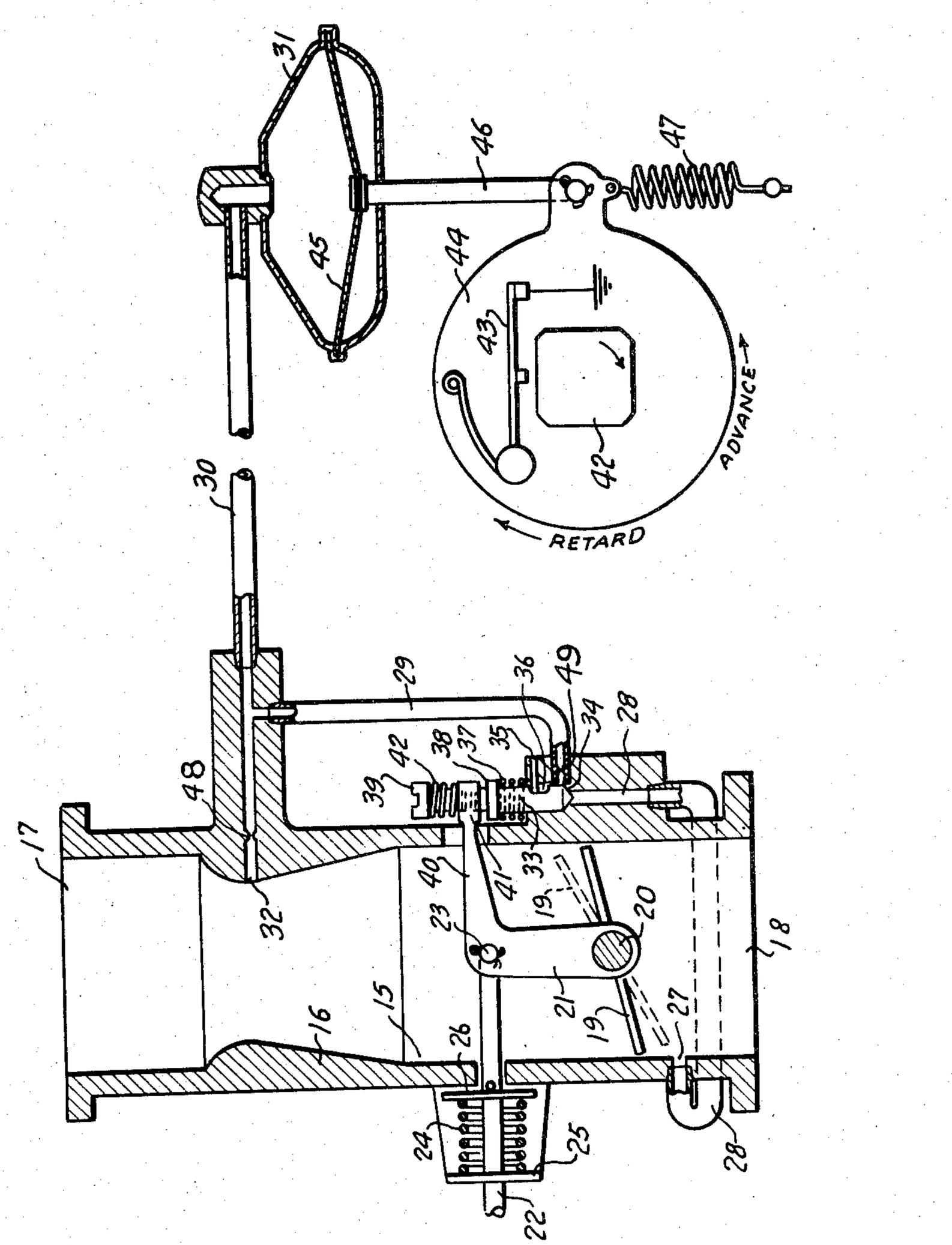
March 6, 1951 M. MALLORY 2,544,608

IGNITION SYSTEM FOR INTERNAL-COMBUSTION ENGINES

Filed July 20, 1948



INVENTOR.
MARION MALLORY
BY
Barnes, Kisselle, Raisch & Choate
ATTORNEYS

Patented Mar. 6, 1951 2,544,608

UNITED STATES PATENT OFFICE

2,544,608

IGNITION SYSTEM FOR INTERNAL-COMBUSTION ENGINES

Marion Mallory, Detroit, Mich.

Application July 20, 1948, Serial No. 39,657

6 Claims. (Cl. 123—117)

1

This invention relates to an ignition system for an internal combustion engine.

It is an object of this invention to produce a simple, efficient and dependable mechanism which utilizes the intake manifold suction of an internal combustion engine to advance and retard the ignition spark so as to obtain maximum efficiency in the burning of the charge under all operating conditions of the engine.

In ignition systems having a suction device to advance the spark when the engine is working under light load and on part throttle and where the suction device is connected between the throttle and engine, it has always been difficult to get the spark to retard fast enough to prevent spark knocking when the throttle was suddenly opened to about three quarters throttle position. This is due to the fact that the vacuum between the throttle and engine does not die down fast enough to retard the spark rapidly. In my ignition system this difficulty is overcome.

The drawing is a sectional view showing my ignition system.

My ignition system is illustrated by the elements referenced as follows: Referring to the drawing, the intake passageway is designated 15, venturi 16, inlet 17 and the outlet to the engine 18. Throttle valve 19 on shaft 20 controls the flow of motive fluid through outlet 18 to the internal combustion engine. A crank arm 21 is fixed on throttle shaft 20 and is manually controlled by rod 22 pivoted as at 23 to crank 21. Compression spring 24, operating between bracket 25 and washer 26 keyed on rod 22, tends to close throttle 19 to idle position. Port 27 is positioned in the intake passageway and communicates by means of passageway 28, conduits 29 and 30 with servo-motor 31. Conduit 30 connects into venturi 16 through orifice 32. Communication between passageway 28 and conduit 29 is controlled by needle valve 33 which seats against seat 34. Pin 35, operating in slot 36 in valve 33, limits the upward or opening movement of valve 33. Compression spring 37, operating against collar 38 on valve 33, tends to raise and open the same. Screw 39 is threaded into arm 40 of crank 21 as at 41 and is held in adjusted position by compression spring 42. The lower end of idle adjusting screw 39 seats against the top 38 of valve 33.

When the engine is idling, as shown in the drawing, spring 24 acts through crank 21 and screw 39 to hold valve 33 closed and communication between the intake manifold on the engine side of throttle valve 19 and conduit 29 is shut off. As soon as throttle arm 40 moves the slightest distance, even a few thousandths of an inch, screw 39 will move upwardly and permit spring 37 to open valve 33 correspondingly thereby to admit intake manifold vacuum into lines 29, 30 and suction device or servo-motor 31.

2

The timing mechanism is conventional and essentially the same as that shown in my Patent 2,268,490. This timing mechanism consists of a rotatable cam 42 which operates the electrical circuit breaker 43. Circuit breaker 43 is mounted on plate 44 which can be rotated counterclockwise to advance the spark and clockwise to retard the spark. Suction device 31 is used for advancing and retarding the spark. The suction device comprises a flexible diaphragm 45 mounted in a housing which is connected by conduits 30 and 29 with the intake passageway. Diaphragm 45 is connected by rod 46 with plate 44 and tension spring 47 tends to rotate plate 44 clockwise in spark retarding position. With this suction controlled ignition timer the vacuum in suction device will never be as high as the intake manifold vacuum due to the air bleeding into conduit 30 through orifice 32 but the spring 47 is of such tension as to give sufficient spark advance.

If desired, suction line 30 can be connected to an ignition timer of the type shown in my Patent 2,306,889 wherein part of the spark advance will be controlled by a centrifugal governor and the supplementary spark advance by intake manifold vacuum. With this last mentioned type of ignition timer orifice 32 will be omitted and the suction device or servo-motor will be connected directly to conduit 29.

The drawing shows the position of all the parts of my ignition system when the throttle valve is in idle position. I have shown in the dotted lines the position of only throttle valve 19 in partly open position at the point at which orifice 27 is about to pass from the engine side to the atmosphere side of throttle valve 19. Orifice 27 is positioned in intake passageway 15 so that it will always be on the engine side of the throttle valve when the throttle valve is in idle position and where it will pass through or over the atmosphere side of the throttle valve at whatever partly open position of the throttle valve is necessary to cause the spark to retard quickly enough upon further opening of the throttle valve. Orifice 27 can be located in intake passageway 15 at a position where it will pass from the engine to the atmosphere side of throttle valve 19 anywhere from about one-quarter to three-quarters open throttle. The position at

which orifice 27 will pass from the engine to the atmosphere side of throttle valve 19 between about one-quarter to three-quarters open position of the throttle valve will depend upon the characteristics of the engine with which my ignition system is used.

My pressure ignition will cause the spark advance to be high when the engine is running under light loads because at such time orifice 27 will be on the engine side of throttle valve 19 but if the throttle 19 is opened further, and particularly if such opening is suddenly executed, orifice 27 will pass to the atmosphere side of the throttle and the spark will be quickly retarded the correct amount so as to obtain maximum power from the burning charges in the engine cylinders.

In my device as throttle 19 opens from idle position, valve 33 opens and connects suction device 31 with orifice 27. Although orifice 27 is subjected to the full intake manifold vacuum as long as orifice 27 is on the engine side of throttle valve 19, nevertheless suction device 31 will never be subjected to the maximum manifold vacuum because orifice 27 will be air bled through port 32 in venturi 16. As throttle 7 moves further from idle toward fully open position, the vacuum on the engine side of throttle valve 19 will decrease because the opening of throttle 19 bleeds down the intake manifold but orifice 27 will be subjected to this intake manifold. This decrease in manifold vacuum causes the spark advance to be reduced as the load on the engine is increased. As throttle 19 is opened, however, the speed of air increases through venturi 16 which maintains enough suction to advance the ignition timing for wide open throttle or full load operation. Thus, at part throttle orifice 32 acts as an air bleed to orifice 27 but at full throttle, orifice 32 ceases to be an air bleed and the velocity of the fluid by orifice 32 creates enough suction or vacuum which influences diaphragm 45 to control the timing of the ignition.

A restriction or restricting orifice 48 is located in conduit 30 between orifice 32 and the junction between conduits 30 and 29. Another restriction or restricting orifice 49 is positioned in line 29 between valve 33 and the junction of conduits 29 and 30. Restriction 49 has a smaller area than the cross-sectional area of conduit 28 and also smaller than the area of orifice 27. Therefore, the full intake vacuum obtaining at orifice 27 will always be established in passageway 28 and if there is a slight leakage around valve 33 this leakage will not affect the pressure in conduit 29. If restriction 49 were located in conduit 28 adajacent orifice 27, then a slight leakage around the stem of valve 33 would air bleed the system down too much. Orifice 48 also has a smaller area than that of orifice 32 and also smaller than the cross-sectional area of conduit 30.

I claim:

1. In an internal combustion engine having an intake passageway and a throttle valve in said passageway controlling the flow of motive fluid into the engine, the combination comprising a servo-motor including a suction chamber and actuated by changes of pressure in the intake passageway, an ignition timer connected to said servo-motor and controlled thereby to advance and retard the ignition spark, an orifice in the intake passageway positioned on the engine side of the throttle valve when the throttle valve is closed and passing on to the atmosphere side of

the throttle valve as the throttle valve opens from idle position, the above said orifice being positioned in the intake passageway adjacent to the throttle valve and on the engine side of the throttle valve when in idle position, the above said orifice being located with respect to the throttle valve so that as the throttle valve opens the above said orifice will pass from the engine to the atmosphere side of the throttle valve when the throttle valve is opened within a range from about one-quarter to three-quarters open position, a conduit connecting the above said orifice with said servo-motor, valve means for shutting off communication between the above said orifice and the servo-motor when the throttle valve is in idle position, and means actuated in unison with the throttle valve for opening said valve means whenever the throttle valve is opened further than idle position to place the servo-motor in communication with the above said orifice whereby the intake passageway pressure obtaining at the above said orifice, when the above said orifice is on the engine side of the throttle valve, is established in said servo-motor and the servo-motor responds to advance the spark, a venturi in the intake passageway on the atmosphere side of the throttle valve, and an orifice in said venturi in communication at all times with the suction chamber of said servo-motor.

2. The combination claimed in claim 1 including resilient means for yieldably retarding the ignition timer when the throttle is in idle position.

3. In an internal combustion engine having an intake passageway and a throttle valve in said passageway controlling the flow of motive fluid into the engine, the combination comprising a servo-motor including a suction chamber and actuated by changes of pressure in the intake passageway, an ignition timer connected to said servo-motor and controlled thereby to advance and retard the ignition spark, an orifice in the intake passageway positioned on the engine side of the throttle valve when the throttle valve is closed and passing on to the atmosphere side of the throttle valve as the throttle valve opens from idle position, a conduit connecting said orifice with the suction chamber of said servo-motor, valve means for shutting off communication between said orifice and the suction chamber of said servo-motor when the throttle valve is in idle position, and means actuated in unison with the throttle valve for opening said valve means whenever the throttle valve is opened further than idle position to place the suction chamber of said servo-motor in communication with said orifice whereby the intake passageway pressure obtaining at said orifice, when the orifice is on the engine side of the throttle valve, influences said servo-motor and the servo-motor responds to advance the spark, a venturi in said intake passageway on the atmosphere side of said throttle valve, and an orifice in said venturi communicating at all times with the suction chamber of said servo-motor.

4. The ignition system as claimed in claim 3 including resilient means tending at all time to retard the ignition timer, said resilient means retarding the spark when the throttle valve is in idle position.

5. In an internal combustion engine having an intake passageway and a throttle valve in said passageway controlling the flow of motive fluid into the engine, the combination comprising a servo-motor actuated by changes of pressure in the intake passageway, an ignition timer con-

nected to said servo-motor and controlled thereby to advance and retard the ignition spark, an orifice in the intake passageway positioned on the engine side of the throttle valve when the throttle valve is closed and passing on to the atmosphere side of the throttle valve as the throttle valve opens from idle position, a conduit connecting said orifice with said servo-motor, valve means for shutting off communication between said orifice and the servo-motor when the throttle valve is in idle position, a restriction in said conduit between the said valve means and the servo-motor, said restriction being smaller than the said orifice in the intake passageway, and means actuated in unison with the throttle valve for opening said valve means whenever the throttle valve is opened further than idle position to place the servo-motor in communication with said orifice whereby the intake passageway pressure obtaining at said orifice, when the orifice is on the engine side of the throttle valve, is established in said servo-motor and the servo-motor responds to advance the spark.

6. In an internal combustion engine having an intake passageway and a throttle valve in said passageway controlling the flow of motive fluid into the engine, the combination comprising a servo-motor including a suction chamber and actuated by changes of pressure in the intake passageway, an ignition timer connected to said servo-motor and controlled thereby to advance and retard the ignition spark, an orifice in the intake passageway positioned on the engine side of the throttle valve when the throttle valve is closed and passing on to the atmosphere side of the throttle valve as the throttle valve opens

from idle position, a conduit connecting said orifice with the suction chamber of said servo-motor, valve means for shutting off communication between said orifice and the suction chamber of said servo-motor when the throttle valve is in idle position, and means actuated in unison with the throttle valve for opening said valve means whenever the throttle valve is opened further than idle position to place the suction chamber of said servo-motor in communication with said orifice whereby the intake passageway pressure obtaining at said orifice, when the orifice is on the engine side of the throttle valve, influences said servo-motor and the servo-motor responds to advance the spark, a restriction in the above said conduit positioned between the said valve means and the servo-motor, said restriction being smaller than the above said orifice in the intake passageway, a venturi in said intake passageway on the atmosphere side of said throttle valve, a second conduit between said orifice in the venturi and the suction chamber of said servo-motor, and a restriction in said second conduit smaller than the said orifice in the venturi.

MARION MALLORY.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,969,682	Arthur	Aug. 7, 1934
2,301,554	Mallory	Nov. 10, 1942