized so as to secure an initial mixture of the components of the charge. The compressed air which acts as the propellant then carries this mixture under the pressure of the air into a distributer, from which it passes to the engine, the action still being to cause a propulsion of the fuel into the engine by means of the compressed air. It will be seen that the use of compressed air cannot be omitted for the reason that compressed air provides for initial atomization and also for the reason that a second system of fuel supply is not possible when using low volatile fuel. The fuel being heavy must be forced into this and cannot be sucked into place. Some means for providing water for the charge is necessary, as water is a necessary ingredient of the charge in order to preclude excessive temperatures and pressures. Heavy fuel oil can be burned without water and is so burned in Diesel and semi-Diesel engines but these engines are relatively heavy. The Otto engine as used in automobiles and trucks is not very heavy and it is for the purpose of using any fuel oil in these engines that this process and mechanism was devised. Furthermore, the water has the collateral advantage in assisting in the prevention of carbonization in the engine cylinders.

The mixing chamber 31 cannot be omitted, as by this means the ingredients of the charge are brought together and broken up into an initial mixture, which is essential in carrying out my invention. The distributer is an absolutely necessary feature of the construction for the reason that the mixture being under pressure must be valved to the engine. The engine intake valves could not be used for this purpose since they require to handle separately the bulk of the air required for the combustion. Also the distributer cannot be omitted since it provides for final mechanical atomization without which the charge as supplied to the engine would not burn completely. This header 19, through suitable connections which form no particular part of my invention, connects at its opposite ends to the fuel tank 20 and a water tank 21. The fuel tank and water tank are illustrated as being combined, the water tank being separated from the fuel tank merely by the partition or wall 22. The water tank and the fuel tank each have an opening whereby they may be filled, this opening in each case being closed by a cap 23, which cap closes over a screen 24 extending down into the tank.

Extending upward from the bottom of the tank 20 is an outlet pipe 25 which is connected through a suitable and conventional coupling 26 to a fuel pipe 27, which is also coiled around the exhaust pipe 13 and then extends to the mixer. In the water tank there is also a pipe which extends to the bottom of the tank, and which pipe connects by attachments of conventional form to a water supply pipe 28. This supply pipe 28 is not coiled around the exhaust pipe 13, but is carried directly to the mixer, as will now be described. Of course, it will be understood that the upper portions of the tanks 20

and 21 are filled with air under pressure, the pressure being less than in the tank 14, and that this pressure forces the liquid fuel and water out through the pipes 27 and 28 respectively. It will be seen that inasmuch as the pipes 11 and 27 are coiled a large number of times around the exhaust pipe, that the liquids in these pipes will be highly heated.

Mounted upon the dashboard B or in any other suitable location are the brackets 29 and 30 which support the mixer 31. This mixer is an elongated hollow body which surrounds a mixing chamber 32. Extending downward from the bottom of this mixing chamber are a plurality of screw-threaded nipples 33 which may be either formed with the body or engaged therewith in any suitable manner, and with these nipples the fuel, water and air pipes engage, one of these nipples engaging with the charge outlet pipe. Each nipple is formed within the chamber 32 with a valve seat 34, and coacting with each valve seat is a needle valve stem 35 which passes through a suitable gland or stuffing box 36 in any suitable or usual manner. There are four of the nipples 33 and, therefore, four needle valve stems 35. At the ends of the mixing chamber there are outwardly extending lugs 37 and 38 whereby the mixing chamber is adapted to be attached to the brackets 29 and 30, and one of these lugs, the lug 38, is extended up to support upon it the sight feed casing 39. This sight feed casing discharges through a nipple 40 extending down through the lug 38, and this nipple 40 is connected by a pipe 41 to the adjacent nipple 33 so that water may pass through the sight feed casing into the mixing chamber 32. The sight feed device 39 is of common and ordinary form and is so constructed that water will pass drop by drop across the sight opening 42 and through the nipple 40 and pipe 41 and so into the mixing chamber. The amount of water which thus passes is controlled by the needle valve stem 44 in an obvious manner. The pipe 28 passes from the water supply tank directly into the upper end of the casing 39 by means of a nipple or like coupling 45. The air pipe 11 is connected to the first nipple remote from the water connection, and the next adjacent nipple or second nipple 33 is connected to the fuel pipe 27, and the next adjacent nipple is connected to an outlet pipe 46, the outlet through this nipple and the pipe being controlled by a needle valve having a stem 47, which stem extends higher than the stems 35 of the other needle valves.

Attached to the upper ends of all of the needle valve stems 35 are arms 48 which are longitudinally slotted at their extremities, as at 49, all three of these arms being connected by links 50. One of these arms 48 is provided with a handle 51, and it will be obvious that a parallel motion is secured so that an actuation of the handle 51 will cause the same actuation of all three arms 48 and the same actuation of all three needle valve stems 35 so that thus the feed of air, fuel and water is controlled by these three needle valves. These arms 48 are connected to the needle valve stems 35 by means of clamps so that each needle valve stem may be independently set in what may be termed its normal position with relation to any other needle valve stem 35, and then after they are thus set, the several needle valve stems may be coincidently operated. Thus it is possible to adjust the needle valve so that a differential feed of water, air and fuel may be secured to thus secure proper proportioning of the water, air and fuel.

The link 50 is connected to the arm 48 in the manner illustrated in Figure 6, wherein the slot in this arm 48 is shown as having a screw-threaded pin 52 extending through it which is provided with a shoulder 53 and at opposite ends with the nuts 54 between which are disposed the link member 50 and washer 50^a. The same construction applies to the connection between the several arms controlling the several needle valves and the links 50 and 50^a. It will be obvious that these pins 52 may be adjusted, as before stated, in the slots 49 to any desired extent.

From the nipple controlled by the outlet needle valve 47 leads a mixer pipe 46, as previously stated. This pipe 46 extends over the top of the exhaust manifold 13 and then extends downwardly and enters the bottom of a valve casing 55 which constitutes the distributer. This valve casing is approximately cup-shaped in form and has a tubular extension 56 axially arranged which extends downward and then is flanged to form a base 57. The tubular extension is contracted in diameter upward from the point 58 (see Figure 8), and disposed within this contracted portion of the extension is a rotatable spindle 59, and disposed within the case 55 and rotating therewith is a rotatable valve disk 60 which is formed integral with the spindle and rotates therewith. Surrounding the spindle 59 and disposed on the bottom of the casing 55 below the valve head 60 is an oscillatable disk 61 constituting a throttle. This disk 61, as illustrated in Figure 12, is formed with four port openings 62, and at one point on its periphery with a radially extending notch 63. The head or disk 60 is formed as illustrated in Figure 10 with an elongated arcuate slot or port 64 so disposed as to register with the ports 62 as the valve head or disk 60 is rotated. It will be seen from Figures 8 and 11 that at the junction of the stem 59 with the head 60 the under face of this head 60 is annularly recessed, as at 65, and extending radially from this recess 65 is a recess 66 having a cir-

cumferentially elongated portion 67 which sweeps over the port 62 in the travel of this head. The spindle 59 is annularly recessed, as at 68, this recess 68 forming a continuation of the annular recess 65, as indicated in Figure 8. The disk 61 has a central opening which is larger than the contracted or reduced portion of the stem 59 at the point 68.

The stem 59 fits down inside the tubular portion 56 and has a reduced part 59^a which extends down into and has rotative engagement with a rotatable head 69 forming part of a shaft 70 which is driven in any suitable manner at the same speed of rotation as is the timer shaft of the engine. In other words, the speed of rotation of the shaft 70 is exactly the same as that of the timer shaft, the timer not being shown, however, as it forms no part of my invention and is of any usual or ordinary construction. This head 69 is supported within a sleeve 71 by means of ball bearings 72 so that it may have free rotation. The extension 59^a of the spindle 59, while it rotates with the head 69, has slight sliding engagement therein sufficient to permit a slight upward movement of the head 60 for a purpose to be later stated.

The casing 55 is closed by a cap 73, and the body of the casing 55 is formed at one side with the outwardly projecting flange 74 which is perforated for the passage of the pipes leading to the engine cylinders and the pipe 46 leading from the mixing chamber. The bottom of the casing 55 is formed with four port openings 75^a, 75^b, 75^c and 75^d corresponding to the four cylinders and corresponding to the four port openings 62 of the annular disk 61. The side wall of the casing 55 is also formed with an inlet port 76 leading by a duct to the pipe 46, which leads from the mixer and which constitutes the intake pipe to the distributer. Therefore, it will be seen that the mixture or charge will pass from pipe 46 into the upper portion of the casing 55 above the valve head 60 and entirely fill this upper portion of the casing. Connected to the several ports 75^a, 75^b, 75^c and 75^d are the several pipes 77^a, 77^b, 77^c and 77^d. These pipes extend downward from the ports in the bottom of the casing 53, then extend laterally and up through the openings in the supporting flange 74, then extend straight upward, as illustrated in Figure 3, then laterally and then upward, and thence along the upper surface of the exhaust pipe to the several cylinders. I have illustrated these cylinders as being formed each with a pair of spark plug openings and each cylinder as being provided with the usual spark plug 78 and an elbow 79 extending into the extra spark plug opening and connecting operatively with the corresponding pipes 77^a, 77^b, 77^c or 77^d, as the case may be. Forming part of this connection is a check valve casing 80 within which is disposed a check valve of ordinary or suitable construction which will prevent the back flow of fluid to these pipes but will not prevent the flow of fluid into the cylinder upon the exhaust stroke thereof.

The disk 61, as before stated, is a throttle valve disk and is intended to be oscillated to reduce the effective port opening from the casing into the several cylinder supply pipes, and to this end is provided at its margin with the notch 63 previously referred to. For the purpose of oscillating this disk 61, I form the valve casing 55 with a downwardly projecting barrel 81 on its under face, which barrel extends tangentially to the axial center of the casing 55, and disposed within this barrel 81 is a sliding rod 82. This rod carries at one end a pin 83 which projects up through a slot 84 formed in the floor of the valve casing and into engagement with the notch in the annular disk 61. Thus it will be obvious that as the rod 82 is reciprocated, the valve 61 will be oscillated. This rod passes out through a stuffing box which closes the end of the barrel 81, and the extremity of the rod is pivotally connected to a lever 85 which is pivoted at one end to a link 86, which in turn is pivotally connected by a pivot screw to a boss 87 projecting downward from the bottom of the casing. The outer end of this lever 85 is pivotally connected to a fuel control rod 88 which carries a head 89 at one end fitting between the forks of the lever 85 and pivoted thereto by a pivot pin 90. This fuel control rod comprises a steel wire and a flexible tube surrounding the wire, the tube being designated 91. This flexible tube extends up to the inside of the dashboard and then extends through a bracket 92 projecting upward from the bracket 29 and is clamped by this bracket 92 through the intermediary of the set screw 93. The steel wire continues on through the flexible tube and is pivotally connected to a lever 94 passing through a rotatable stud 95 carried on the lever. This lever extends inward and is pivoted at 96 to the bracket 29, and the lever operates over an arcuate rack or sector 97. The lever is provided with any suitable resilient locking means engageable with the teeth of this rack so as to hold the lever set in any adjusted position. This locking means is of conventional form and is designated 98. It will be obvious that by shifting this lever in one direction or the other, the lever 85 will be shifted and this in turn will shift the rod 82 and oscillate in one direction or the other the throttle disk 61, thus bringing the ports 62 of this throttle disk into a greater or less register with the ports 75^a, 75^b, 75^c and 75^d. When the disk is shifted in one direction to its full extent, the port 62 will be carried

out of alignment with the ports leading to the engine cylinders. When the disk is shifted to the other extent to its full degree, the ports 62 will be carried into full alignment with the ports leading to the cylinders and the amount of the effective opening of these cylinder inlet ports will be controlled by the position of this throttle disk in an obvious manner.

The operation of this mechanism will be obvious from what has gone before. The air and liquid fuel components of the charge will be highly heated by the respective pipes passing around the exhaust. The water and liquid fuel will be forced into the mixer under pressure and the air under pressure will be forced into the mixer. The water will pass into the mixer drop by drop through the sight feed and the contact of the water with the highly heated liquid and the impact of the water particles with the liquid particles from the fuel charge and the air under high pressure will cause the complete breaking up and intermingling of the separate components of the mixture and a thoroughly mixed charge will result. This charge, because of the pressure in the mixing chamber, will be carried out through the pipe 46 to the upper portion of the distributor casing 55. As the valve head 60 rotates, the ports 64 will successively connect the ports 75^a, 75^b, 75^c and 75^d with the interior of the distributor casing 63, and as the elongated port 64 sweeps over any one of the ports 62, and, therefore, over any one of the ports 75^a, 75^b, 75^c or 75^d, the charge will pass into the pipes leading to the several cylinders. It is to be understood that the ports of the distributor coincide respectively during the suction stroke for each separate cylinder so that on the suction stroke of each cylinder the ports are opened to permit the inlet of a charge to that cylinder. The length of time within which any one cylinder intake pipe will be connected to the distributor will depend upon the speed of rotation of the head 60 and the length of the slot 63. This head 60, of course, rotates, as before stated, synchronously with the timer of the engine, and thus the charge is distributed or conducted successively to the various cylinders. During the passage of the imperforate portion of the valve head 60 over any of the ports compression, explosion and exhaust takes place in the usual manner. The feed of the several components of the charge into the mixing chamber can be controlled by operating the handle 51, as before stated, and the engine may be throttled down or opened up by operating the fuel control lever 94.

The purposes of the recesses 65, 66 and 67 is to permit lubrication of the valve head 60, throttle valve 61 and the stem 59 of valve head 60 by lubricant discharged from oil cup 99 which discharges lubricant into the annular recess 68. Centrifugal force will carry this lubricant outward to the recess 67 and, therefore, over the upper face of the throttle valve 61 so as to lubricate the contacting surfaces of the throttle valve and head 60.

I do not wish to be limited to the manner in which the air and liquid fuel are heated. Preferably, however, they are heated by the means illustrated, that is through the heat of the exhaust pipe, and it is obvious that extra air superheated and sent into the manifold can be used to increase the efficiency of the engine if so desired. By this construction, low grade oils, such as distillate, kerosene, etc., can be used. There are more heat units in the low grade oils than there are in gasoline or the more volatile hydrocarbons and by making it possible to use the low grade oils, it is possible to double the mileage per gallon over what can be secured from gasoline per gallon. It will be seen that this attachment can be applied to the engine without dismantling the engine in any way, and that this does not interfere in any manner with the usual gasoline carbureting, charge forming and feeding devices. I have not illustrated the usual gasoline carbureter and its connection to the intake manifold of the engine, as this is common in all engines using low grade oils known to me, which engines are started on gasoline and the low grade oils are only put into use as fuel after the engine has been running a predetermined time and become warmed up. This fuel charge forming and feeding mechanism eliminates any deposit of carbon within the engine, and this means that the construction completely vaporizes and mixes the heavy hydrocarbon.

It will be seen that the water is forced into the sight feed pipe 39 under pressure and that the water is taken from the chamber 39 of the sight feed through the pipe 41 by suction.

Feeding oil, steam and superheated air to the engine by causing these elements of the fuel charge to pass into a mixing chamber and then to be drawn into the cylinders of the engine will cause the fuel to be easily ignited and all of the fuel will be burned clean in the cylinders, leaving no carbon on the walls of the cylinders or on the spark plugs. Furthermore, by using the feed system which I have described I have found that the fuel is much easier to ignite in cold weather than it otherwise would be. The amount of fuel fed to the engine is readily adjusted and governed from the seat of the car. This system of feeding has been found particularly clean where heavy oils are used and indeed cleaner with heavy oils than the

ordinary system is with the best of fuel. By the use of this system of feeding, heavy oils may be used, after the car is started, eliminating a large proportion of the expense of operating the car both as to fuel and as to lubricant for the cylinders for the reason that the fuel is used is somewhat of a lubricant itself.

A distributer is used for the reason that the fuel leaving the mixing chamber forms a mixture as it is entering the feed lines to each other, which otherwise would not be properly mixed, but it will be understood that the distributer might feed the oil direct to an intake manifold for the engine instead of directly to the several cylinder heads. On the suction stroke of a cylinder the vapor will be drawn into the cylinder either from a manifold or from the tubes running directly from the distributer. The cut-off in the rotating head gives the amount which should enter each cylinder either for heavy or light duty.

While I have illustrated a preferred form of my invention, I do not wish to be limited to the exact details, as it is obvious that they may be varied in many ways without departing from the spirit of the invention.

I claim:—

1. The combination with an internal combustion engine, of a mixing chamber connected to separate sources of water, air and fuel all under pressure, a distributer having means for intimately mixing the components of the charge and having pipes connected to the individual cylinders of the engine and discharging a charge successively into the several cylinders, the distributer being operatively connected to the mixing chamber.

2. The combination with an internal combustion engine and a mixing chamber, means for discharging water, heated liquid fuel and air all under pressure into said mixing chamber, a carbureting, mixing distributer having pipes connected to the individual cylinders of the engine, and discharging a charge successively into the several cylinders upon the suction strokes thereof, and a pipe connection between the distributer and the mixing chamber.

3. The combination with an internal combustion engine, of a mixing chamber, means for discharging air, water and liquid fuel into the mixing chamber under pressure and preheating the air and liquid fuel before their discharge into the mixing chamber, a carbureting and mixing distributer including a casing, a pipe connection leading from the casing to the mixing chamber, means for controlling the flow of air, water and liquid fuel into the mixing chamber, independent means for controlling the flow from the mixing chamber to the distributer, and pipes connecting the distributer with the individual cylinders of the engine, said distributer including a rotatable element acting to mix the components of the charge successively opening communication between the distributer and said several pipes discharging successively into the several cylinders on the suction strokes thereof.

4. The combination with an internal combustion engine having a plurality of cylinders, of a fuel tank, a water tank, pipes leading therefrom, an air pipe connected to a source of compressed air, a mixing chamber into which said pipes discharge, compressed air operated means for forcing the water and fuel from said water and fuel tanks respectively, means for heating the fuel and air prior to their entrance into the mixing chamber, means in the mixing chamber for atomizing and controlling the inlet of water, air and liquid fuel, a distributer including a casing, a pipe connecting the casing to the mixing chamber, means for controlling the passage of the mixture from the mixing chamber to said pipe, pipes leading from the distributer casing to the several engine cylinders, and a rotatable member disposed within the distributer acting to intermittently mix the charge, said member acting successively to open communication between the interior of the mixing chamber and said last named pipes to cause charges to be successively discharged into the several cylinders upon the suction strokes thereof.

5. The combination with an internal combustion engine having a plurality of cylinders, of a fuel tank, a water tank and air reservoir, means for leading air under reduced pressure from the air reservoir to the fuel tank and to the water tank, a pipe connected to the air reservoir and to a source of air under pressure, a mixing chamber, atomizing nozzles discharging into the mixing chamber and with which the several pipes are individually connected, means for heating the air and fuel in the air and fuel pipes prior to their discharge into the mixing chamber, a distributer having a rotary distributing and mixing member, a pipe leading from the mixing chamber to said distributer, means for controlling the amount of fuel, water and air entering the mixing chamber and for controlling the amount of mixture passing from said chamber to the distributer, and pipe connections from said distributer to the several cylinders of the engine.

6. A process of forming a charge for explosive engines of very heavy or low grade fuel oils which consists in forcing air under high pressure and water and fuel under pressure and in proper proportions to a

mixing device, the air and fuel being heated prior to their introduction to the mixing device to a degree which will cause the fuel to flow and to be readily atomized, atomizing the fuel, air and water as it is discharged into the mixing device and forcing the mixed charge under the pressure of the air to the engine through a distributer and charge measurer whereby to cause definite quantities of the charge to be admitted successively to the cylinders of the engine.

In testimony whereof I hereunto affix my signature.

GEORGE WILTON BARTLETT.