Nov. 5, 1929. F. L. NASH ET AL 1,734,872

HUMIDIFIER FOR INTERNAL COMBUSTION ENGINES

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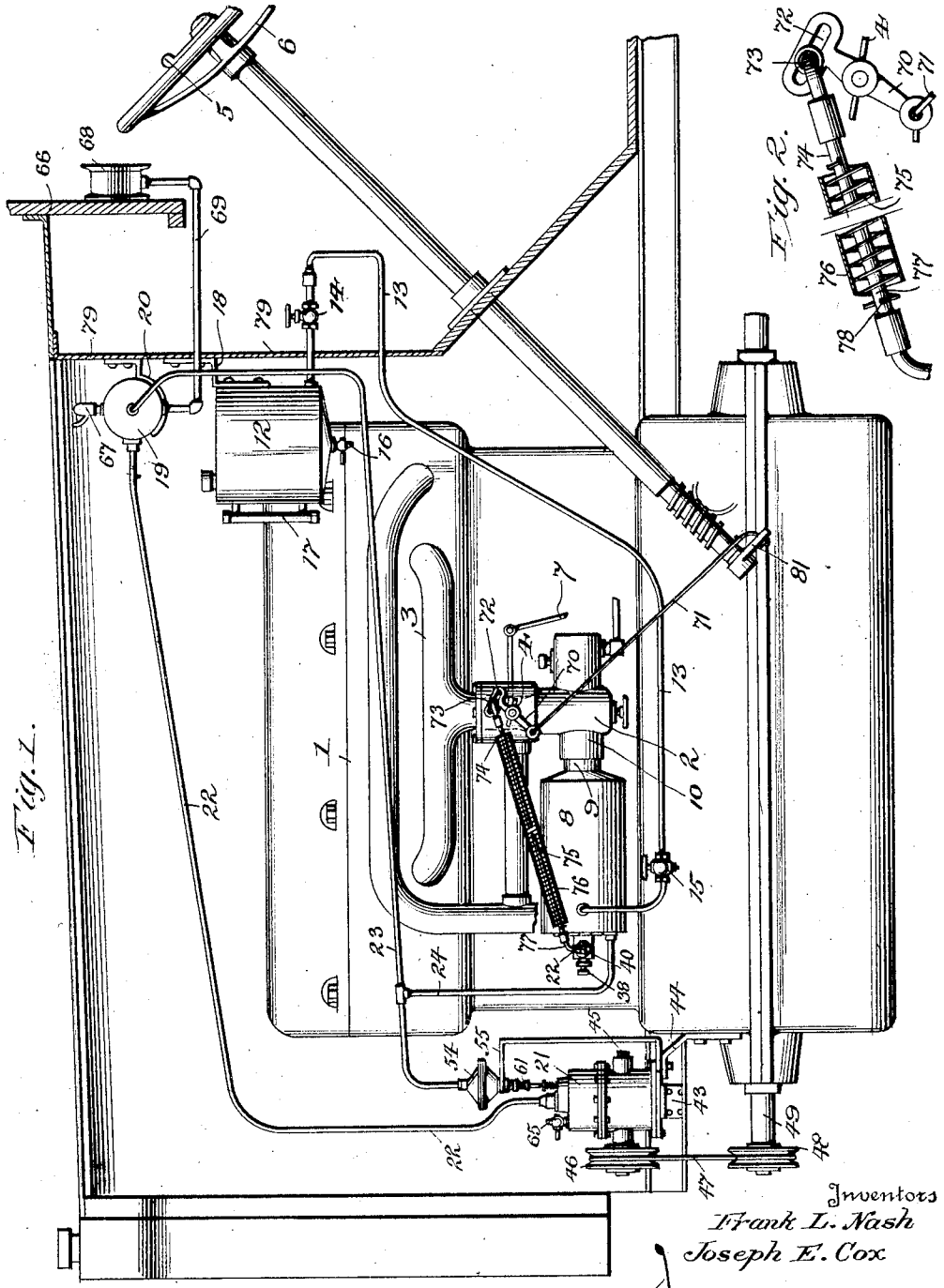


Fig. 1.

Fig. 2.

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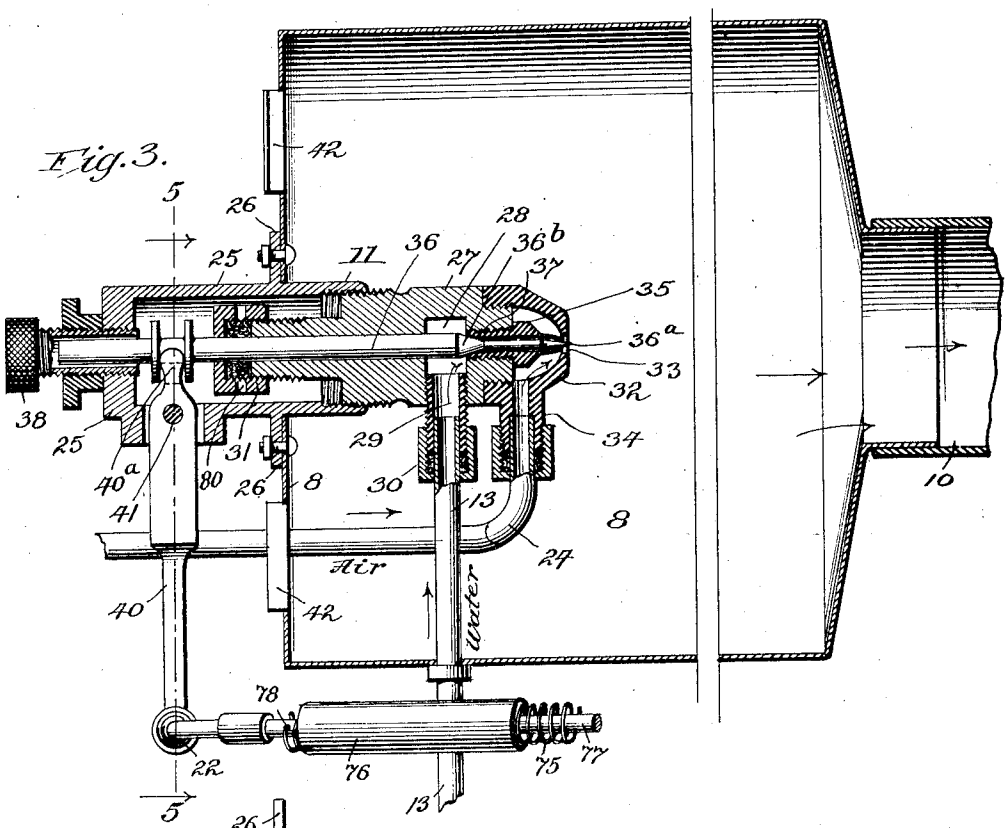
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HUMIDIFIER FOR INTERNAL COMBUSTION ENGINES

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Fig. 3.



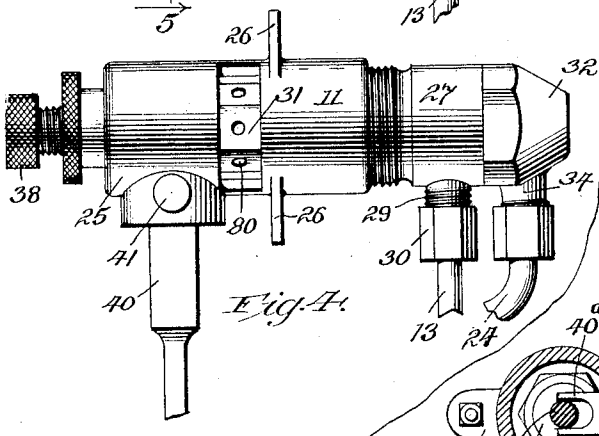
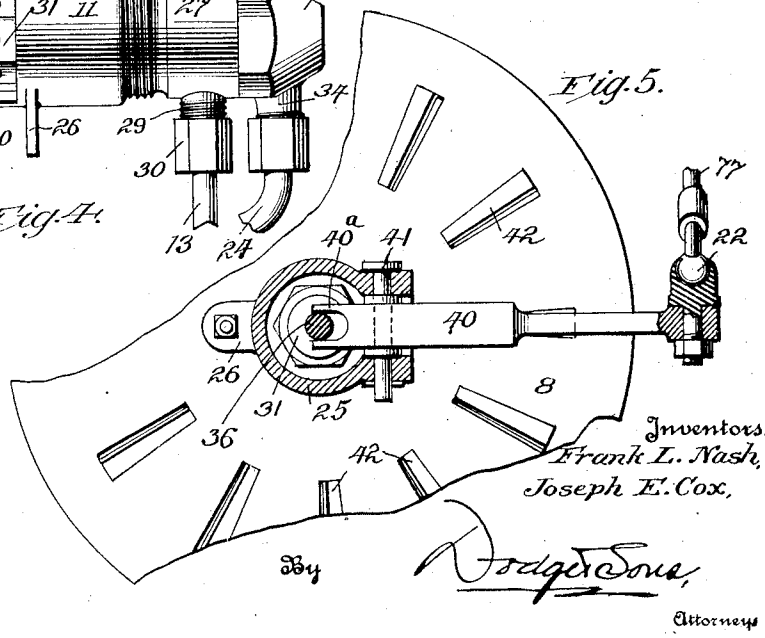


Fig. 4.

Fig. 5.



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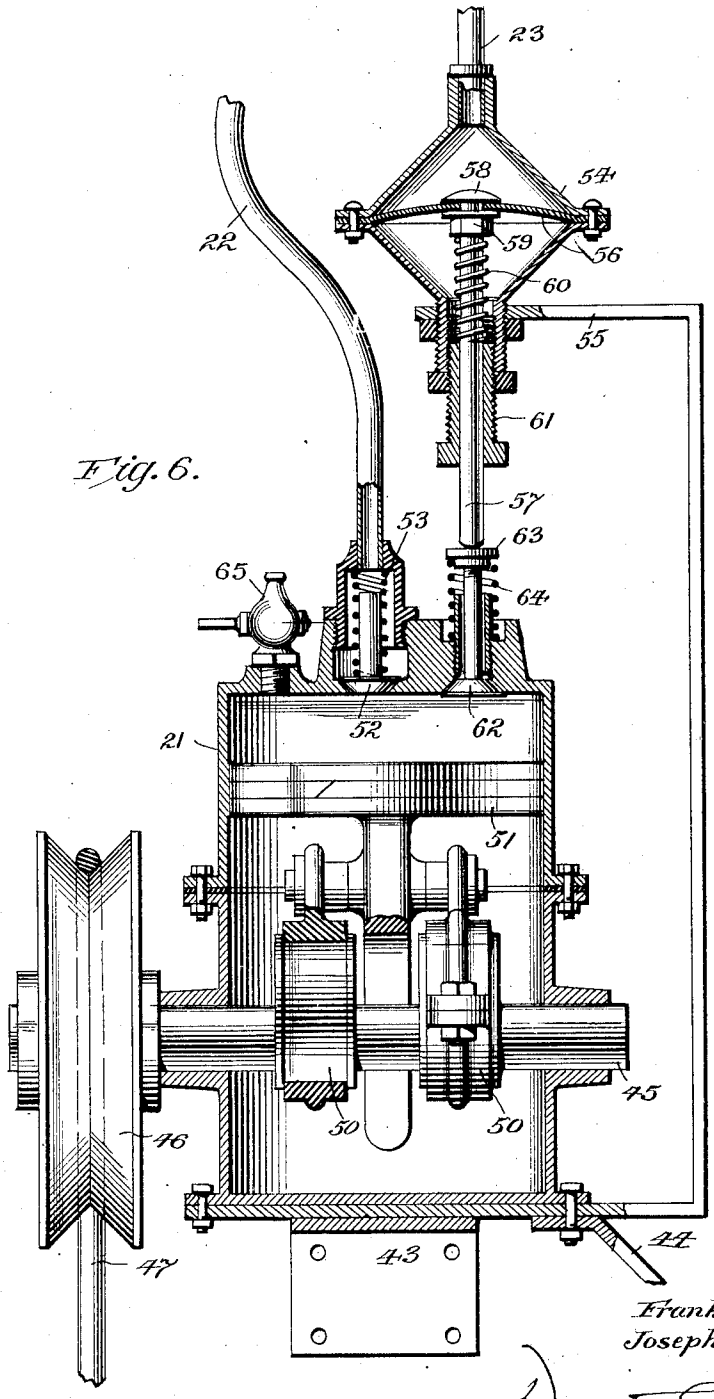
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HUMIDIFIER FOR INTERNAL COMBUSTION ENGINES

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Fig. 6.



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UNITED STATES PATENT OFFICE

FRANK L. NASH AND JOSEPH E. COX, OF ROSEMARY, NORTH CAROLINA

HUMIDIFIER FOR INTERNAL-COMBUSTION ENGINES

Application filed April 19, 1923. Serial No. 271,329.

Our invention relates to humidifiers for internal combustion engines.

It is common knowledge that an internal combustion engine, particularly of the type using gasoline for fuel, runs more efficiently and develops more power at night, or when the atmosphere contains considerable moisture. It has been suggested that improved operation of such engines could be obtained by supplying predetermined amounts of moisture to the engine along with the combustible mixture.

Many devices, of which we are aware, supply moisture to the intake manifold by the suction of the engine so that the supply of water is not only intermittent but the water vapor may enter the engine cylinders in the form of large drops which tend to lower the temperature of the combustible mixture below the point of maximum efficiency, and to cause an accumulation of water in the explosion chamber.

By the use of apparatus embodying our invention water can be supplied to the engine constantly under air pressure and may be broken up into a fine atomized spray. The possibility of large drops of water entering the engine cylinders is thereby avoided and the engine operates more efficiently, fuel consumption being reduced and carbon formation being cut down to a minimum.

We will describe one form of humidifier embodying our invention and then point out the novel features in claims.

In the accompanying drawings,—

Fig. 1 is a side elevation, partly in section, of one form of apparatus embodying our invention, the apparatus being shown as applied to the engine of a motor vehicle;

Fig. 2 is a detail of a portion of the apparatus shown in Fig. 1;

Fig. 3 is a horizontal section through the spray head and mixing chamber associated with the carburetor intake;

Fig. 4 is a detail view of the spray head employed in the mixing chamber;

Fig. 5 is a fragmental view partly in section of the spray head operating mechanism, the section being taken on the line 5—5 of Fig. 3; and

Fig. 6 is a vertical sectional view of the air compressor shown in Fig. 1.

Referring first to Fig. 1, the reference character 1 designates generally an internal combustion engine to which fuel is supplied from a carburetor 2 through an intake manifold 3. A throttle valve 4 controls the fuel supply and is actuated either by a hand throttle 5 mounted on the steering wheel 6, or by an accelerator 7. For the purpose of simplification, the complete accelerator connection is not shown.

Associated with the carburetor 2 is a cylindrical mixing chamber 8 having a restricted portion 9 connected with the intake 10 of the carburetor. The mixing chamber 8 carries at its left hand end, a spray head 11 (Fig. 3) which is adapted to supply and to regulate the moisture supplied to the carburetor. Water is supplied to the spray head 11 from a tank 12 suitably mounted on the dash 79 of the vehicle. As here shown this tank is secured to the dash by means of a bracket 18. This tank is connected with the spray head by a pipe 13 which contains a shut off valve 14 for cutting off the supply of water, and a drain cock 15 mounted adjacent to the mixing chamber 8 for draining off any water which remains in the pipe. The tank 12 also has a sediment cock 16 in the bottom thereof, through which the tank may be drained to prevent the contents from freezing, and to remove any sediment which may collect in the tank after long continued use. A glass gage 17 secured to tank 12 indicates the depth of the water in the tank.

Air is supplied to the spray head 11 from an air tank 19 carried by a bracket 20 suitably secured to the dash 79, compressed air being supplied to this tank by means of a small air compressor 21 through a pipe 22. The tank 19 is also provided with a connection 23 having a branch 24 connected with the spray head 11.

Having pointed out the source of supply of the air and water, we will now describe in detail the structure of the spray head 11.

This spray head comprises a hollow body 25, carrying flanges 26 for securing it to the wall of the mixing chamber 8. The right hand end of the body 25 is internally threaded

for the reception of a hollow plug 27 which contains a water chamber 28. Threaded into the wall of the plug 27 and connecting with the chamber 28 is a threaded nipple 29 to which the water inlet pipe 13 is connected by a screw cap 30. The left hand end of the plug 27 carries a cap 31 with a suitable packing for rendering liquid tight a needle 36 which passes therethrough. Needle 36 has a conical shoulder 36[b] near its pointed end. The packing in cap 31 may be compressed by rotating the cap, suitable openings 80 being provided for the insertion of a tool. The forward end of plug 27 carries a conical shell 32 having an aperture 33 in the front thereof and directly in line with the passageway through the plug. An air connection to the shell 32 is provided by means of an extended portion 34 connected with the air pipe 24. The plug 27 also has threaded into its right hand end a small nipple 35 having a conical needle valve seat 37 in its left hand end and through which passes the needle 36 and which cooperates with conical shoulder 36[b]. In its right hand position this needle contacts with valve seat 37 to prevent water from the chamber 28 from passing out through the nipple 35. The needle 36 has a sharp point 36[a] which in the closed position of the needle valve projects through the opening 33 in cap 32 so as to prevent accumulation of dirt in this opening. Longitudinal adjustment of the needle 36 is provided for by means of a hollow screw plug 38 which may be moved in and out to limit the horizontal throw of the needle 36.

Water entering the chamber 28 from pipe 13 may pass out through the needle valve between seat 37 and shoulder 36[b] and thence through the aperture 33 in shell 32. It will be seen that the relation between shell 32 and nipple 35 is such as to form a substantially annular chamber to which compressed air is supplied from pipe 24. The air entering this chamber under pressure is given a swirling motion of high velocity and when this air encounters the fine stream of water ejected through the needle valve, the water is broken up into a very finely atomized spray. This spray is thrown out axially from the aperture 33 through the mixing chamber toward intake 10 where it is drawn in and mingles with the combustible mixture supplied to the carburetor.

Actuation of the needle 36 is produced by connection with the engine throttle 4. The needle 36 carries two rigid collars mounted thereon and between which moves the forked end 40[a] of a lever 40 pivoted about a pin 41 which passes through a portion of the wall of member 25. Inasmuch as the throttle valve arm 70 swings through a considerable arc in opening the throttle and the needle 36 need have only a very limited movement for controlling the position of the needle valve, a lost motion connection must be provided between these members. As here shown arm 70 is provided with an elongated slot 72 which cooperates with a pivot pin 73 carried by the right hand end of a rod 74. Rod 74 is rigidly connected to one end of a coil spring 75, this spring being arranged for limited longitudinal movement within a casing 76. Attached to the other end of spring 75, at 78, is a second rod 77 which is connected to the needle valve operating arm 40 by means of a ball and socket joint 22. It will be clear that when hand throttle 5 is moved so as to open the throttle 4 the arm 70 will be rotated in a counter-clockwise direction by means of the rod 71 and the lever 81 which are connected with the throttle lever 5. As the arm 70 rotates, the pin 73 connected with the rod 74 transmits motion to the spring 75. When the rod 74 moves toward the left, motion is transmitted through the spring 75 and rod 77 to the needle 36 to open the valve. The resiliency of spring 75 is such as to limit the motion of the lever 40 to a short arc and since the pivot pin 41 is very close to the needle 36, the motion of the needle valve is still further diminished. By varying the tension of spring 75 and the length of the slot 72 in arm 70, any desired relation between the movements of the throttle 4 and the needle 36 may be secured.

We will now describe the compressor 21 which is provided for the purpose of supplying compressed air to the tank 19. As here shown this compressor is secured to the vehicle chassis and to the engine by brackets 43 and 44, respectively. Suitably journaled within the compressor wall is a shaft 45 carrying a pulley 46 driven by a belt 47, this belt being connected to the crank shaft 49 of the engine by a second pulley 48. Secured to the shaft 45 within the compressor chamber are two eccentrics 50 arranged to produce reciprocating motion of a piston 51. The top wall of the compressor is provided with an inlet valve 62, and an outlet valve 52. Inlet valve 62 is normally held in closed position by a light spring 64 but during downward travel of the piston 51 atmospheric pressure is sufficient to overcome the tension of spring 64 so that air rushes into the piston chamber. Outlet valve 52 is biased to closed position by a spring 53 but when piston 51 moves upwardly the pressure of the air overcomes the force of spring 53 and the air is forced out through the valve and thence through pipe 22 to tank 19.

In order to prevent the pressure within tank 19 from exceeding a predetermined amount, here taken as fifteen pounds per square inch, we provide diaphragm valve 54 carried by a suitable bracket 55 secured to the casing of the compressor. This valve contains a diaphragm 56 which is movable downwardly whenever pressure in pipe 23

builds up above the amount for which the device is set. The diaphragm 56 operates a pin 57 suitably secured thereto by a head 58 and a nut 59. This diaphragm is normally biased to its upward position by a spring 60 held in position and at any tension by an apertured plug 61. The pin 57 is arranged to contact with a head 63 on valve 62 and to open this valve whenever the pressure above diaphragm 56 builds up above the amount for which spring 60 is adjusted. The valve 62 is therefore adapted to operate both as an inlet valve for the compressor, and as an unloading valve in case the pressure within tank 19 exceeds a predetermined amount. Whenever the piston 51 moves downward, air is drawn in through the valve 62 and when the piston 51 moves upwardly this valve is held closed by the pressure built up above the piston. If the pressure in tank 19 exceeds fifteen pounds per square inch, the diaphragm 56 is moved downwardly due to pressure accumulating in pipe 23 so that valve 62 is opened to allow the air within the compressor to escape. In case it is desired to cut off the supply of compressed air to the tank 19, we provide an escape cock 65 which may be opened.

As an additional safeguard against excessive pressure being generated within the tank 19, a safety valve 67 is associated therewith, and the valve may be set to allow the air within the tank to escape whenever the pressure therein exceeds a predetermined amount. A pressure gage 68 mounted on the instrument board 66 of the vehicle is supplied with air pressure from tank 19 through a pipe 69, and indicates to the driver of the vehicle what the air pressure within the tank is.

The operation of the device is as follows:—

Whenever the engine is running, the compressor 21 operates to supply compressed air to the tank 19 and this air is delivered to the spray head 11 through pipes 23 and 24, and thence to the opening 33 in the front of the spray head where it escapes. When the air pressure in tank 19 builds up to a suitable amount, the valve 14 on the dash of the vehicle is opened allowing water from the tank 12 to feed by gravity through pipe 13 to the chamber 28 of the spray head. When the throttle of the engine is opened the needle 36 of the spray head needle valve is moved to the left far enough to open the valve and allow water from the chamber 28 to escape to the inside of the nipple 35 and reach the opening 33 in the front of this nipple. At this point the water encounters the swirling air which is supplied to the interior of the cap 32 from the pipe 24 and is broken up into a fine atomized spray which is forced outwardly through the mixing chamber 8 to intake 10 where it is drawn through the carburetor 2 and into the engine cylinders along with the combustible mixture from the carburetor.

External air for the carburetor enters the mixing chamber 8 through louvers 42 and enters the carburetor intake 10 along with the atomized water from spray head 11. As the speed of the engine is varied by opening and closing the throttle valve 4 the needle valve opens and closes to vary the amount of atomized water supplied to the intake manifold and by suitable initial adjustment of the lever arms, the supply of water may be made to produce the most efficient operation of the engine for each amount of fuel which is supplied thereto.

It will be manifest that the humidifying apparatus which we have described is suitable for use in combination with any internal combustion engine and that the structure which we have described can be applied to an engine without material modification of the normal working parts thereof.

Although we have herein shown and described only one form of humidifying apparatus embodying our invention, it will be obvious that various changes may be made in the details thereof, within the scope of the appended claims, without departing from the spirit and scope of our invention.

What is claimed is:—

1. The combination with an internal combustion engine having a carburetor, of a source of water; a source of compressed air for atomizing the water; a mixing chamber connected to said carburetor; a spray head axially disposed within said chamber and connected with said source of water and with said source of compressed air; and means controlled by the engine throttle for varying the amount of water supplied to said spray head.

2. The combination with an internal combustion engine having a carburetor; a mixing chamber connected with the intake of said carburetor; a spray head within said chamber disposed in axial alinement with said intake; means for supplying water to said spray head; and means controlled by the engine throttle for varying the amount of water supplied to said spray head.

3. The combination with a gasoline engine having a carburetor, of a mixing chamber connected with said carburetor; a spray head axially disposed within said chamber; means for supplying water to said spray head; means for supplying compressed air at constant pressure to said spray head; and means controlled by the engine throttle for controlling the water supplied to said spray head.

4. The combination with an internal combustion engine, having a carburetor, of a mixing chamber connected with the intake of said carburetor; a spray head axially disposed within said chamber; means for supplying compressed air at constant pressure

to said spray head; means for supplying water to said spray head; and a needle valve within said spray head for controlling the supply of water to said head, said valve being actuated from the engine throttle.

5. The combination with an internal combustion engine having a carburetor, of a mixing chamber connected to the intake of said carburetor; means for supplying water to said chamber; a compressed air tank; an air compressor for supplying air to said tank; means for limiting the pressure in said tank to a predetermined value; means for supplying air from said tank to said chamber for atomizing the water supplied thereto; and lost motion means controlled by the engine throttle for controlling the amount of water supplied to said chamber.

6. The combination with an internal combustion engine and a carburetor therefor, said carburetor having a substantially horizontally disposed air inlet; of a spray head mounted adjacent said inlet and having an outlet aperture in axial alinement with said air inlet; means for supplying water to said spray head; a source of compressed air for atomizing the water and spraying it axially into the air inlet; and means controlled by the engine throttle for varying the amount of water supplied to said spray head.

In testimony whereof we have signed our names to this specification.

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JOSEPH E. COX.