No. 744,257. PATENTED NOV. 17, 1903.

T. L. & T. J. STURTEVANT.

CARBURETER FOR EXPLOSION ENGINES.

APPLICATION FILED DEC. 27, 1901.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

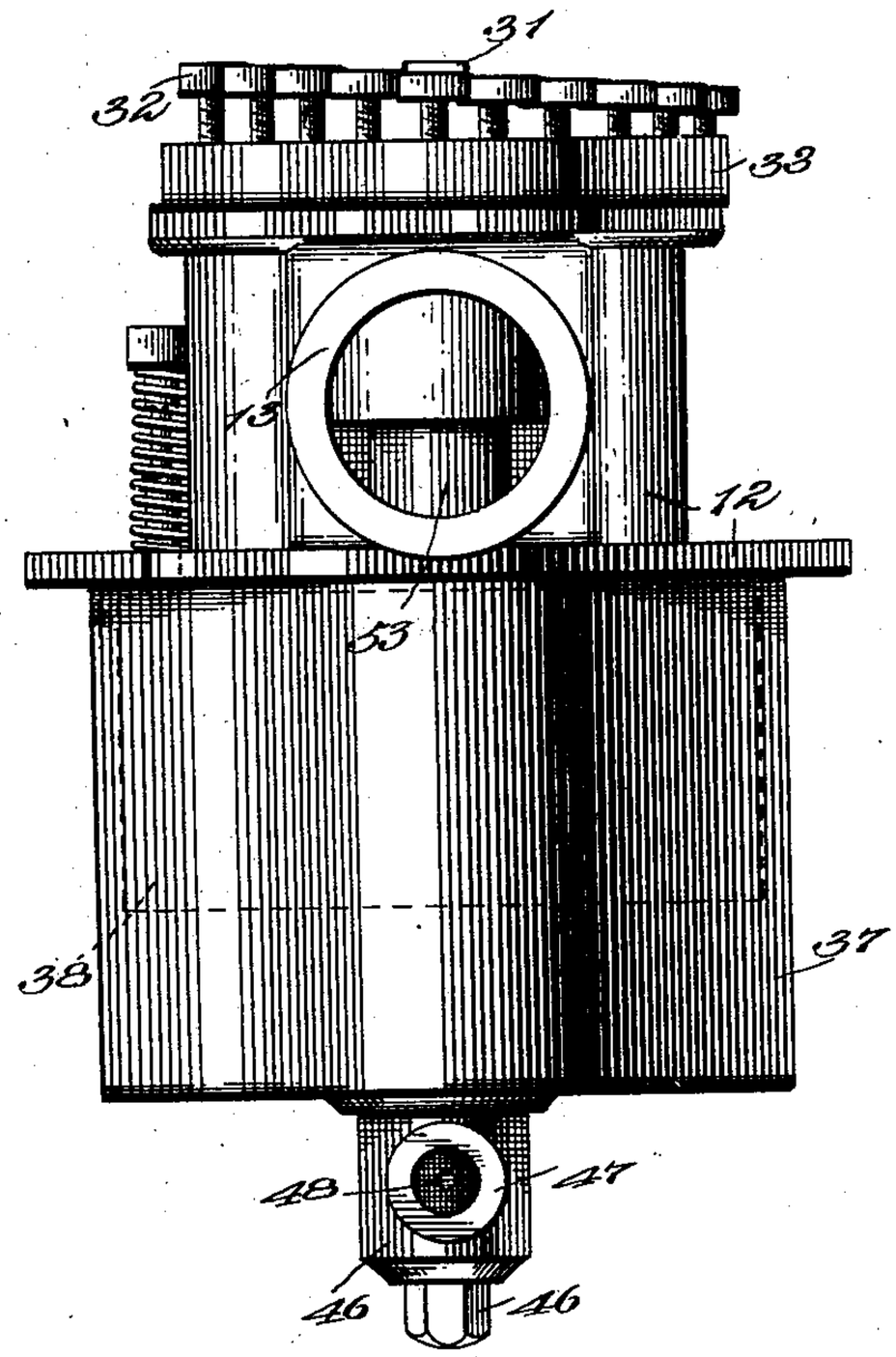
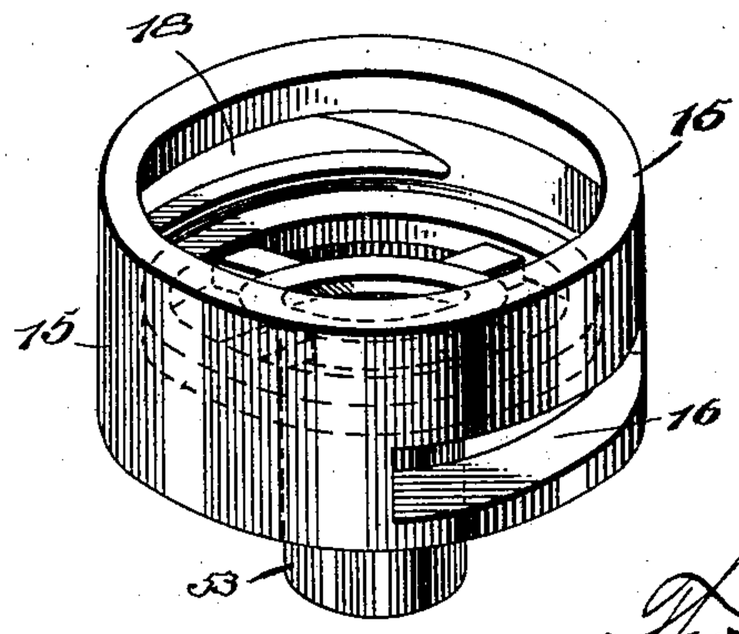


Fig. 4.



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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3

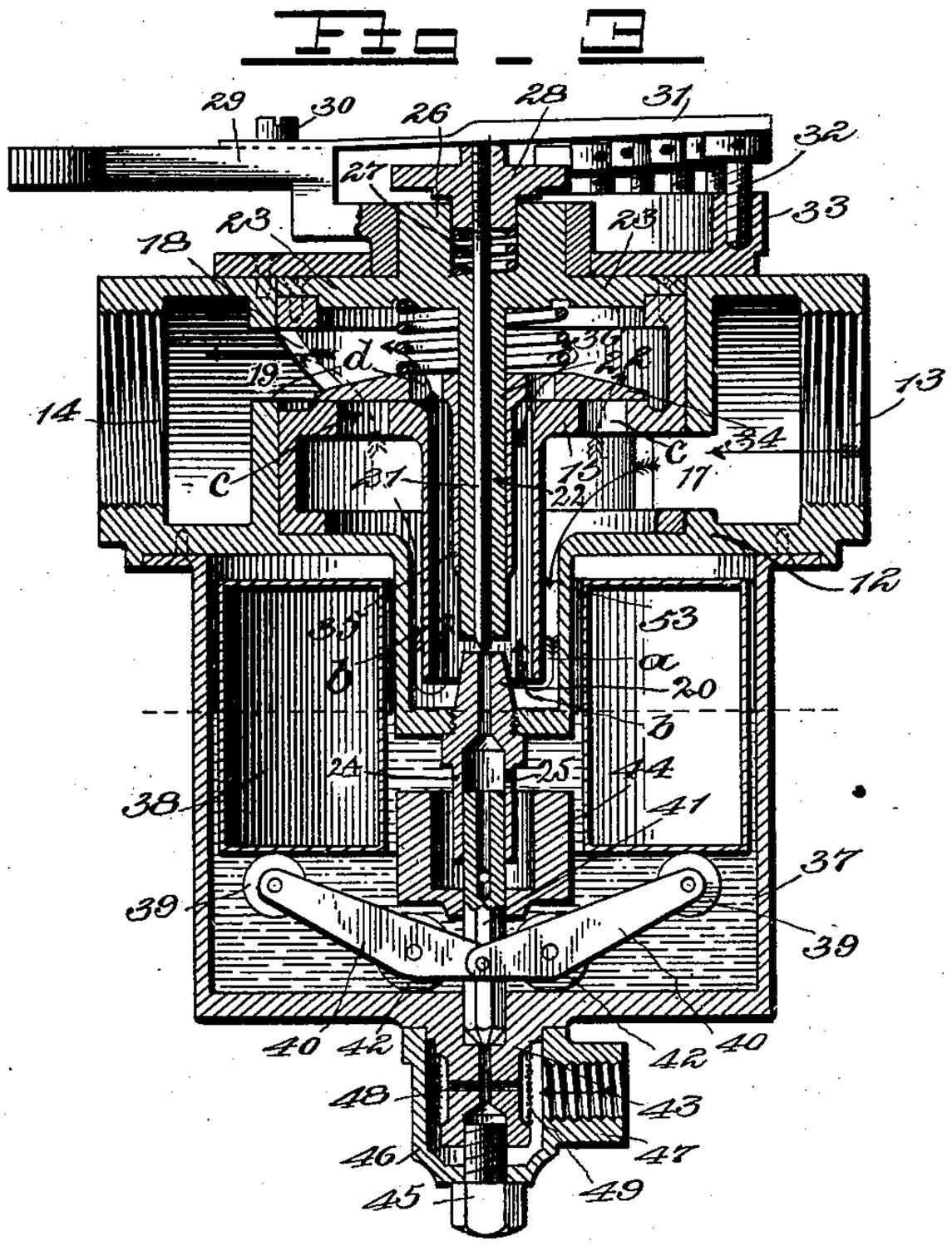
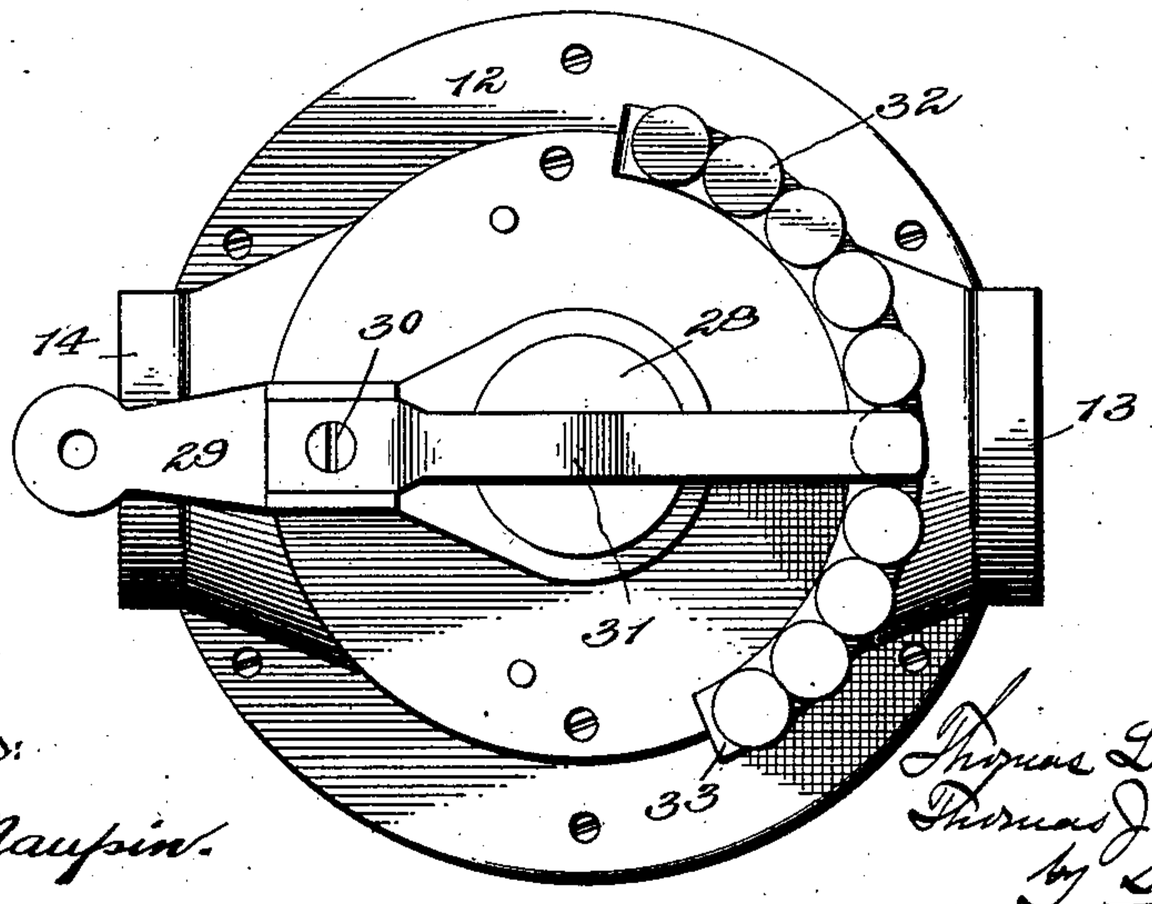


Fig. 5



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UNITED STATES PATENT OFFICE.

THOMAS LEGGETT STURTEVANT, OF QUINCY, AND THOMAS JOSEPH STURTEVANT, OF NEWTON CENTER, MASSACHUSETTS.

CARBURETER FOR EXPLOSION-ENGINES.

SPECIFICATION forming part of Letters Patent No. 744,257, dated November 17, 1903.

Application filed December 27, 1901. Serial No. 87,415. (No model.)

To all whom it may concern:

Be it known that we, THOMAS LEGGETT STURTEVANT, residing at Quincy, in the county of Norfolk, and THOMAS JOSEPH STURTEVANT, residing at Newton Center, in the county of Middlesex and State of Massachusetts, citizens of the United States, have invented certain new and useful Improvements in Carbureters for Explosion-Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to that class of carbureters for gas or explosion engines by the use of which the explosive mixture of air and gas is produced by mingling a spray of a liquid hydrocarbon with a current of air passing through the carbureter; and the invention has for its object to provide a carbureter of the class referred to which will be of simple construction and in which not only can the inlet and outlet passages of the carbureter be readily controlled, but in which there will be an automatic regulation of the liquid-fuel supply simultaneously with the manual regulation of the inlet and outlet openings, as also an automatic regulation of the air, and air and mingled gases passing through the carbureter in such a manner that if the suction or partial vacuum by which the spray of the liquid fuel is produced becomes excessive at any time such excessive suction or partial vacuum will be automatically relieved through the instrumentality of what is termed a "vacuum-valve," which when open will permit of a more direct passage of the incoming air through the carbureter, and thereby relieve the excessive suction or partial vacuum in the spraying and mixing chamber.

In the accompanying drawings, Figure 1 is an elevation of the improved carbureter. Fig. 2 is a plan view, and Fig. 3 a central sectional view, of the same. Fig. 4 is a detail perspective view of the throttle-valve with the top plate thereof removed.

Referring to the drawings, 12 denotes the frame or casing of the carbureter, consisting, preferably, of a casting of brass or other suitable material and provided with an inlet tube or portion 13 and an outlet tube or portion 14. Centrally mounted in the frame or casing of the carbureter is a throttle-valve 15, which is in the form of a hollow cylinder divided by a horizontal diaphragm into upper and lower chambers, said chambers being interconnected by direct ports or openings *c* through the diaphragm and being indirectly connected through the mixing-tube 53, to which reference will be made hereinafter, which depends from the horizontal diaphragm centrally through the lower chamber. (See Figs. 3 and 4.) The lower chamber of said throttle-valve has an inlet-opening 16 so arranged as to register with an inlet-passage 17 of the inlet tube or opening 13, the upper chamber of said throttle-valve being also provided with an outlet-opening 18, also so arranged as to register with an outlet-passage 19, with which the outlet tube or opening 14 of the carbureter is provided.

Properly seated in the lower portion of the frame or casing of the carbureter is a spray-nozzle 20, the discharge-opening of which is controlled by a needle-valve 21, adjustably mounted on a central tube 22, depending from a top plate or cover 23, with which the throttle-valve 15 is provided, said cover being rigidly secured to said valve and having at its top a hub 26, provided with a central recess in which is arranged a coil-spring 27, compressed between the lower wall of said recess and the lower end of a hub on a thumb-nut 28, threaded on the upper end of the stem of the said needle-valve 21, so that by turning said nut the said valve may be raised or lowered in the tube 22, the valve-stem being preferably square or of other polygonal form in cross-section and the central opening in the tube 22 being of corresponding form, so that the said valve-stem will not turn with the said thumb-nut. Rigidly attached to the hub 26 of the throttle-valve cover is a regulating-lever 29, by which the said valve may be turned, and attached to the said lever 29 by a screw 30 is a spring-arm 31, the outer or free end of which is arranged to engage and swing over a series of adjustable stops afforded by the heads of the screws 32, tapped in the cover-plate 33, fixed to the frame or casing 12 of the carbureter, said stops being adjusted to different heights. To prevent the screws 32 from working loose, and thus accidentally changing their positions of adjustment, when once properly set or adjusted, they are preferably split and sprung apart slightly, so as to turn hard in their tapped holes in the cover-plate 33.

The spring 27 has a tendency to lift the needle-valve from its seat at the top of the spray-nozzle 20 and to force the top of the thumb-nut 28 into contact with the regulating spring-arm 31, so that the position of the said spring-arm as determined by the contact of its upper end with any one of the adjustable stops 32 will correspondingly determine the position of the needle-valve relative to its seat at the upper end of the spray-nozzle 20, accordingly as the said needle-valve may be regulated by the adjustment of the thumb-nut 28. In other words, the thumb-nut is intended to provide for any desired adjustment of the needle-valve for certain conditions, and the further adjustment of the said needle-valve will be controlled by the spring-arm 31 and the coöperating stops 32, according to the position of adjustment of the regulating-lever 29, by which the position of the throttle-valve is controlled. Thus when the throttle-valve is turned by the regulating-lever 29 to open its inlet and outlet passages wider the fuel-supply will be simultaneously increased by an upward movement of the needle-valve 21 from its seat by the automatic lifting action of the spring 27 as the spring-arm 31 is lifted by the successively higher stops 32, and when the said regulating-lever 29 is moved to partially close the inlet and outlet passages of the throttle-valve the fuel-supply is simultaneously and automatically lessened, as the free end of the spring-arm is permitted to fall as it sweeps over the lower stops 32, the pressure of said spring-arm being sufficient to overbalance the stress of the lifting-spring 27.

The throttle-valve 15 is provided, in addition to the central tube 22, with a larger concentric tube 53, between which and the central tubular portion of the frame of the carbureter is afforded an annular air-inlet passage *a*, which communicates at its lower portion with an annular spray-passage *b*, within the throttle-valve, and which spray-passage serves as a mixing-chamber for the incoming air and the spray of liquid hydrocarbon emerging from the spray-nozzle 20, such spray being taken up by the incoming air and the two forming an explosive gaseous mixture.

The spray of liquid hydrocarbon from the spray-nozzle 20 is preferably induced by a suction or partial vacuum through the outlet tube or opening of the carbureter, and which suction or partial vacuum also induces a proper inflowing current of air to the inlet tube or opening, and for the purpose of automatically controlling this suction or partial vacuum and to relieve the same when it becomes excessive a controlling vacuum device or vacuum-valve is provided. This vacuum-valve consists in the present instance of a disk 34, having a tubular stem 35 encircling the inner tubular part 22 of the throttle-valve, said disk 34 being normally pressed to its seat on the said throttle-valve by a light spring 36, so as to close openings *c* in a horizontal diaphragm of said throttle-valve, said disk being provided with a circular series of openings *d*, communicating with the spray or mixing chamber *b* and with the exhaust-passage in the throttle-valve, so that normally the gaseous explosive mixture passes outward through the said passages *d* to the outlet of the carbureter and thence to the gas-engine. If, however, the frictional resistance in the passage *a* or spray and mixing passage *b* or the suction or partial vacuum through the carbureter becomes excessive, the vacuum valve or disk 34 will be automatically lifted against the pressure of its spring 36 from its seat on the throttle-valve, thereby opening the passages *c* more or less and permitting the incoming air to take a more direct course through the throttle-valve, thereby relieving the excessive pressure or suction.

Suitably attached to the carbureter is a reservoir 37, within which is arranged an annular float 38, resting on rollers 39, with which levers 40, pivotally attached at their inner ends to the needle-valve 41, are provided, said levers being also furnished with rollers 42, resting on the bottom of the reservoir 37 and serving as fulcra for said levers. The needle-valve 41 rests at its lower end on a valve-seat formed in an inlet-nozzle 43 at the lower end of the reservoir 37, and the said valve is controlled by the float 38 through the said levers 40. The stem of the needle-valve 41 is preferably of polygonal form, while the hole in the bottom of the reservoir in which the said needle-valve is held is round, so that the incoming liquid hydrocarbon can pass upward by the said valve into the chamber of the reservoir 37. The said stem of the said needle-valve is provided with a weight 44, which has a tendency to force the said needle-valve downward to its seat when the position of the float 37 permits of such action. The stem of the needle-valve 41 is preferably telescopically mounted in the hollow stem 24 of the spray-nozzle 20, said stem 24 being preferably provided with one or more inlet-openings 25 for inflow of the liquid fuel, and the stem of the said needle-valve may also be formed partly hollow and be provided with one or more inlet-openings for the liquid fuel, as shown in Fig. 3.

Attached to the bottom of the reservoir 37, preferably by a screw 45, tapped into the nozzle 43, is a removable cap 46, having a nozzle 47 for the incoming fuel-supply. The cap 46 can be turned in any desired direction to bring the fuel-nozzle thereof to any desired point when the said screw 45 is properly loosened to permit of such operation, and the said cap will be held rigidly in place when the said screw is tightened. The nozzle 43 at the lower end of the reservoir 37 is provided with transverse recesses 48, through which the fuel within the chamber of the cap 46 can flow to the central opening in said nozzle and to the needle-valve passage, and the said nozzle 43 is preferably provided with an annular

recess or reduced portion covered by a circular wire-gauze screen or strainer 49, which will prevent any solid particles from entering the carbureter, thus preventing the passage in the carbureter from being clogged by such solid particles.

In the use of the improved carbureter liquid fuel is supplied to the reservoir 37 until the latter is sufficiently full, when the float 38 therein rises high enough to permit the needle-valve 41 to close the fuel-inlet. The suction or partial vacuum induced from the engine or in any well-known manner will cause an inflow of air at the inlet-opening of the carbureter and will also cause a spray of the liquid fuel to issue from the spray-nozzle 20, and as this spray is vaporized and absorbed by the inflowing air in the spraying and mixing passage or chamber *b* an explosive gaseous mixture is produced. The spray-regulating needle-valve 21 will be so set or adjusted by means of the regulating thumb-nut 28 as to admit the desired quantity of liquid fuel for a given adjustment of the throttle-valve or for an engine of any particular size or capacity, and thereafter when the regulating-lever 29 is moved to open the throttle-valve wider the fuel-supply will be simultaneously increased by the automatic lifting of the said needle-valve in the desired ratio determined by the proper adjustment of the adjustable stop-screws 32, and conversely the fuel-supply will be simultaneously decreased by the automatic depression of said needle-valve when the regulating-lever is moved to decrease the inlet and outlet passages of the throttle-valve, and which throttle-valve turns within the casing or frame of the carbureter, so as to enable the effective sizes of its inlet and outlet openings to be simultaneously increased or diminished. Instead of employing the independently-adjustable screws 32 for the regulation of the free end of the spring-arm 31 an inclined rib, either fixed or adjustable, might be employed for the same purpose.

The automatic regulation of the suction or pressure of the air and gas or explosive gaseous mixture flowing through the carbureter and of the fuel-supply induced by such suction or pressure by the spring-pressed controlling disk or vacuum-valve 34 is deemed an important feature of the invention in that it effectively guards against any improper action due to too strong a suction or pressure. Thus if the suction or pressure becomes sufficiently strong as to cause the stress of the light spring 36 to be overcome the said disk or valve will be lifted more or less, thus opening the passages *c*, and by thus permitting the inflowing air to take a more direct course through the carbureter than when it traverses the passages *a* and *b* the excessive suction or pressure is immediately reduced and an excessive amount of liquid-fuel spray in the carbureter is prevented. This automatic regulating device or vacuum valve so regulates the supply of liquid fuel drawn up by suction that the carbureter is adapted to engines of widely different sizes, since the supply of oil or liquid fuel is always in proportion to the air-supply. Thus if the suction be weak all of the inflowing air is directed through the spraying and mixing chamber; but if it be strong some of the air takes a short passage through the openings *c* direct to the outlet-passage.

By providing the float-operated and fuel-supply needle-valve-controlling-levers 40 with the antifriction-rollers 39 and 42 the operation of the needle-valve 41 is rendered very sensitive, so that the fuel-supply can be regulated to a nicety, and by arranging the fuel-reservoir beneath and preferably concentric with the throttle-valve and at or near the vertical center of the carbureter a very compact and convenient structure is produced. Also the wire-gauze screen or strainer to prevent the entrance of solid particles in the liquid fuel is advantageous, and the removable cap covering said screen or strainer enables the latter or the chamber in the cap to be conveniently cleaned when necessary.

The outlet-opening 18 of the throttle-valve 15 is preferably formed tapering or V-shaped at one end, as shown more clearly in Fig. 4 and as also indicated in Fig. 3. This construction renders the valve more sensitive or capable of a finer regulation than if the said opening were of equal size throughout its length or extent, as it contributes to a more gradual opening and closing of the outlet-passage of the throttle-valve by a given extent of movement of the regulating-lever 29 than would otherwise result, and thus enables the speed of the engine to be better regulated by a finer or closer adjustment of the gaseous-fuel supply.

Having thus described our invention, we claim and desire to secure by Letters Patent—

1. In a carbureter, the combination with a valve-casing having an air-inlet port and a vapor-outlet port, of a throttle-valve controlling said ports and having a central spray-passage and mixing-chamber, a spray-nozzle delivering fuel to said mixing-chamber, a fuel-supply valve controlling the supply from said spray-nozzle, and means for controlling said fuel-supply valve from said throttle-valve.

2. In a carbureter, the combination with a valve-casing having an air-inlet port and a vapor-outlet port, of a throttle-valve controlling said ports, said throttle-valve having a central spray-passage and mixing-chamber, a spray-nozzle delivering to said mixing-chamber, a fuel-supply valve controlling the supply from said spray-nozzle, means for controlling said fuel-supply valve from said throttle-valve, whereby movement of said throttle-valve will result in simultaneous movements of said fuel-supply valve, and means for adjusting said fuel-supply valve independently to vary the spray-nozzle outlet and the supply of fuel.

3. In a carbureter, the combination with a valve-casing having an air-inlet port and a vapor-outlet port, of a throttle-valve controlling said ports, said throttle-valve having a central spray-passage and mixing-chamber, a spray-nozzle delivering to said mixing-chamber, a fuel-supply valve controlling the supply from said spray-nozzle, means for holding said fuel-supply valve normally open, and means whereby movements of said throttle-valve will be imparted to said fuel-supply valve.

4. In a carbureter, the combination with a valve-casing having an air-inlet port and a vapor-outlet port, of a throttle-valve controlling said ports, said throttle-valve having a central spray-passage and mixing-chamber, a spray-nozzle delivering to said mixing-chamber, a spring-retracted fuel-supply valve controlling the supply from said spray-nozzle; and means whereby movement of said throttle-valve will be imparted to said spring-retracted fuel-supply valve.

5. In a carbureter, the combination with a throttle-valve normally and positively controlling the air-supply, a fuel-supply valve, and a vacuum-valve supported by said throttle-valve and operable by suction within the carbureter to effect an automatic control of the air-supply supplemental to the positive control thereof by the throttle-valve and regulate the proper mixture of fuel and air.

6. In a carbureter, the combination with a valve-casing having air-inlet and vapor-outlet ports, of a throttle-valve normally controlling said inlet and outlet ports, a fuel-supply valve controllable from said throttle-valve, and a vacuum-valve supported by said throttle-valve and operable by suction within the carbureter to effect a supplemental, automatic control of the air-supply and regulate the proper mixture of fuel and air.

7. In a carbureter, the combination with a casing having an air-inlet port, a throttle-valve normally controlling the supply of air passing through the said port, said throttle-valve being provided with passages for the vapor and supplemental air ports or passages, a fuel-supply valve, and a vacuum-valve operable by suction within the carbureter and normally closing said supplemental air-passages, said vacuum-valve serving to effect an automatic control of the air-supply and regulate the proper mixture of fuel and air.

8. In a carbureter, the combination with a fuel-supply spray-nozzle, and a valve for regulating the fuel-supply, of a spraying and mixing chamber surrounding the said nozzle and valve, an air-inlet chamber surrounding said spraying and mixing chamber and communicating therewith, and a throttle-valve for regulating the inflow of air and outflow of gaseous mixture.

9. In a carbureter, the combination with a fuel-supply spray-nozzle and a valve for regulating the fuel-supply, of a spraying and mixing chamber surrounding the said nozzle and valve, an air-inlet chamber surrounding said spraying and mixing chamber and communicating therewith, and a throttle-valve for regulating the inflow of air and outflow of gaseous mixture, said throttle-valve having tubular portions which, in connection with a portion of the casing or frame of the carbureter, form the said air-inlet passage and said spraying and mixing chamber.

10. In a carbureter, the combination with a fuel-supply spray device and a valve for regulating the fuel-supply, of a spraying and mixing chamber surrounding the said fuel-supply device and valve, an air-inlet chamber surrounding said spraying and mixing chamber and communicating therewith, and a throttle-valve for regulating the inflow of air and outflow of gaseous mixture, said throttle-valve having tubular portions which, in connection with a portion of the casing or frame of the carbureter, form the said air-inlet passage and said spraying and mixing chamber, and an automatic controlling device or vacuum-valve mounted on the said regulating device or throttle-valve.

11. In a carbureter, the combination with the frame or casing thereof provided with suitable inlet and outlet openings, of a regulating device or throttle-valve centrally mounted in said frame or casing and having inlet and outlet openings to suitably register with the inlet and outlet openings of the casing, a spray device for the inflowing liquid fuel, a valve for controlling the supply of liquid fuel, means for turning the said regulating device or throttle-valve within the frame or casing of the carbureter, to open or close the inlet and outlet passages more or less, and automatic means for changing the position of the fuel-supply valve so as to open or close the said valve, more or less, simultaneously with the opening or closing of the inlet and outlet passages of the carbureter.

12. In a carbureter and in combination, a casing having air-inlet and vapor-outlet ports; a fuel-supply valve; a throttle-valve having chambers communicating respectively with said air-inlet and vapor-outlet ports and connected with each other by direct and indirect passages, and means normally closing the direct passages between said chambers.

13. In a carbureter, and in combination, a casing having air-inlet and vapor-outlet ports; a fuel-supply valve; a throttle-valve having chambers communicating respectively with said air-inlet and vapor-outlet ports, and connected with each other by direct and indirect passages, and automatic controlling means normally closing the direct passages between said chambers.

14. In a carbureter and in combination, a casing having air-inlet and vapor-outlet ports; a fuel-supply valve; a throttle-valve having chambers communicating respectively with said air-inlet and vapor-outlet ports, and con-

nected with each other by direct and indirect passages, and a vacuum-valve operable by suction within the carbureter and which normally closes the direct passages between said chambers.

15. In a carbureter, and in combination, a casing having an air-inlet, a fuel-inlet, and a vapor-outlet; a throttle-valve having chambers communicating respectively with said air-inlet and said vapor-outlet, said chambers being connected by direct and indirect passages, said throttle-valve controlling the ingress of air to one of said chambers and the delivery of gas from the other; and a valve, for the fuel-inlet, controlled by the said throttle-valve.

16. In a carbureter and in combination, a casing having an air-inlet, a fuel-inlet, and a vapor-outlet; a throttle-valve having a lower chamber communicating with said air-inlet and an upper chamber communicating with said vapor-outlet, ports connecting said chambers, and a mixing-tube carried by said throttle-valve to which said fuel-inlet delivers, said mixing-tube forming an indirect connection between said chambers.

17. In a carbureter, the combination with a casing having an air-inlet, a fuel-inlet, and a vapor-outlet; of a throttle-valve divided horizontally into upper and lower chambers communicating respectively with the vapor-outlet and air-inlet; ports connecting said chambers, means normally closing said ports, and a mixing-tube depending from said valve to which said fuel-inlet delivers, said tube forming an indirect connection between said chambers.

18. In a carbureter, the combination with a casing having an air-inlet, a fuel-inlet, and a vapor-outlet; of a throttle-valve divided horizontally into upper and lower chambers communicating respectively with the vapor-outlet and air-inlet; ports connecting said chambers; a vacuum-valve operable by suction within the carbureter and normally closing said ports, and a mixing-tube depending from said valve to which said fuel-inlet delivers, said tube forming an indirect connection between said chambers.

19. In a carbureter, the combination with a fuel-supply reservoir, of a valve for controlling the opening to said reservoir, a float in said reservoir, levers controlled by said float and connected with said valve, and antifriction-rollers resting on the bottom of said reservoir and affording fulcra for said levers.

20. In a carbureter, the combination with a fuel-supply reservoir, of a valve for controlling the opening to said reservoir, a float in said reservoir, levers controlled by said float and connected with said valve, antifriction-rollers resting on the bottom of said reservoir and serving as fulcra for said levers, and additional antifriction-rollers at the outer end of said levers and on which said float rests.

21. In a carbureter, the combination with a throttle-valve, of a fuel-supply valve, an operating-lever for the throttle-valve, and a yielding arm carried by said throttle-valve lever to actuate the fuel-supply valve.

22. In a carbureter, the combination with a throttle-valve, of a fuel-supply valve, means to normally lift said fuel-supply valve from its seat, an operating-lever for said throttle-valve, a yielding arm carried by said lever to control said fuel-supply valve, and means for giving movement to said yielding arm to actuate said fuel-supply valve.

23. In a carbureter, the combination with a throttle-valve, of a fuel-supply valve, a spring to normally lift said valve from its seat, an operating-lever for said throttle-valve, a spring-arm carried by said lever and controlling said fuel-supply valve, and adjustable means for giving movement to said spring-arm to actuate said fuel-supply valve.

24. In a carbureter, the combination with a rotary throttle-valve for the air-inlet, of a reciprocating fuel-supply valve, a fuel-supply-valve-controlling arm carried by said rotary throttle-valve, and means, independent of said throttle-valve-operating devices, for raising and lowering said controlling-arm as said throttle-valve is rotated.

25. In a carbureter, the combination with a rotary throttle-valve for the air-inlet, of a reciprocating fuel-supply valve, a spring to normally lift said valve from its seat, a spring-arm carried by said throttle-valve and normally tending to depress said reciprocating fuel-supply valve, and adjustable means for raising said spring-arm.

26. In a carbureter, the combination with a fuel-supply valve and a spring disposed to normally lift the same from its seat, of a regulating-lever provided with a spring-arm which limits the lifting movements of said valve from its seat by its spring, and means for varying the position of the free end of said spring-arm so that as the position of the said regulating-lever is changed the position of the said valve, relative to its seat, will also be changed, to open or close the valve more or less.

27. In a carbureter, the combination with a fuel-supply valve and a spring disposed to normally lift the same from its seat, of a regulating-lever provided with a spring-arm which limits the lifting movements of said valve from its seat by its spring, and a graduated series of adjustable devices or stops pressed against by said spring-arm and over which the free end of the latter swings when the position of the said regulating-lever is changed, and which stops serve to govern the position of said spring-arm and, through the said spring-arm, the position of the said fuel-supply valve.

28. In a carbureter provided with suitable inlet and outlet passages, a controlling device or throttle-valve for opening or closing the said passages and provided with comparatively direct air-openings, as *c*, a spring-

pressed disk or vacuum-valve provided with openings for the passage of the gaseous mixture, and which, if the suction or pressure becomes excessive, will be automatically moved, against the stress of its spring, to permit a more direct passage of inflowing air through the said openings *c* and thereby relieve the excessive suction or pressure.

In testimony whereof we affix our signatures in presence of two witnesses.

THOMAS LEGGETT STURTEVANT.
THOMAS JOSEPH STURTEVANT.

Witnesses:
O. R. MURRY,
LLOYD MAKEPEACE.