This invention relates generally to devices for mixing air and liquid fuel into a proper fuel-air gaseous mixture, and particularly to a charge forming device wherein liquid fuel is introduced into an air stream in a circular path, so that the fuel is distributed equally across the air stream.

The apparatus according to the present invention makes use of an air driven device having vanes causing rotation of the device within an air stream, the vanes being automatically varied in pitch to regulate within close limits the proper fuel-air mixture. The structure according to the invention includes a pump driven by the air driven device to exert pressure against nozzles rotating in the air stream. By reason of adjustment of the pitch of the vanes the spinning effect can be nicely adjusted, the sweeping of air past the nozzles lessened, all to avoid over enrichment for high speed operation, extra enrichment for idling and load conditions being also accommodated.

With the foregoing considerations in mind it is a principal object of the invention to provide a charge forming device characterized by structure for introducing liquid fuel evenly across an air stream.

Another object is to provide a charge forming device wherein the fuel is introduced into an air stream in a swirling rotative path, and to regulate the amount of rotation of the structure introducing the liquid fuel.

Still another object is to provide a charge forming device having vanes rotating in an air stream to be charged with fuel, and to regulate the pitch of the rotating vanes in accordance with the speed of the air stream to control the rate of charging fuel to the air stream.

A yet further object is to provide a pump having axial delivery to charge forming nozzles of a charge forming device having structure for introducing fuel in a swirling and rotative path across a moving air stream.

Other objects and important features of the invention will be apparent from a study of the specification following taken in conjunction with the drawing which together describe and illustrate a preferred embodiment of the invention, and what is now considered to be the best mode of practicing the principles thereof. Other embodiments of the invention may be suggested to those having the benefit of the teachings thereof hereof, and such embodiments are intended to be reserved especially as they fall within the teachings of the aforesaid claims.

In the drawing:

FIG. 1 is a longitudinal sectional view through a charge forming device according to the present invention; and

FIG. 2 is a side view of a portion of the device showing a movable vane for regulating the speed of a motor forming part of the device.

Referring now to the drawing, the improved charge forming device according to the present invention is referred to generally by the reference numeral 10 and includes an air horn 11 secured in any convenient fashion to the inlet manifold of an internal combustion engine, both of the latter being shown. The air horn includes a butterfly valve 12, opening with a rock shaft 13 actuated by a throttle linkage 14 for the purpose of speed control.

The air horn 11 has a support spider 16 for the conventional air filter 17 which has a central opening 18 for a fixed shaft 19 for the charge forming device 10, shaft 19 having a threaded end receiving a hold-down wing nut 21 for filter 17.

The charge forming device 10 is adapted to be supplied with liquid fuel supplied by a line 22 to a float bowl 23, the level of which is controlled by the conventional float 24 and float actuated valve 26. The float bowl 23 may conveniently be secured to the side of an air horn 11, as shown, or at any other convenient place. Float bowl 23 is connected to charge forming device 10 by a rigid fuel line 27 extending through the wall of horn 11 at a sealing grommet 28, the rigid fuel line 27 being connected at a coupling 29 to a tubular portion 31 of the fixed shaft 19.

The charge forming device 10 comprises an air stream operated motor indicated generally by reference numeral 30 and consisting of a motor casing 32 having a top closure 33 threaded thereto, and having an opening 34 centrally thereof for the fixed shaft 19. Motor casing 32 has a lower closure 36 and an opening 35 for tubular portion 31 and threaded thereto. The casing 32 is divided into a first speed control chamber 37 and a metering chamber 38 by a seal member 39 supported on an annular flange 41 extending inward of the casing 32. Fixed shaft 19 has a flange 42 resting on seal 39.

The motor casing 32 is caused to rotate on fixed shaft 19 by vanes 43 fast on shafts 44 extending through openings 45 in motor casing 32 and supported in a collet 46 which is not fast to fixed shaft 19. A bearing 47 is interposed between collet 46 and a crown gear 48 having crown teeth 49 meshing with pinion teeth 51 formed on the shafts 44. Rotation of the vanes 43 along their axes and crown gear 48 along its longitudinal axis is restrained by a spring 52 having its lower end 53 secured to crown gear 48, and its upper end secured at 54 to the closure 33.

The level of the fuel in float bowl 23 rises almost to orifices 56 in the tubular portion 31 of fixed shaft 19, and suction is created within the metering chamber 38 to lift the fuel up and past the orifices 56. The suction is created by the air moving past a plurality of spray tubes 57 terminating in nozzle tips 58 for atomizing the fuel. Spray tubes 57 are held in the lower closure 36 and communicated with the bottom of metering chamber 38. A gasket member 59 bearing against a flange 61 on tubular portion 31, and with closure 36 serves to seal the bottom of chamber 38 against leakage.

The metering chamber 38 has a helical pump 62 having the pitch on the vane thereof decreasing from the top of chamber 38 to the bottom thereof. Helical pump has the periphery of its scroll turning with motor casing 32.

The operation of the charge forming device thus far described is believed apparent from the description thus far, but it may be noted that the cranking of the engine causes the vanes 43 to rotate with motor casing 32 in the air stream created by the engine suction. The nozzle tips 58 rotate with the motor casing 32, such rotation creating suction at the nozzle tips, the suction being manifested by passing the helical pump 62 and at the top of hollow tube 31 to lift the fuel up to orifices 56 and through the same. When ignition of the engine takes place, the increasing velocity of the air stream causes the vanes 43 and motor casing 32 to turn more rapidly, thereby increasing the suction effect at spray nozzle tips 58. The suction at the orifices 56 is augmented by the pumping action of the helical pump 62 which operates to increase the flow of fuel as the engine increases its speed.

However, the over enrichment of the fuel-air mixture provided by slowing down the rotation of the motor casing 32 and the vanes 43. The pressure of the air stream is operable to turn the vanes 43 on their shafts 44, at the same time turning the crown gear 48. This turning movement of crown gear is opposed by the winding of spring 52.

As the rotation is slowed down, the suction effect is decreased, as is also the pumping effect of helical pump.
62. Since the velocity of the air stream varies, the speed of the motor casing 32 and spray nozzles 58 will likewise be varied, so as to control the fuel-air mixture for all conditions of throttle opening.

Since the spray nozzles 58 turn at all times, the fuel will be sprayed uniformly across the entire area of the air horn.

It is to be understood that the foregoing particularization is for the purpose of illustration only, and that many changes in the construction and design may be made without departing from the spirit and scope of the present invention, as defined by the claims here appended.

I claim:

1. In a charge forming device for an internal combustion engine, an air horn leading to the intake manifold of such engine, a fixed shaft extending longitudinally of said air horn, a lower portion of said shaft being hollow and connected to a level controlled supply of liquid fuel, a motor casing turning on said fixed shaft including first and second chambers therein, a plurality of vanes turning with said motor casing including means for mounting said vanes for change in pitch according to the intensity of the air stream movable in said horn, means in one of said chambers yieldably constraining said vanes against a change in pitch, nozzle means connected to said second chamber and rotating with said motor casing, means connecting said hollow shaft portion with said second chamber whereby upon rotation of said motor casing and said nozzle means fuel will be introduced in said air horn at said nozzle means from said level controlled supply.

2. The invention according to claim 1 wherein said vane means are constrained by spring means at said first chamber.

3. The invention according to claim 2 wherein said vanes turn with pinions cooperating with gear means operatively connected to said spring means.

4. The invention according to claim 1 wherein said hollow shaft has at least one orifice therein above the level of said supply whereby upon rotation of said nozzle means suction will be manifested against said fuel to lift same into said second chamber for distribution by said nozzle means.

5. The invention according to claim 1 wherein said second chamber has a pump operated by said motor casing for augmenting the suction on the fuel in said hollow shaft.

6. The invention according to claim 5 wherein said pump is a helical pump having changing pitch on the vane thereof.

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HARRY B. THORNTON, Primary Examiner.

RONALD R. WEAVER, Examiner.