

1,089,478.

Witnesses;

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UNITED STATES PATENT OFFICE.

ALEXANDER T. KASLEY, OF SWISSVALE, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE COLONIAL TRUST COMPANY, TRUSTEE, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

EXPLOSION-MOTOR.

1,089,478.

Specification of Letters Patent.

Patented Mar. 10, 1914.

Application filed September 1, 1909. Serial No. 515,578.

To all whom it may concern:

Be it known that I, ALEXANDER T. KASLEY, a citizen of the United States, and a resident of Swissvale, in the county of Allegheny and State of Pennsylvania, have made a new and useful invention in Explosion-Motors, of which the following is a specification.

This invention relates to means for controlling the explosive mixture to internal combustion engines and one object is to provide means for automatically varying the ratio of the components of the mixture as the thermal value of the gas content thereof varies.

In gas-engine practice it has been found that the thermal value of the gas forming one of the components of the mixture is liable to vary, especially is this so when the gas is derived from a producer. If a fixed ratio between the components of the mixture that is, between the air and gas, is maintained, the efficiency of the engine will vary as the quality of the gas varies. With this invention I am enabled to change the ratio of air and gas making up the mixture in accordance with the variations in the quality of the gas. This is done automatically so as to maintain the best mixture under all conditions.

In the figure illustrating one embodiment of my invention, I have shown an arrangement for accomplishing the desired result, the various parts being shown in diagram.

1 designates an inlet pipe of the motor cylinder through which the charge of air and gas passes and said pipe is throttled by a valve 2, having a stem 3 connected to the link 4, said link being connected to a governor lever 5 fulcrumed in the bracket 6 and engaging the collar 7 of the governor 8 which is driven from the shaft of the motor. The pipe 1 communicates through any suitable connection with the air inlet pipe 9 and with the gas inlet pipe 10. The pipes 9 and 10 are provided with valves 11 and 12 respectively, said valves being operated from a lever 13 fulcrumed at 14 and connected to said valves by the links 15 and 16. The lever 13 is provided with an arm 17 connected to a link 18 engaging a crank pin 19 on the shaft 20 of a gear 21. The gear 21 meshes with the worm 23 on the shaft 24, said shaft 24 being driven by a motor 25

having suitable connections with the generator 26 driven by the engine. The governor lever 5 is connected to a link 27 engaging a floating lever 28 which is connected to the arm 17 through a link 29. The lever 28 is also connected to a rod 30 of a rheostat 31 having the usual resistances, the operation of which will be explained hereinafter. The generator 26 is provided with leads 32 and 33 terminating in contacts 34 and 35. The motor 25 is provided with leads 36, 37, 38 and 39. The lead 36 is provided with two contacts 40 and 41 and the lead 37 is provided with a contact 42. The lead 38 ends in the rheostat 31 and the conductor wire 43 leads from the rheostat into the resistance 44 in the main line 45 of the generator 26. The lead 39 is connected to the resistance 44 which is in series with the main line 45, and 46 is the other lead of the main line.

In the drawings, I have illustrated a three-point switch in the generator circuit, said switch shown as comprising two pivoted contact bars 47 and 48 connected together by a link 49 and actuated so as to cover the contacts 41 and 42, or 42 and 40, dependent upon the direction in which the motor shaft 24 is to be driven. The switch consisting of the bars 47 and 48 and the link 49, is constantly vibrated so as to periodically close the contacts with the wires 36 and 37 through contacts 41 and 42, or contacts 40 and 42. The constant forward and backward movement of the bars 47 and 48 is accomplished by the link connection 49 actuated from a crank arm 51 of a shaft 52 driven so that the motor 25 may be driven first in a forward direction and then a rearward direction.

Assuming all of the parts to be properly assembled and in operative position, it will be apparent that the valve 2 will assume a position determined by the load on the engine and by the efficiency of the mixture, it being evident that a greater quantity of the mixture will be required if it is not of good explosive efficiency. For every one-half revolution of the shaft 52, the contact arms 47 and 48 will make contact so as to cause the motor 25 to rotate the gear 21 so as to make a change in the mixture. If this change enables the engine to carry the load with less gas the link 30, being connected to such a

point on lever 28 as to move with the gas consumption as determined by the positions of valves 2 and 12, will change the resistance of 31 in such a way as to diminish the speed of motor 25 when the next contact of pièces 47 and 48 runs the motor in the reverse direction, and vice versa. The net result of any two runnings of the motor will therefore be to leave lever 17 in a more desirable position.

The duration of one complete running of motor 25 (the runnings will vary in duration) will only be sufficient to carry crank 19 through an angle less than 180 degrees.

When the gas engine is started, there may be considerable variation, first in one direction and then in the other, of the valves 11 and 12 but as the equilibrium of gas mixture is approached, the fluctuation will become less and less until it will remain between the limits of the most efficient position, and after the device has found the best mixture under existing conditions there will be very little fluctuation on either side of the desirable point. When it is understood that a five per cent. variation in B. T. U.'s in a given charge will for all practical purposes mean a constant charge of explosive mixture, it will be apparent that the slight variation of the valves due to the shifting of the contact arms 47 and 48 will be inappreciable unless the gas becomes suddenly richer or poorer.

I have also provided means for preventing sudden changes of load from seriously affecting the mixture in case of engines driving generators. Resistance 44 in the main circuit causes the difference in potential that causes current to flow in resistance 31. If the load suddenly increases, the governor will increase the resistance of 31 but the increased voltage drop through 44 will keep the current in 39 and 43 approximately the same, as long as no change occurs in gas quality and vice versa.

Shaft 52 is driven by any suitable means either from the explosion motor or some other source of power and may oscillate, but preferably revolves.

A very sudden change in the richness of the gas would make the engine shut down before either the apparatus described or the engineer could adjust the mixture, but all properly arranged plants have sufficient capacity in the piping and scrubbers, and possibly a gas reservoir, to cause any sudden change in the gas from the producer to be distributed over an appreciable length of time.

If a change in gas quality takes place first, if it becomes richer, that motion of the motor which causes the gas valve 12 to open slightly will cause a slight drop in speed, the governor balls will slowly fall, the link 27 will be raised, and the resistance 31 will be higher, the field of motor 25 will be

slowly weakened, so that by the time the reverse run of motor 25 occurs it will run faster and cause the gas valve 12 to close up a good deal so as to be nearer the correct position. This will cause the engine to speed up, governor balls will rise slowly, resistance of 31 will be smaller, and by the time the next reverse run takes place, the field of the motor will be strong, and the motor will run slow so as to produce a relatively small increase in the opening of valve 12. As every motion in the right direction is greater than the following motion in the wrong direction, the valves will finally come to the best position. If the gas becomes leaner instead of richer, the governor actions are just the reverse of those described, so that the net result is that valve 12 is opened wider. Link 29 has not been mentioned in the above paragraph. If it were omitted and the end of lever 28 were fixed, it will be apparent to those skilled in the art that the apparatus will set for the mixture which carries the greatest load. This mixture, however, will result in a slightly higher consumption of fuel than if the mixture were a little leaner. Link 29 causes the position of rheostat 31 to vary with the amount of gas used and not entirely with opening of valve 2 as the gas flow varies with the opening of both valve 12 and valve 2.

In the case of engines driving other apparatus, the dynamo 26 would be the one which furnishes the ignition current and leads 39 and 43 would be connected to 32 and 33 and the resistance 44 would be omitted.

The circuit including the wires 38 and 39 is the field circuit of motor 25 and the circuit including wires 36 and 37 is the armature circuit of said motor. It will be understood that the resistance decreases as link 30 is moved downward and increases as said link moves upward.

It should be understood that the invention is not limited to the use of electric motors as fluid pressure motors or friction motors could be used in the same way, the resistance 31 becoming a throttle or other governing mechanism.

What I claim is:

1. In combination with an internal combustion engine, a mixing device having valved air and gas inlets, an electric motor for operating the valves of said inlets and means for varying the effective opening of the gas valve as the calorific value of the gas varies.

2. Means for regulating the mixture for an explosion motor comprising mixture mechanism, of which a reversible motor forms a part, means for alternately operating said motor in either direction and means for varying the speed of the motor in either direction.

3. Means for regulating the mixture for

an explosion motor comprising an air valve, a gas valve, a reversible motor for opening and closing said valves and means for varying the speed of the motor in either direction.

4. Means for regulating the mixture for an explosion motor comprising a gas conduit, an air conduit, valves in the conduits, a motor for imparting opening and closing movements to said valves, means for alternately operating said motor during a given time in either direction and means for causing said motor to speed up at intervals in either direction.

5. Means for regulating the charge of air and gas for an explosion motor dependent upon the quality of the gas, said means including conduits and valves for the air and gas supplies and an agent for operating said valves whereby more gas will be permitted to enter the combustion chamber of the motor when the gas is lean than when the gas is of relatively rich quality.

6. Means for regulating the charge of mixture for an explosion motor comprising a motor, air and gas inlet mechanism controlled by said motor, a source of power for said motor, a circuit in which the motor and source of power are installed, resistances in

the circuit and governor actuated means for controlling the resistances to determine the speed of the motor in either direction.

7. Means for regulating gas engines comprising mixture mechanism, a motor for operating said mechanism, a source of power and its circuit with which the motor is in series, a circuit maker and breaker in the circuit, means for regulating and intermittently making and breaking the circuit, resistances in the circuit and governor controlled means for cutting in or cutting out the resistances dependent upon the speed of the motor.

8. Means for regulating gas engines comprising mixture mechanism, a motor for said mechanism, a governor actuated means for controlling the speed of the motor, means for reversing the motor and means controlled by the governor for throttling the charge of mixture entering said motor.

In testimony whereof, I have hereunto subscribed my name this 30th day of August, 1909.

ALEXANDER T. KASLEY.

Witnesses:

C. W. McGHEE,
GEORGE C. WALKER.