

H. B. ANDERSON.
 STARTING MECHANISM FOR INTERNAL COMBUSTION ENGINES.
 APPLICATION FILED OCT. 31, 1911.

1,058,214.

Patented Apr. 8, 1913.

2 SHEETS-SHEET 1.

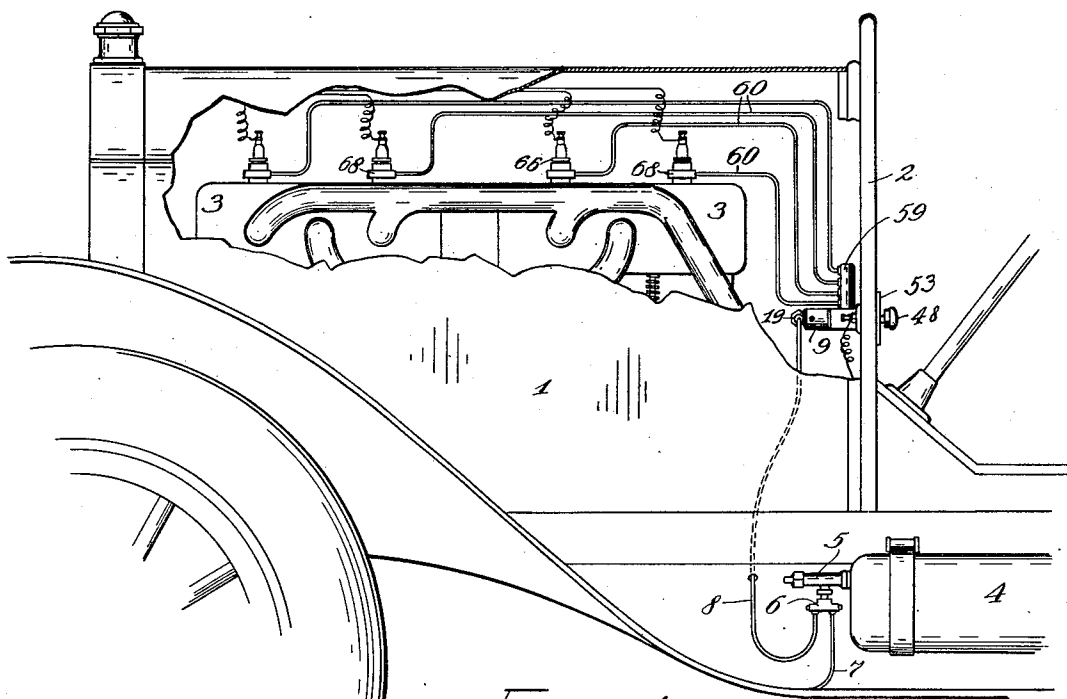


FIG. 1

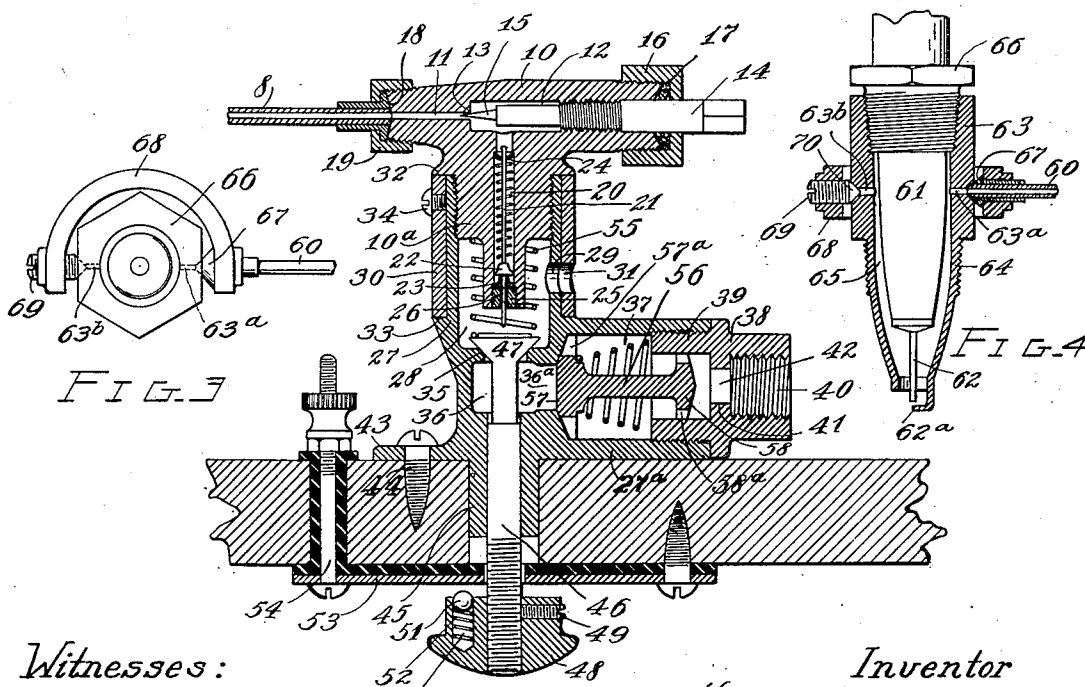


FIG. 2

Witnesses:
 Foreman West.
 Chas. Watt

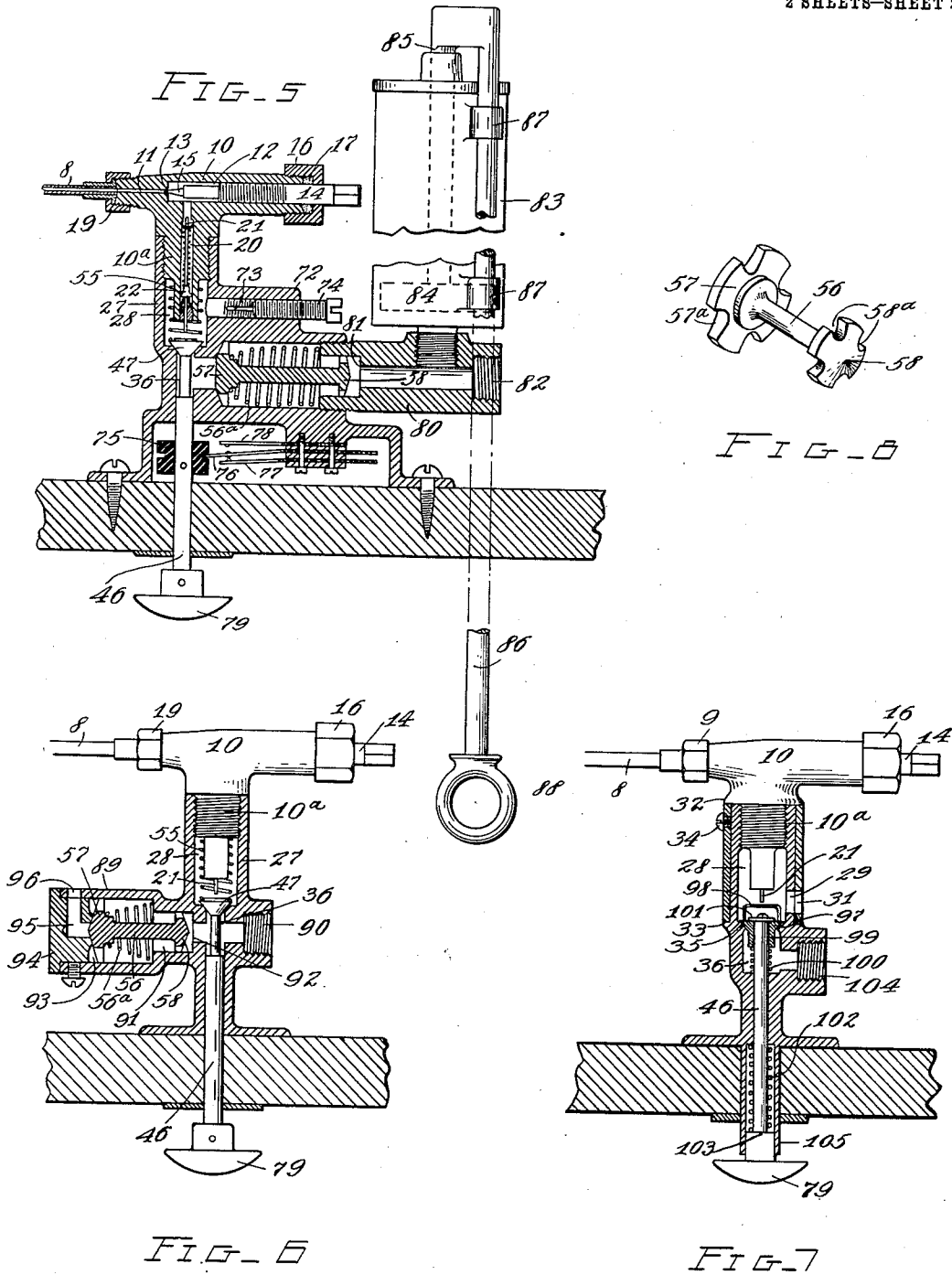
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Witnesses:

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UNITED STATES PATENT OFFICE.

HAROLD B. ANDERSON, OF LAKEWOOD, OHIO.

STARTING MECHANISM FOR INTERNAL-COMBUSTION ENGINES.

1,058,214.

Specification of Letters Patent.

Patented Apr. 8, 1913.

Application filed October 31, 1911. Serial No. 657,839.

To all whom it may concern:

Be it known that I, HAROLD B. ANDERSON, a citizen of the United States, residing at Lakewood, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Starting Mechanism for Internal-Combustion Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to starting mechanism for internal combustion engines, and more especially to that type of starting mechanism wherein a combustible fluid, preferably a fixed gas, is supplied to the cylinder of such an engine, to be ignited by the usual spark plug, thus dispensing with the necessity of cranking the engine.

The general object of this invention is to provide mechanism of such character which is extremely simple of construction, of great efficiency and reliability in action, and which can be readily applied to existing installations with a minimum of alteration therein.

More limitedly, the invention contemplates an improved construction and operation of the valve mechanism whereby the flow of the combustible fluid to the engine cylinders is secured and to a special construction whereby the charge of combustible fluid for the starting of the engine will be supplied to the cylinder only when the speed of the motor is very slow, as is the case when stopping the motor.

Still more specifically this invention is an improvement upon that disclosed in the application filed by myself and Alexander Winton on August 15th, 1906, Ser. No. 330,714.

Further and more generally speaking, the invention consists of the combinations of elements embodied in the claims set forth hereinafter and illustrated in the drawings forming part hereof, wherein—

Figure 1 represents a side elevation of the front portion of an automobile having the invention applied thereto, the hood being broken away; Fig. 2 represents a sectional detail through the valve mechanism by which the flow of combustible fluid is controlled; Fig. 3, an end elevation of a spark plug, showing the connections whereby combustible fluid may be supplied to said plug and thus to the cylinder; Fig. 4 a longitudinal sectional view through the plug and connections shown in Fig. 3; Fig. 5 a view,

similar to Fig. 2, of a modified form of the invention, showing the same used in connection with a hand pump; Figs. 6 and 7 are views similar to Fig. 5 of modified forms of the valve mechanism; and Fig. 8 a perspective view of the automatically operating valve which prevents the combustible fluid from being supplied to the engine when the latter is running at high speed.

Describing by reference characters the various parts illustrated in the drawings and with particular reference to the modification shown in Figs. 1, 2, 3, 4, and 8, 1 denotes the hood, 2 the dash, and 3 the engines of a motor vehicle. 4 denotes the tank usually found on motor vehicles and containing acetylene gas for lighting purposes. 5 denotes a tubular connection carried by said tank and provided with a manifold 6, from which extends a tube 7 for conveying gas to the lamps, and a special tube 8, which extends to a valve mechanism indicated generally at 9 and secured to the front of the dash. This mechanism will now be described in detail:—10 denotes a T-shaped valve member, preferably a casting, provided within its T-head with a bore 11 which extends inwardly from one end of the member to a larger bore or chamber 12, there being a valve seat 13 formed between said bores. The valve stem 14 is threaded into one end of the T-head and is provided with a valve 15 coöperating with the seat 13. A suitable stuffing box for the valve stem is provided by means of the usual gland 16 and packing 17. The end of the T-head 10 opposite the stuffing box is provided with a conical seat 18 for the correspondingly shaped end of the conduit 8, being detachably connected to the T-head by means of a gland nut 19. The member 10 is provided with a bore 20 communicating with the chamber 12 and extending at substantially right angles therefrom, and in the said bore a valve stem 21 is located. This stem forms part of a valve of the type used in pneumatic tires. The valve stem is provided with a valve 22 adapted to coöperate with a seat 23 in the lower end of the bore 20. The upper end of the stem is guided by a spider 24, fitting loosely in an opening in said spider. The outer end of the stem 21 projects beyond the branch 10^a of the T, there being a bushing 25 threaded into the end of the bore 20 and provided with a bore 26 sufficiently larger than the stem 21 to per-

mit a free flow of gas therearound. A second valve member of general L-shaped form is threaded onto the branch 10^a of the T. The branch of the L-shaped member which is so attached to the first mentioned valve member is indicated at 27 and is provided with a chamber 28 which is adapted to receive the gas flowing past the regulating valve 15. The chamber 28 is provided with a port 29 in one of the walls thereof and this port is controlled by a sleeve 30 having a port 31 therein adapted to register with the port 29, the sleeve 30 being rotatably mounted upon the casing 27 and being confined between shoulders 32 and 33 carried respectively by the T and the casing 27. A set screw 34 serves to retain the sleeve 30 in any desired position to permit such regulation as may be necessary of the air flowing into the chamber 28 through the ports 29 and 31, to mingle with the gas in proper proportions to form a combustible and explosive mixture.

An annular valve seat 35 is interposed between the two branches of the L-shaped member, there being a chamber 36 into which the mixture from the chamber 28 may pass when the valve cooperating with the seat 25 is open. The chamber 36 is adapted to communicate with the chamber 37 in the other branch of the L-shaped valve member, the last mentioned chamber being arranged to communicate, through a suitable connection 38, with the manifold or other supply conduit leading to the engine. This connection is shown as provided at one end 39 with an external thread by means of which it is threaded into the branch 27^a, at its other end 40 with an internal thread for the reception of any suitable conduit, and as provided intermediate of such ends with an annular valve seat 41 provided with a central port 42.

The L-shaped member of the valve mechanism is conveniently provided with a flange 43, by means of which said mechanism may be conveniently affixed to the dash, as by screws 44. It is also provided with a sleeve 45 projecting in axial alinement with the bore 20 and chamber 28 and constituting a guide for the valve stem 46, said stem being provided at its inner end with a valve 47 cooperating with the seat 35. At its outer end, the valve stem is provided with a knob 48, which is adjustably secured to said stem and is secured in place by means of a set screw 49. The knob is provided with a cavity 50, extending from the inner face thereof, and in this cavity is mounted a ball 51, which ball is held at the outer end of said cavity by means of a spiral spring 52. The ball may be conveniently retained within its aperture by staking the outer end of the cavity to contract the same. This ball cooperates with a metal plate 53 secured to

the dash, to which plate there is connected one of the terminals 54 of the magneto or other igniting circuit. The valve 47 and its stem are normally held in their outermost or closed position by means of a spring 55 within the chamber 28 and bearing at one end against the body 10^a and at its other end against the valve 47.

An automatically operating valve is located within the valve chamber formed by the chamber 37 and the inner end of the connection 38. This valve is shown in detail in Figs. 2, 5, 6 and 8, and comprises generally a stem 56 having at each end a valve head. One of these heads 57 controls the flow of gaseous fluid into the chamber 37 through the aperture 36^a and the other head 58 controls the flow from the chamber 37 into the conduit leading to the engine. Each valve head comprises a central body or valve proper which is of such size and shape as to closely engage its corresponding seat and is provided, outside of said valve proper, with a suitable number of slots or passageways 57^a and 58^a to permit the gaseous fluid to flow freely through the chamber 37 and the interior of the sleeve 39 when the valves are unseated.

In the embodiment of the invention shown in the first four figures, the connection 40 communicates with a manifold 59 and from this manifold extend the conduits 60 which lead to the various engine cylinders. While the valve mechanism described herein is capable of general application, I have shown, as part of the igniting mechanism, the spark plugs of the engine, as indicated in Figs. 1, 3 and 4. For this purpose, each conduit 60 is connected to a special design of valve plug which will admit the igniting fluid through the cylinder and in such proximity to the spark point as will insure ignition. A convenient form of plug for this purpose is provided by elongating the outer casing and the inner body of a plug so as to form a chamber extending outside of the engine cylinder and into which chamber the conduit 60 may discharge.

In the drawings, 61 denotes the inner body of a spark plug, 62 the point or terminal carried thereby; 63 denotes the outer casing of the plug, which is provided with a thread 64 by means of which the plug may be screwed into place in the cylinder wall, the outer portion of the casing 63 being squared for the reception of a wrench. By elongating the body 61 and casing 63 a chamber 65 is provided which extends outside of the engine cylinder, which chamber may be conveniently closed by means of a suitable packing nut 66 threaded into the outer end of the casing 63. The chamber 65 is conveniently placed in communication with the conduit 60 by the construction shown herein, wherein a port 63^a is pro-

vided in the wall of the casing 63, said port havng a conical recess at its outer end for the reception of the conical inner end 67 of the conduit. The conical end of the conduit is conveniently carried by a yoke or frame 68 which yoke is provided, opposite the tapered end of the conduit 67 with a screw 69 and having a conical end 70 adapted to fit within a conical recess in the casing 63 opposite the conical recess at the outer end of the port 63^a. It will be apparent that, by merely tightening up the screw 69, a non-leaking connection may be made between the conduit 60 and the spark plug. For convenience of application, the conical seats on opposite sides of the plug casing may each merge with a bore (63^a and 63^b) whereby the conduit may be applied to either side of the plug and no special care need be exercised in applying the yoke to the plug. From the construction shown it is evident that combustible fluid admitted to the cylinder will first fill the chamber 65 and be in such proximity to the points or terminals 62 and 62^a as will insure ignition.

The construction of the spark plug and the arrangement of the parts whereby it forms part of the conduit for supplying ignition gases to the cylinder constitute the subject matter of my co-pending application No. 657,840 filed October 31, 1911.

With the parts arranged as described the operation will be as follows: Just prior to stopping the engine, the operator pushes the button 48 with his foot. This cuts out the ignition current to the plugs. In the embodiment shown in Fig. 2, the circuit is grounded through the terminal 54, plate 53 and knob 48. The inward movement of the valve stem unseats the valve 47 and the movement of said valve unseats the valve 22. The valve 15 being set for the desired rate of flow, gas can enter the chamber 28, where it is mixed with air entering through the ports 29 and 31. At first, as the engine slows down, its suction upon the automatic valve 57, 58 will be so great that the valve 58 will be seated against the action of the spring 56^a, and no gas will enter the cylinders until this suction falls below the tension of said spring. The parts preferably will be so proportioned that this result will be obtained at about the last two strokes of the motor. Meanwhile, until the suction so falls the port around the valve 15 will be protected from the suction of the engine and, even where the gas discharges into a mixing chamber, the loss of gas prior to the unseating of the valve 58 will be small.

In Fig. 5 of the drawings there is shown a modification of the invention, which differs from that shown in the views discussed hereinbefore in illustrating a differ-

ent form of circuit breaker, a different form of air valve, and the employment of a hand operated pump to force the gases to the cylinders. The parts which are substantially identical with those in the preceding figures are designated by like numerals. In this figure, the air valve is formed by means of a hollow internally threaded boss 72 projecting from the mixing chamber 28 and provided with a slot 73 for the admission of air, which slot is controlled by means of a valve plug 74 threaded into said boss. For the purpose of grounding or cutting out the ignition, the valve stem 46 is provided with a collar 75 having a slot which receives the outer end of a spring plate 76 located between two other plates 77 and 78. The plates 76 and 77 are normally in contact and may form part of the battery circuit. When the knob 79 is pushed inwardly to admit gas to the chamber 28 the battery circuit is broken between the plates 76 and 77 as well as at the switch usually provided. The magneto circuit is grounded or short-circuited between the plates 76 and 78.

Instead of the form of connection shown in Fig. 2, the valve 58 is mounted within a connection 80 having a seat 81 and an internally threaded end 82 for the reception of the conduit leading to the engine or engines. Intermediate of the valve seat 81 and the threaded end 82, the connection 80 has a cylinder 83 communicating therewith wherein there is mounted a piston 84, the rod 85 whereof is connected to an operating rod 86, which may be suitably guided by sleeves 87 projecting from the cylinder and is provided with an operating handle 88. It will be obvious that a movement of the piston 84 away from the connection 80 will create a suction in the supply conduit and particularly in that part extending from the double acting valve 57—58 to the engine, and that a reverse movement will create a compression in said conduit.

In Fig. 6 there is illustrated a modification of the invention wherein the construction of the parts is substantially identical with the like-numbered parts in the preceding modifications. In the particular form of invention shown in Fig. 6, the automatic valve governs the admission of air to the gas flowing past the valve 47. 89 denotes a casing projecting at substantially right angles from the casing 27 and preferably directly opposite the internally threaded connection 90 for the conduit supplying gas to the engines. The casing 89 is provided with a reduced bore or chamber 91 provided with a valve seat 92, cooperating with the valve 58 and with an enlarged bore or chamber 93 for the valve 57. The outer end of the casing 89 is closed by a plug 94 having an angular passageway 95 communicating at its

outer end with an aperture 96 in the casing, the flow of air of said passageway being controlled by the valve 57.

In Fig. 7 there is illustrated a modification of the invention wherein the flow of gas and air to the mixing chamber 28 is secured in substantially the same manner as in the case of the form of the invention first described. The parts which correspond in construction to those in Fig. 2 are given like reference numerals. The automatic valve construction is more directly connected with the valve stem 46 than is the case with the modifications hereinbefore described and needs particular description. 97 denotes a valve which is adapted to rest upon the seat 35 formed between the chambers 28 and 36. This valve is provided with an upwardly projecting yoke 98 which is adapted to engage the valve stem 21 and open the valve carried thereby. The valve 97 is sleeved upon the stem 46 and the sleeve portion 99 which extends into the chamber 36 is engaged by a spring 100 which tends to unseat the valve. The valve stem 46, however, is provided with a disk 101 which is adapted to overhang the valve 97 and is held against said valve by a spring 102 surrounding the stem 46 and pressing outwardly against a suitable enlarged portion or abutment 103 thereof. From the chamber 36 there extends a threaded connection 104 for the conduit leading to the engine. In the operation of this modification, the action of the spring 100 to unseat the valve 97 is normally prevented by the opposing action of the spring 102. When the operator pushes the knob 79 inwardly, it abuts against the surrounding sleeve 105 and the valve 97, being relieved of the action of the spring 102, will be unseated by the spring 100 and the yoke 98 will, through the movement of the valve 97, engage the valve stem 21 and unseat its valve. Gas can now flow to the chamber 28, and the mixture of gas and air from said chamber can flow to the chamber 36 and thence to the engine cylinders, provided that the suction of the motors is not too great. If the suction is too great, the valve 97 will be seated thereby and remain seated until the diminishing suction is overcome by the action of the spring 100, and the flow of fluid fuel to the engine will not occur until the valve is thus unseated.

In all the embodiments of the invention shown herein an automatic valve is employed which is operated by the suction of the engine to prevent the flow of fluid to the engine when the suction is too great but to allow the flow of such fluid when the suction is sufficiently light,—as when the engine is substantially at a stand still and just before this condition. It will be apparent that the head of the automatic valve

which is remote from the spark plug and cylinder will act as a check valve to prevent the loss of compression when the engine is started, the head of the valve which is nearer the spark plug and cylinder serving to prevent the waste of gas through the admission of the same to the spark plug and cylinder before the engine has nearly stopped.

The invention disclosed herein is comparatively simple and inexpensive but is extremely efficient in operation. The regulating valve 14 can be adjusted to control the amount of gas flowing through the conduit so as to adapt the same for the needs of the engine. After such regulation has been effected, the flow of the gas thus regulated may be instituted by unseating the valve 22. The employment of the automatic valve 58, 59 protects the entire gas line extending therefrom to the tank 4 from the suction of the engines except when the suction falls to the predetermined degree. This results in a great saving of gas in a system wherein the charging of the engines is accomplished just prior to stopping the same, and this saving is an important desideratum both with and without the employment of a mixer. The automatic valve is also of great advantage when the lamps are in use, as it protects the lamp conduits 7 from the suction of the engines until this suction falls to such an extent as to produce no material effect on such conduits and the satisfactory operation of the lamps.

Having thus described my invention, what I claim is:—

1. In starting mechanism for internal combustion engines, the combination of a gaseous fluid supply conduit, an engine cylinder with which said conduit is connected, valve mechanism normally preventing the flow of fluid through said conduit to said cylinder, and automatically operating valve mechanism within said conduit arranged to prevent the flow of fluid through said conduit until the suction produced within the cylinder falls to a predetermined degree.

2. In starting mechanism for internal combustion engines, the combination of a gaseous fluid supply conduit, an engine cylinder with which said conduit is connected, a valve regulating the flow of fluid through said conduit, valve mechanism normally preventing the flow of fluid from the former valve to said cylinder, and automatically operating valve mechanism within said conduit arranged to prevent the flow of such fluid through said conduit and past the former valves until the suction produced within the cylinder falls to a predetermined degree.

3. The combination of a cylinder of an internal combustion engine, a gaseous fuel conduit communicating therewith and adapted to supply fuel thereto for the purpose of starting the engine, and means con-

trolled by the speed of such engine for permitting the flow of such fuel through the conduit to the cylinder.

4. The combination of a cylinder of an internal combustion engine, a gaseous fuel conduit communicating therewith and adapted to supply such fuel thereto for the purpose of starting the engine, a regulating valve in such conduit, a spring seated cut-off valve normally preventing the flow of fuel through said conduit, and an automatically operating valve interposed between the former valves and the cylinder and arranged to control the flow of the starting fluid in accordance with pressure conditions in the cylinder.

5. The combination of a cylinder of an internal combustion engine, a fluid conduit communicating therewith, a valve for regulating the flow of such fluid through said conduit, a normally seated valve in said conduit, and a valve interposed between the former valves and the cylinder and arranged to prevent the flow of gaseous fuel through the conduit until the suction produced within the cylinder falls to a predetermined degree.

6. The combination of a cylinder of an internal combustion engine, a fluid conduit communicating therewith and adapted to supply fluid thereto for starting purposes, a valve for regulating the flow of such fluid through said conduit, a mixing chamber within said conduit, and an automatically operating valve interposed between the mixing chamber and the cylinder and arranged to prevent the flow of fluid from said chamber to the cylinder until the suction within the latter falls to a predetermined degree.

7. The combination of a cylinder of an internal combustion engine, a fluid conduit communicating therewith and adapted to supply fluid thereto for starting purposes, a valve for regulating the flow of such fluid through said conduit, a mixing chamber within said conduit, a normally closed cut-off valve interposed between the mixing chamber and the cylinder, and an automatically operating valve between the last mentioned valve and the cylinder and arranged to cut off communication between the mixing chamber and the cylinder until the suction in the latter falls to a predetermined degree.

8. The combination of a cylinder of an internal combustion engine, a fluid conduit communicating with said cylinder to supply fluid thereto for starting purposes, said conduit being provided with a valve chamber one end of which is of smaller diameter than the other and having an annular valve seat at each end of said chamber, a valve stem having thereon a pair of valves mounted in opposite ends of said chamber and arranged to reciprocate therewithin, each valve being

adapted to cooperate with a seat, there being one or more passageways provided outside of the central body portion of each valve.

9. The combination of a cylinder of an internal combustion engine, a fluid conduit communicating with said cylinder to supply fluid thereto for starting purposes, said conduit being provided with a valve chamber having an annular valve seat at each end thereof, a valve stem having thereon a pair of valves mounted in said chamber and arranged to reciprocate therewithin, each valve being adapted to cooperate with a seat, there being one or more passage ways provided around the body of each valve, and a valve in the conduit arranged normally to prevent the flow of fluid to the said chamber.

10. The combination of a cylinder of an internal combustion engine, a conduit for supplying fluid thereto for starting purposes, a regulating valve in said conduit, a normally seated cut-off valve in said conduit and interposed between the regulating valve and the cylinder, means whereby the latter valve may be unseated, and an automatically operating valve interposed between the last mentioned valve and the cylinder and adapted to be opened and closed by variations in pressure conditions in that portion of the conduit between said valve and the cylinder.

11. The combination of a cylinder of an internal combustion engine, a conduit for supplying fluid thereto for starting purposes, a valve in said conduit, a second valve in said conduit and normally seated by the pressure of such fluid, a push rod having a portion within said conduit adapted to engage the second valve to unseat the same, and a spring normally holding the rod out of operative relation to said valve.

12. The combination of a cylinder of an internal combustion engine, a conduit for supplying fluid thereto for starting purposes, a valve in said conduit, a second valve in said conduit and normally seated by the pressure of said fluid, a mixing chamber in said conduit into which the stem of said second valve projects, a valve seat interposed between the mixing chamber and the portion of the conduit extending to the cylinder, a valve stem slidably mounted in the conduit and having a valve cooperating with said seat and adapted by its movement to engage said stem, and a spring normally holding the last mentioned valve on said seat.

13. The combination of a cylinder of an internal combustion engine, a conduit for supplying fluid thereto for starting purposes, a valve in said conduit, a second valve normally seated by the pressure of the fluid in said conduit, an automatic valve in said conduit arranged to prevent the flow of such fluid to the cylinder until the suction therein falls to a predetermined degree, an un-

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seating device for the second valve, and means whereby the movement of said device will cut out the igniting circuit.

14. The combination of a cylinder of an internal combustion engine, a conduit for supplying fluid thereto for starting purposes, a valve in said conduit, a mixing chamber in said conduit, a valve controlling the flow of fluid from said mixing chamber, a valve normally seated by pressure of the gas in the conduit to prevent the flow of gas into the mixing chamber, and means whereby the opening of the second valve will unseat the third valve.

15. The combination of a cylinder of an internal combustion engine, a conduit for supplying fuel thereto for starting purposes, a valve in said conduit, a longitudinally movable valve stem within said conduit and interposed between said valve and the cylinder, a valve on said valve stem, a push rod projecting into said conduit and adapted by a movement in one direction to operate said valve stem in a direction to unseat the valve, and a spring opposing such movement of the push rod.

16. The combination of a cylinder of an internal combustion engine, a conduit for supplying fluid thereto for starting purposes, a regulating valve in said conduit, a cut-off valve normally preventing the flow of such fuel through said conduit, and an automatically operating valve interposed between the former valves and the cylinder and arranged to control the flow of such fluid in accordance with pressure conditions in the conduit.

17. The combination of a cylinder of an internal combustion engine, a conduit for supplying fluid thereto for starting purposes, a normally seated valve in said conduit, and a valve interposed between the former valve and the cylinder and arranged to prevent the flow of gaseous fuel through the conduit until the suction therein falls to a predetermined degree.

18. The combination of a cylinder of an internal combustion engine, a conduit for supplying fluid thereto for starting purposes, a valve for regulating the flow of such fluid through said conduit, a mixing chamber within said conduit, and an automatically operating valve interposed between the mixing chamber and the cylinder and arranged to prevent the flow of fluid from said chamber through the conduit until the suction within the conduit falls to a predetermined degree.

19. The combination of a cylinder of an internal combustion engine, a conduit for supplying fluid thereto for starting purposes, a valve in said conduit normally seated by the pressure of such fluid, a push rod having a portion within said conduit adapted to engage said valve to unseat the

same, and a spring normally holding the rod out of operative relation to said valve.

20. The combination of a cylinder of an internal combustion engine, a conduit for supplying fluid thereto for starting purposes, a valve in said conduit normally seated by the pressure of such fluid, said valve having a stem within said conduit, a valve seat in said conduit between the former valve and the cylinder, a valve stem slidably mounted in the conduit and having a valve cooperating with said seat and adapted by its movement to engage the stem of the former valve, and a spring normally holding the last mentioned valve on its seat.

21. The combination of a cylinder of an internal combustion engine, a conduit for supplying fluid thereto for starting purposes, a valve normally seated by the pressure of fluid in such conduit, an automatic valve in said conduit arranged to prevent the flow of fluid to the cylinder until the suction in the conduit falls to a predetermined degree, an unseating device for the first mentioned valve, and means whereby the movement of said device will cut out the igniting circuit.

22. The combination of a cylinder of an internal combustion engine, a conduit for supplying fluid thereto for starting purposes, a valve in said conduit arranged to prevent the flow of such fluid until the suction in the conduit falls to a predetermined degree, and means connected with said conduit for creating a suction therein.

23. The combination of a cylinder of an internal combustion engine, a conduit for supplying fluid thereto for starting purposes, an automatic valve in said conduit arranged to prevent the flow of fluid there-through until the suction in the conduit falls to a predetermined degree, and a pump connected with said conduit.

24. The combination of a cylinder of an internal combustion engine, a conduit for supplying fluid thereto for starting purposes, an automatic valve in said conduit arranged to prevent the flow of fluid there-through until the suction in the conduit falls to a predetermined degree, a valve on the supply side of the automatic valve and normally seated by the pressure of the fluid in said conduit, means for unseating the last mentioned valve, and a pump interposed between the first mentioned valve and the cylinder and communicating with the conduit.

25. In a starter for gas engines in combination with an apertured casing, means for introducing therinto a supply of gas under pressure, means whereby the flow may be manually regulated, means actuated by said last mentioned means for stopping the further actuation of the magneto coincidently with the opening of said valve, and an apertured sleeve adapted to engage over

one of the apertures in said casing, whereby the quantity of air drawn into the casing therethrough by the movement of the gas may be regulated.

5 26. In a starter for gas engines, in combination with an apertured casing, means for introducing thereinto a supply of gas, a pipe connecting one of the apertures in the casing with the engine cylinder, a valve controlling the flow therethrough and adapted to be held in closed position by the suction due to the running of the engine, and means for contemporaneously opening the inlet aperture and for stopping the further action of the magneto, thereby stopping the engine.

15 27. A starter for a gas engine, having in combination a casing provided with a plurality of apertures a stem member slidably engaging therein through one of said apertures, means for introducing a supply of gas into said casing through another of said apertures, means adapted to be positively actuated by said stem for controlling the inflow through said last mentioned means, a pipe connecting said casing with the engine

cylinder, a valve adapted to be closed by the suction in said pipe due to the movement of the engine piston in the cylinder, and means for stopping the magneto coincidently with the admission of gas into the casing and through said pipe.

28. In a starter for gas engines, in combination with a casing member, inlet and outlet pipes leading respectively into the interior thereof and therefrom to connection with the engine cylinders, a normally closed valve controlling the flow through said inlet pipe, a stem member whereby said valve may be actuated, and an electrical connection adapted to be grounded by the actuation of said stem member, whereby ignition of the supply of gas admitted by the opening of said valve is avoided.

In testimony whereof, I hereunto affix my signature in the presence of two witnesses.

HAROLD B. ANDERSON.

Witnesses:

J. B. HULL,

BRENNAN B. WEST.