

Dec. 6, 1955

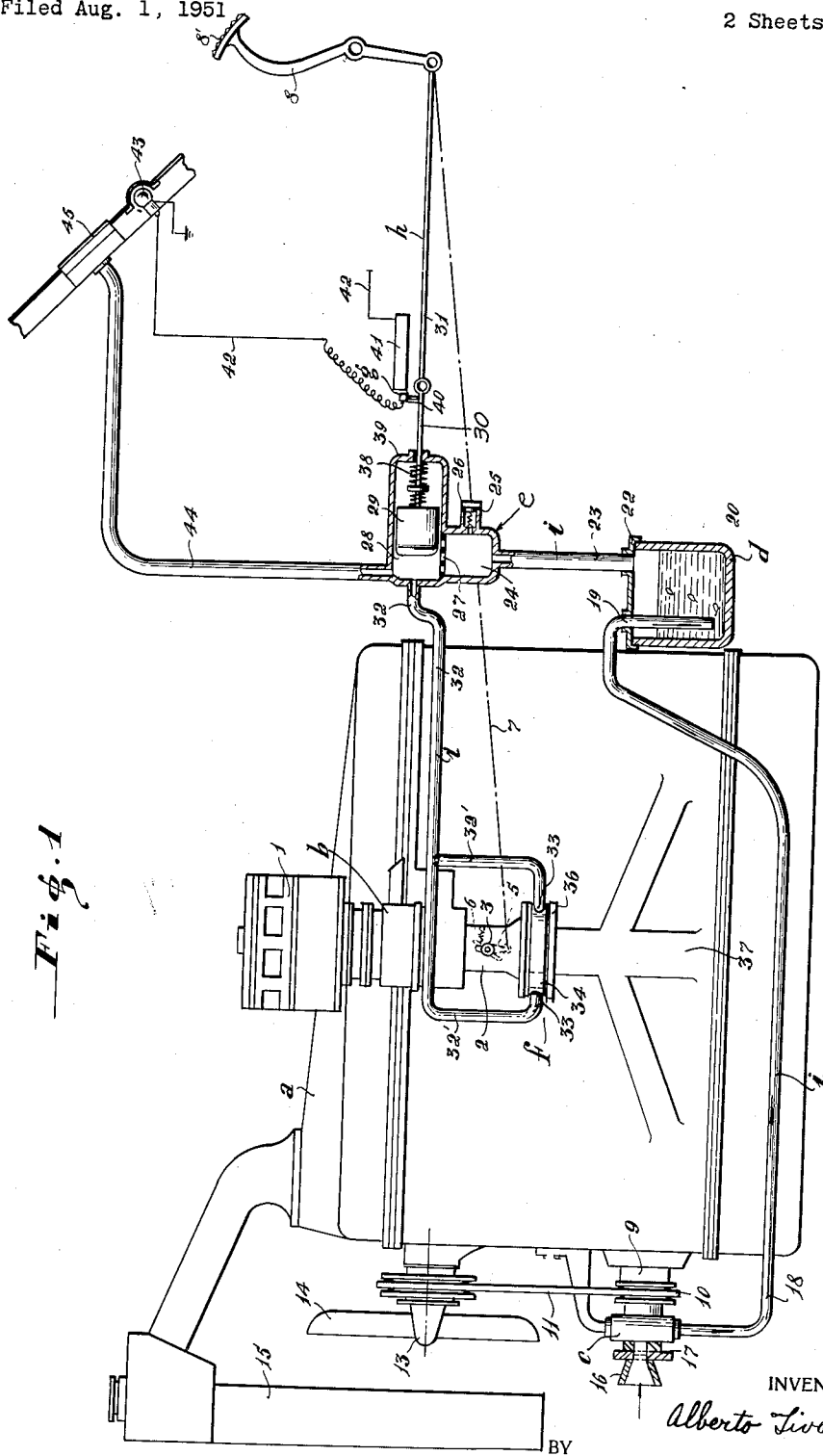
A. TIVOLI

2,725,858

EXPLOSION MOTOR RECARBURETING EQUIPMENT

Filed Aug. 1, 1951

2 Sheets-Sheet 1



INVENTOR

*Alberto Tivoli*

*Indael [Signature]*

BY

**Dec. 6, 1955**

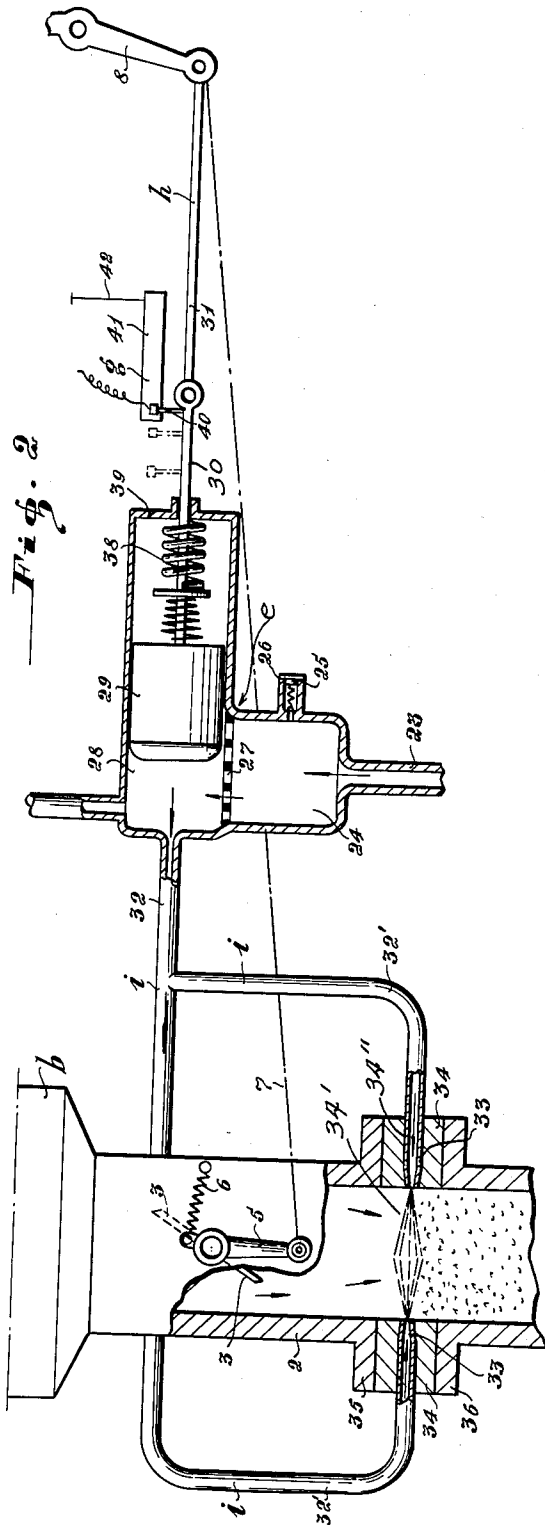
### A. TIVOLI

**2,725,858**

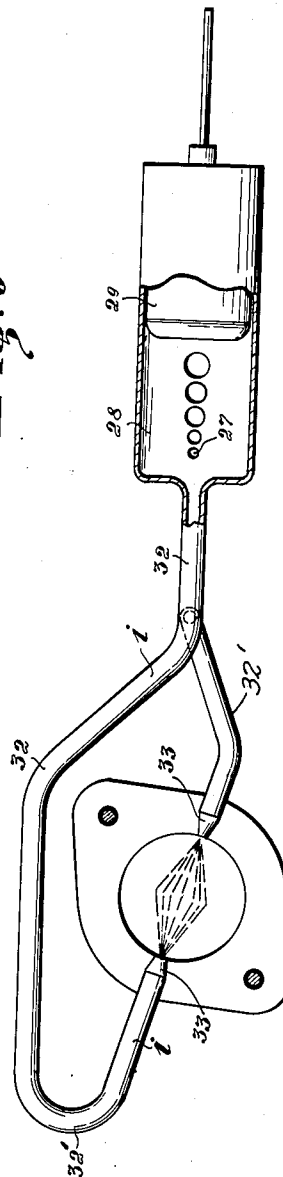
EXPLOSION MOTOR RECARBURETING EQUIPMENT

Filed Aug. 1, 1951

2 Sheets-Sheet 2



*Fid.* 3



INVENTOR

Alberto Livoli

BY

BY Michael S. Smith

1

2,725,858

## EXPLOSION MOTOR RECARBURETING EQUIPMENT

Alberto Tivoli, Adroque, Argentina

Application August 1, 1951, Serial No. 239,726

6 Claims. (Cl. 123—25)

The present invention refers to internal combustion motor equipment, and its purpose is to complete the function of the carburetor by means of atomization attaining dispersion to such an extent that thereby all the hydrocarbon of motor fuel is entirely utilized, resulting, thus, in a most remarkable economy.

A great many devices have been designed for similar purposes, and are generally used as auxiliary appliances between the carburetor flange and the admission manifold, but, although the same may be helpful to some degree in admitting more air during the suction strokes of the pistons, their working produces the opposite of the desired effect in other moments and mostly at slow speed, inasmuch as they tend to produce a lean mixture; consequently, their use is rather inadvisable, and as a matter of fact, uneconomical.

As the difficult point of the old problem was to know how to use all the hydrocarbon contained in gasoline to the best account, tests were directed to the way in which gasoline issues from the carburetor, and on coming to the conclusion that a good deal of hydrocarbon remains in a liquid state without attaining combustibility, some devices were tested with a view to reduce the particles to the state of aerosols; really satisfactory results having been achieved by means of injectors inserted in the passage of the mixture derived from the carburetor. However, this arrangement would not act correctly, if not synchronized in keeping with the volume of gas admitted by the intake valve, which is necessary for a perfect operation.

On this basis and after all kinds of experiments it was possible to arrive at the present invention, the fundamentals of which are applicable to any internal combustion engine as a self-regulating atomizing attachment to the carburetor.

In fact, it is an equipment comprising air compressing means, air filter means, throttle-valve-type means and injector means at the outlet of the main carburetor, so that the air injectors, the volume of which is regulated according to the cut-off position relating to admission of fuel gas, act not only as atomizers, but also add air to the mixture in such a proportion that it exactly corresponds to what is required by the new ratio of mixture, this means full fuel-conditioning actually in full, wherefore it can be said that gas increases in a proportion corresponding to almost twice the initial volume with greater richness of the mixture.

This means that the cooperation of the equipment is likely to lead to efficiency unattainable through any carbureting system whatever, since in this way about 40% can be saved without affecting power or reducing the range of speeds.

A feature that deserves special attention is the way in which the equipment has been designed for the attainment of its synchronization with the car acceleration control means; as the equipment comprises a regulator or feed valve with a set of feed openings controlled in such manner that the volume of air is directly dependent on

2

position of the accelerator pedal, to which a regulator piston controlling the feed openings is coupled, so as to get the right feed proportions by means of said pedal, since it is in direct ratio to the opening of the butterfly throttle valve at the outlet of the carburetor.

In addition to the above purpose, the present invention has pursued several objects, among which attention is called to the fact that it is instrumental to the solving of the world-wide fuel shortage problem, for the extraordinary economy resulting from the practical applications of the carbureting equipment according to the present invention means greater availability of motor fuel.

Another object is to prevent formation of carbon deposit, choking of the oil jet and other drawbacks and troubles arising from incomplete combustion, for, when motor fuel is atomized and entirely reduced to gas, it proves conditioned in such a manner as to burn up without leaving residua.

Still another object of the invention is to keep a perfect balance between the carburetor outlet and the atomizing and vaporizing process at low, mean and full speed, because both phases of control are subject to one and the same drive.

One object more is to find a way to apply the system to any vehicle, brand-new or used. It can be easily set up by anybody who follows simple directions.

The other objects of this invention will appear from the details of the following description, which, for the sake of clarity, has been illustrated by various figures showing the equipment in one preferred embodiment by way of example.

Figure 1 is a general view of the motor of a car fitted with said equipment and shown in a diagrammatic section to illustrate how to combine it with the running motor in order to get proper air compression and impulsion.

Figure 2 is a detail of the governor valve gear control unit for feeding the injectors which eject at the carburetor outlet according to the cut-off position of its butterfly valve, and lastly,

Figure 3 is a plan view of the foregoing unit showing the set of apertures forming a feed valve.

In the several figures the same reference numbers show like or corresponding parts, the unit of various members having been marked with letters.

As appears from the drawings, *a* is the motor fitted with its respective carburetor *b* with its air intake 1 and its exhaust pipe 2 where is located the butterfly valve or disk-type throttle 3, on the spindle or stem 4 of which it has the arm 5 pressed by the spring 6 to the butterfly valve cut-off or to the closure of the carburetor *b* outlet; the arm 5 is connected by means of the rod 7 to the lever 8, the pedal 8' of which constitutes the accelerator or throttle control.

Of course, the axle 9 of the motor *a* has a pulley 10, which, by means of the belt 11, transmits the action to the pulley 12, on the axle of which is the ventilator 14 cooling the radiator 15 belonging to the hydraulic circuit of the same motor *a*.

The apparatus in question comprises an air pump *c*, a bubble filter *d*, a feed governor valve *e*, and a device of injectors *f*.

The pump *c*, being rotary, has its rotor coupled to the shaft 9 of the motor *a*, and, as shown in Figure 1, said pump *c*, at its inlet 16, has a filter 17, whereas at its outlet it is connected to the by-pass pipe 18 ending in pipe 19 projecting into the moistening container 20 which is filled with water or another liquid adapted for air filtering and moistening; the container 20 may be provided with a mesh, the purpose of which is to prevent agitation of the liquid by the air. The container 20 is shut by the cover 22, from which the pipe 23 extends to the chamber or box 24 of the feed control *e*; this chamber 24, on the

3

one hand, has an exhaust valve 25, on which acts the pressure-exerting spring 26, the resistance of which is calculated to keep the chamber tight-closed up to a predetermined pressure limit, and, on the other hand, it has a set of apertures or holes 27, which, like intake ports, admit to the cylinder 28, where the piston 29 acts serving as valve member of the regulator or governor *e*, because this piston when travelling during its strokes within the cylinder 28, is uncovering or obturating the mentioned apertures 27, which are of different size, ranging from large to small.

The piston 29 has a rod 30, which, by means of the connecting rod 31 is coupled to the lever 8 of the accelerator pedal 8', the piston 29 being positioned so as to uncover or cover the apertures 27 proportionally to the position of the throttle control 3.

The pipe 32 connects the cylinder 28 through branches 32' with the injectors 33 of the device *f*. This device *f* comprises an attachment 34 having a passage 34' and being inserted between the flanges 35 and 36, of which the first is part of the outlet means 2 of the carburetor *b*, whereas the second flange 36, is part of the admission manifold 37, the branches of which run to the cylinders of the motor *a*.

As it can be seen, through transverse bores 34' in the attachment 34, the injector nozzles 33 extend transversely to the flow of the gas, which, issuing from the carburetor *b*, goes through the manifold 37 to the cylinders of the motor *a*.

The piston 29 of the feed control *e* is pressed by the spring 38, which, abutting on the cylinder head 39, urges the piston towards the cut-off apertures 27, so that the same piston, though it is depending on the lever 8, tends to assume a position according to its control.

The rod 30 has a contact 40, which, with the contact 41, form together the electric switch *g*; this switch is inserted in the conductor 42 corresponding to the circuit of the indicating lamp or bulb 43 fitted on to the car dashboard for the purpose of warning the driver that at high speed he should not step on the gas more than it is absolutely necessary. This warning is given through the disposition of the stationary contact piece 41. The contact 40 remains spaced from the contact piece 41 from the cut-off position of piston 29 to the opening of the first intake port 27.

The cylinder 28 communicates with a pipe 44 connected to the manometer 45 so as to enable the driver to check the pressure from his seat.

In brief, the explosion motor and atomizing and vaporizing equipment comprises a set of fluid injectors 33 directed to the mixture issuing from the outlet of the carburetor, said injectors being connected to a conduit *i*, formed by the pipes 32, 23 and 18, which conduit is connected to a fluid pressure source which can be formed by an air pump *c* or any suitable source of gas or steam and moistened by a device *d*, said conduit having a feed valve means *e* inserted, the regulator control of which is coupled by a linkage *h* to the accelerator pedal of the motor *a* and by a linkage 7 to the throttle of the carburetor.

#### Operation

Owing to the fact that the rotor of the pump *c* is located on the shaft 9, at the start of the motor *a*, the air entering through the intake 16, runs under pressure through the conduit *i*, travelling through the first branch of the pipe 18, and after bubbling in the filter *d*, where it becomes moist at a time, it proceeds on its way through the second section of the conduit *i*, i. e., the pipe 23, and reaches the chamber 24. If the intake or admission port 27 is not open, the air discharges through the valve 25.

When the vehicle starts off through the action of the accelerator pedal 8', the butterfly valve 3 opens gradually, and, as the control means 7 is linked with the linkage *h* formed by the connecting rod 31 and the rod 30,

4

the effect is simultaneous. While the gas prepared by the carburetor *b* leaves the outlet 2, since the piston 20 uncovers one or more intake ports 27, and the pressure air goes through the third section or branch of the conduit *i*, i. e., through the pipe 32, and is thrown by the injectors 33 into the gas stream issuing from the carburetor. In proportion with the travel of lever 8, the butterfly valve 3 and the feed valve means 27, 29 open more and more, so that a feeding adequate to the required speed is obtained proportionally.

As the injectors 33 blow into the stream of the gas flowing from the carburetor *b*, they act as atomizers in such a manner as to reduce to minimum size the bigger droplets still existing in the volume of mixture, which assumes the character of real gas, without changing into a lean mixture through the admixture of air, inasmuch as the big droplets disperse in the corresponding volume at a ratio of approximately 1 to 16.

This signifies that the air pressed through the injectors 33 is just what is required in order to obtain a rich and properly balanced mixture for the driving of the motor *a*.

In consequence of the incorporation of the air causing the vaporizing of nearly half the fuel which issues from the carburetor *b*, the fuel consumption is reduced, saving about 40% fuel, as proven by tests.

Besides extraordinary efficiency, the system offers some other advantages of vital importance, and especially as concerns the combustion in itself, since, to complete its effectiveness, it avoids the presence of disturbing droplets and does not leave behind appreciable residua, preventing carbonizing or desulphurization likely to affect spark plugs.

As stated, handling is controlled according to measuring units before the driver's eyes, apart from the indicating lamp 43, which, when the first intake port 27 is uncovered, lightens to signal the minimum speed limit.

The linkage *H*, instead of being mechanical, may be hydraulic with a simple water pipe connection.

Instead of pure air, the fuel mixture can be mixed with a vapor or gas for feeding the injector; so, for instance, the container 20 can be filled with alcohol or another spirit capable of being vaporized and taken along by the bubbling air.

There is no doubt that on carrying the present invention into practice, modifications can be made in certain constructional details and form of the equipment without departing from the fundamental principles which are clearly specified in the following claims.

#### I claim:

1. For use with an internal combustion motor, an atomizing equipment, comprising, in combination, a carburetor having an outlet means adapted to be connected to the motor; a movable throttle means located in said outlet means; air pump means driven from said motor; injector means located in said outlet means; conduit means connecting said air pump means with said injector means; feed valve means located in said conduit means and being movable between a plurality of positions for varying the amount of air supplied by said air pump means to said injector means; a moistening container located in said conduit means and adapted to contain a liquid so that air passing through said moistening container passes through the liquid in the form of bubbles for being moistened; and a linkage connecting said feed valve means with said throttle means for movement therewith so that the amount of air injected by said injector means into said outlet means conforms to the amount of fuel mixture released into said outlet means by said throttle means.

2. For use with an internal combustion motor, an atomizing equipment, comprising, in combination, a carburetor having an outlet means adapted to be connected to the motor; a movable throttle means located in said outlet means; air pump means driven from said motor; an attachment secured to said outlet means and adapted to be secured to the manifold of the motor, said attach-

5

ment being formed with a passage for connecting said carburetor with the manifold of the motor, and with at least one transverse bore; injector means located in said transverse bore and opening into said passage; conduit means connecting said air pump means with said injector means; feed valve means located in said conduit means and being movable between a plurality of positions for varying the amount of air supplied by said pump means to said injector means; and a linkage connecting said feed valve means with said throttle means for movement therewith so that the amount of air injected by said injector means into said outlet means conforms to the amount of fuel mixture released into said outlet means by said throttle means.

3. For use with an internal combustion motor, an atomizing equipment, comprising, in combination, a carburetor having an outlet means adapted to be connected to the motor; a movable throttle means located in said outlet means; air pump means driven from said motor; injector means located in said outlet means; conduit means connecting said air pump means with said injector means; feed valve means located in said conduit means and including a cylinder, and a piston movable in said cylinder, said cylinder being formed with a set of feed apertures communicating with said air pump means, and with at least one outlet opening communicating with said injector means, said piston being movable between a plurality of positions for consecutively closing and opening, respectively, said feed apertures for varying the amount of air supplied by said air pump means to said injector means; a linkage connecting said piston with said throttle means for movement therewith so that the amount of air injected by said injector means into said outlet means conforms to the amount of fuel mixture released into said outlet means by said throttle means; a circuit including an electric indicating lamp; and a switch in said circuit for operating said indicating lamp, said switch being closed and opened, respectively, by said piston in a predetermined position of the same.

4. For use with an internal combustion motor, an 40

6

atomizing equipment, comprising, in combination a carburetor having an outlet means adapted to be connected to the motor; a movable throttle means located in said outlet means; air pump means driven from said motor; injector means located in said outlet means; conduit means connecting said air pump means with said injector means; feed valve means located in said conduit means and including a cylinder, and a piston movable in said cylinder, said cylinder being formed with a set of feed apertures communicating with said air pump means, and with at least one outlet opening communicating with said injector means, said piston being movable between a plurality of positions for consecutively closing and opening, respectively, said feed apertures for varying the amount of air supplied by said air pump means to said injector means; a moistening container located in said conduit means and adapted to contain a liquid so that air passing through said moistening container passes through the liquid in the form of bubbles for being moistened; and a linkage connecting said piston with said throttle means for movement therewith so that the amount of air injected by said injector means into said outlet means conforms to the amount of fuel mixture released into said outlet means by said throttle means.

5. An equipment as claimed in claim 4 wherein said air pump means includes a filter.

6. An equipment as claimed in claim 5 comprising a circuit including an electric indicating lamp; and a switch in said circuit for operating said indicating lamp, said switch being closed and opened, respectively, by said piston, in a predetermined position of the same.

#### References Cited in the file of this patent

#### UNITED STATES PATENTS

|           |                    |                |
|-----------|--------------------|----------------|
| 1,097,380 | Weglein, Jr. ----- | May 19, 1914   |
| 1,713,377 | Ecureux -----      | May 14, 1929   |
| 1,746,309 | Herier -----       | Feb. 11, 1930  |
| 1,777,199 | Graff -----        | Sept. 30, 1930 |