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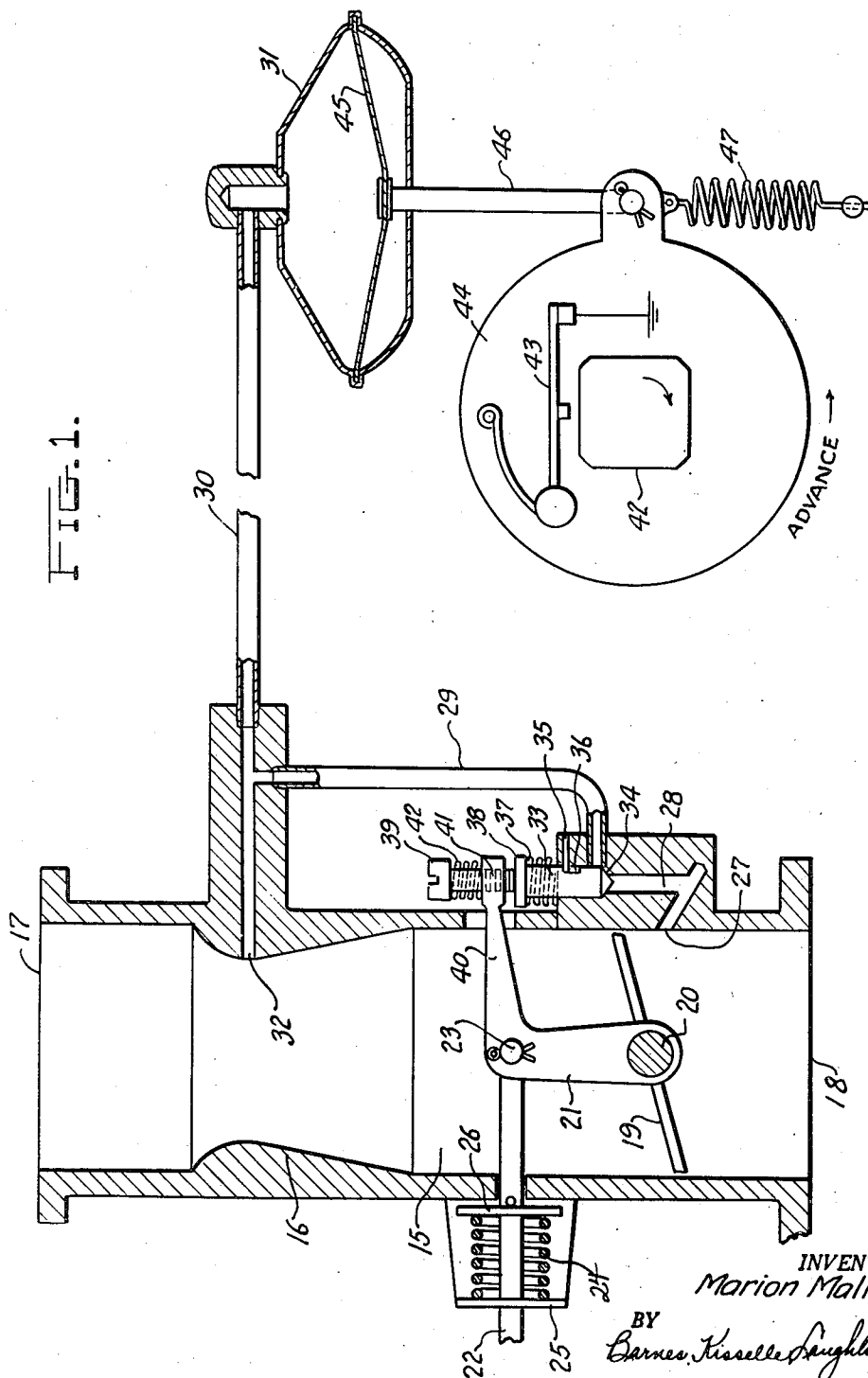
2,471,111

MECHANISM FOR UTILIZING THE MANIFOLD SUCTIONS
OF INTERNAL-COMBUSTION ENGINES

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2 Sheets-Sheet 1

FIG. 1.



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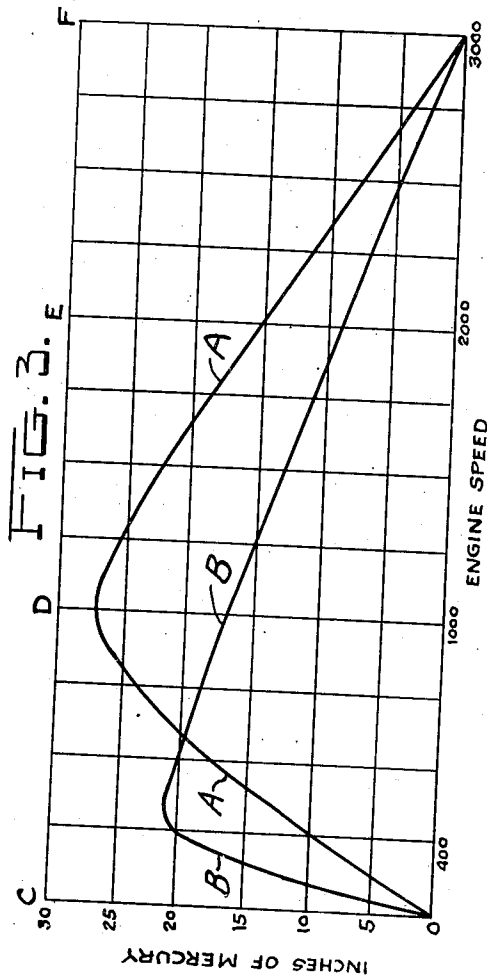
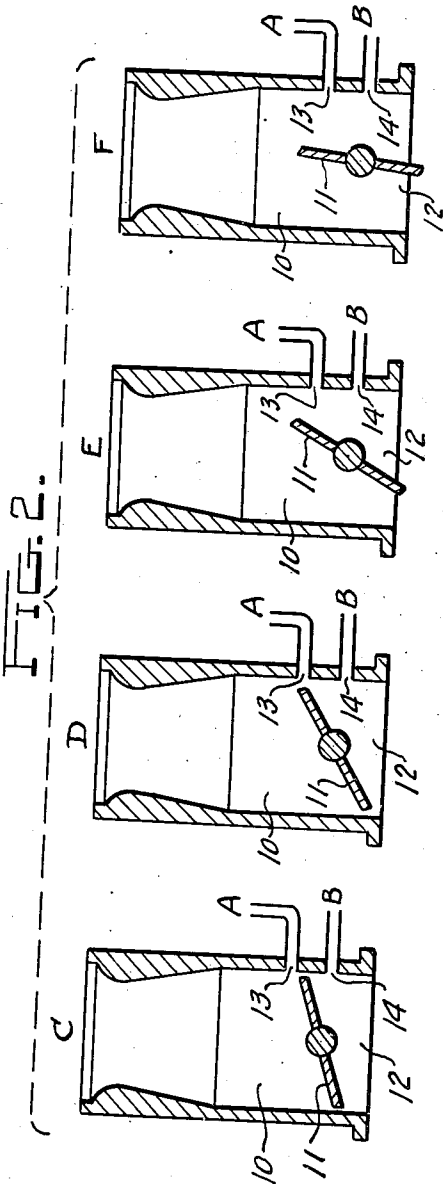
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2 Sheets-Sheet 2



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2,471,111

MECHANISM FOR UTILIZING THE MANIFOLD SUCTION OF INTERNAL-COMBUSTION ENGINES

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This invention relates to mechanism for utilizing the manifold suction of an internal combustion engine.

It is common practice to use the vacuum or suction existing in the intake manifold of an internal combustion engine for operating servomotors which, for example, operate ignition timers, degassers, and other devices.

It is an object of this invention to produce a simple, efficient and dependable mechanism for utilizing the true manifold suction for operating suction devices.

Fig. 1 is a vertical sectional view showing my device applied to an ignition system.

Fig. 2 shows four sectional views of the intake passageway of an internal combustion engine illustrating different positions of the throttle valve with respect to two different conduits connected into the intake passageway adjacent the throttle valve.

Fig. 3 is a graph showing the vacuum in inches of mercury which exists in the intake manifold between the throttle valve and engine at different throttle settings corresponding to those shown in the four views of Fig. 2.

In many instances where the manifold vacuum between the throttle valve and engine is used for operating a suction device it is highly desirable to utilize the true manifold vacuum rather than a modified manifold vacuum. Referring to Fig. 2 I have shown an intake passageway 10 provided with the usual butterfly throttle valve 11 and having an outlet 12 to the engine. A conduit A connects into the intake passageway at 13 just above throttle valve 11 at idle position and conduit B connects into passageway 10 at 14 always on the engine side of throttle valve 11.

In a heretofore known ignition system for an internal combustion engine the suction device or servo-motor which controls the circuit breaker plate to advance and retard the spark is connected by means of a conduit A into the intake passageway as illustrated at 13. The suction or vacuum existing at inlet 13 for conduit A is illustrated by curve A in Fig. 3 and the vacuum obtaining at the different throttle settings of views C, D, E and F, Fig. 2, correspond with the vacuum shown where vertical lines C, D, E and F intersect curve A, Fig. 3. The true vacuum existing between the throttle valve and the engine in intake passageway 10 is shown by curve B, Fig. 3, and the vacuum indicated where vertical lines C, D, E and F intersect curve B is the vacuum which obtains respectively at port 14

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in passageway 10 at the corresponding settings of throttle valve 11 in views C, D, E and F.

When the engine is idling, view C, Fig. 2, there is no suction in conduit A. As the throttle is moved toward open position and reaches the position shown in view D, Fig. 2, orifice 13 is placed between the engine and the throttle and will be subject not only to the static manifold vacuum but the velocity of the motive fluid flowing by orifice 13 will increase the suction in conduit A much higher than the manifold vacuum as shown in the graph, curve A. Further, the vacuum at orifice 13 will not reach its maximum until the throttle has opened a considerable distance and then the suction device will advance the spark too far for this throttle setting. Comparing the vacuum at different engine speeds, it will be seen that the vacuum at orifice 13, curve A, is actually increasing between lines C and D, Fig. 3, when the vacuum at orifice 14 is decreasing, curve B, Fig. 3.

In my ignition system I propose to use the true manifold vacuum because the spark should be advanced and retarded substantially directly in proportion to the rise and fall of the true intake manifold vacuum. If the spark is advanced in accordance with curve A then, for example, when the vacuum reaches the high indicated by the intersection of the vertical line D with curve A, the spark will be advanced too far and the engine will knock. Further, if the spark is advanced in accordance with curve A, the advance will be too late as the throttle opens from idle position. The spark should be advanced at a maximum when the maximum vacuum obtains in the intake manifold and should decrease as this vacuum falls. This I achieve by controlling my spark advance directly in accordance with the true vacuum obtaining in the engine intake manifold.

My device for accomplishing this end will now be described. Referring to Fig. 1, 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 at all times between the throttle valve 19 and the engine and communicates by means of passageway 28, conduits 29 and 30 with servo-motor 31. Conduit 30 connects into venturi

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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 Fig. 1, 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.

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 shown in curve B 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.

With my vacuum ignition as above described, the spark is advanced immediately as the throttle opens from idle and the spark advance curve will be substantially as indicated by curve B, Fig. 3.

Another advantage of my device is that the idle speed can be varied without affecting the spark advance mechanism. Screw 39 can be turned in to thereby adjust throttle valve 19 counterclockwise to raise the idle speed but valve 33 will remain closed. Similarly valve 39 can be turned out to move valve 19 clockwise and thereby lower the idle speed. Regardless of the position to which valve 19 is adjusted to vary the idle speed valve 33 will remain closed and the spark will remain retarded for idle but the spark will start to advance immediately when throttle arm 40 is turned to open the throttle valve from idle position. This result cannot be obtained where the vacuum ignition is connected into the intake passageway as illustrated at 13 in Fig. 2. In such a vacuum ignition system adjusting of the throt-

tle stop to vary the idle engine speed will inevitably vary the spark timing.

I claim:

1. In an internal combustion engine having an intake passageway and a throttle valve controlling the flow of motive fluid into the engine, the combination comprising a servo-motor, a conduit connecting said servo-motor into the intake passageway on the engine side of said throttle valve at all positions of the throttle valve, valve means for controlling communication between the said intake passageway and said servo-motor through said conduit, and adjustable means interconnecting said throttle valve and said valve means whereby said throttle valve and valve means open and close in unison, said interconnecting means closing said valve means whenever the throttle valve is in idle position, said interconnecting means and valve means cooperating when said valve means is closed to positively limit the closing movement of said throttle valve, said interconnecting means being constructed and arranged so that it can be adjusted to vary the idle position of the throttle valve without affecting the opening and closing of the said valve means.

2. In an internal combustion engine having an intake passageway and a throttle valve controlling the flow of motive fluid into the engine, the combination comprising a servo-motor, a conduit connecting said servo-motor into the intake passageway on the engine side of said throttle valve at all positions of the throttle valve, valve means for controlling communication between the said intake passageway and said servo-motor through said conduit, and an adjustable connection between the said throttle valve and said valve means for operating said valves in unison and for closing said valve means whenever the throttle valve is in idle position, said adjustable connection positively moving with said throttle valve and cooperating with said valve means when the latter is closed to positively limit the closing or idle position of said throttle valve, the adjustment of said connection to vary the idle position of said throttle valve being independent of said valve means whereby said valve means will close regardless of the idle position of said throttle valve.

3. In an internal combustion engine having an intake passageway and a throttle valve controlling the flow of motive fluid into the engine, the combination comprising a servo-motor, a conduit connecting said servo-motor into the intake passageway on the engine side of said throttle valve at all positions of the throttle valve, valve means for controlling communication between the said intake passageway and said servo-motor through said conduit, and an operative connection between said throttle valve and valve means which is adjustable for length to vary the idle position of said throttle valve, the said adjustable connection causing the throttle valve and valve means to open and close in unison and always closing said valve means whenever the throttle valve is in idle position, an increase in length of said adjustable connection increasing the idle speed of said engine and a decrease in the length of said connection decreasing the idle speed of said engine.

4. In an internal combustion engine having an intake passageway and a throttle valve controlling the flow of motive fluid into the engine, the combination comprising a servo-motor, a conduit connecting said servo-motor into the intake passageway on the engine side of said throttle valve

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at all positions of the throttle valve, valve means for controlling communication between the said intake passageway and said servo-motor through said conduit, and means for opening and closing said throttle valve including a member positively connected to said throttle valve and which abuts against said valve means to close the same whenever the throttle valve is in idle position, said member and valve means serving to positively limit the closing movement of said throttle valve for idle position.

5. The combination as set forth in claim 4 wherein said member is adjustable to vary the idle position of the throttle valve.

6. In an internal combustion engine having an intake passageway and a throttle valve controlling the flow of motive fluid into the engine, the combination comprising a servo-motor, a conduit connecting said servo-motor into the intake passageway on the engine side of said throttle valve at all positions of the throttle valve, valve means for controlling communication between the said intake passageway and said servo-motor through said conduit, and means for opening and closing said throttle valve including an adjustable stop which abuts said valve means and closes the same whenever the throttle valve is in idle position whereby whenever the throttle valve is opened from idle position the valve means will open substantially immediately to place the servo-motor under the influence of the intake passageway vacuum on the engine side of said throttle valve, said stop and valve means serving to positively limit the closing movement of the said throttle valve for idle position.

7. In an internal combustion engine having an intake passageway and a throttle valve controlling the flow of motive fluid into the engine, the combination comprising a servo-motor, a conduit connecting said servo-motor into the intake passageway on the engine side of said throttle valve at all positions of the throttle valve, valve means for controlling communication between the said intake passageway and said servo-motor through said conduit, resilient means tending to open said valve means, a crank arm operable to open and close said throttle valve, an adjustable connection between said crank arm and said valve means constructed and arranged so that actuation of the crank arm to close said throttle valve to idle position will always close said valve means, the said connection being adjustable when the said valve means is closed to change the idle position of the throttle valve and thereby change the idle speed of the engine without affecting the closed position of said valve means.

8. In an internal combustion engine having an intake passageway and a throttle valve controlling the flow of motive fluid into the engine, the combination comprising a servo-motor, a conduit connecting said servo-motor into the intake passageway on the engine side of said throttle valve at all positions of the throttle valve, valve means for controlling communication between the said intake passageway and said servo-motor through said conduit, an arm actuable to open and close said throttle valve, an adjustable stop on said arm constructed and arranged to abut said valve means and close the same when the arm is actuated to move the throttle valve to idle position, the said valve means when closed serving as an abutment for said adjustable stop whereby the stop can be adjusted to change the idle position of said throttle valve, the said valve means always opening substantially immediately

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as the throttle valve moves out of idle position to thereby place the servo-motor under the influence of the intake passageway vacuum on the engine side of the throttle valve.

9. In an internal combustion engine having an intake passageway and a throttle valve therein controlling the flow of motive fluid through said passageway into the engine, an orifice in the wall of said intake passageway and positioned between the throttle valve and the engine, a conduit arranged for communication with said orifice, valve means for shutting off communication between the said orifice and conduit, and an adjustable operative connection between said throttle valve and valve means for always closing said valve means when the throttle valve is in idle position and for always opening said valve means when the throttle is opened from idle, said adjustable connection cooperating with said valve means when the latter is closed to positively limit the closing movement of said throttle valve, said adjustable connection being constructed and arranged for adjustment to change the idle position of the said throttle valve, the said adjustable connection always closing said valve means irrespective of the idle position of said throttle valve.

10. The combination as set forth in claim 9 including a servo-motor connected to said conduit, and spark ignition means actuated by said servo-motor to advance the spark as the vacuum established in said servo-motor increases and retard the spark as the vacuum in said servo-motor decreases.

11. In an internal combustion engine having an intake passageway and a throttle valve therein controlling the flow of motive fluid through said passageway into the engine, a suction device, a conduit connecting said suction device into the intake passageway on the atmosphere side of said throttle valve, a conduit connecting said suction device into the intake passageway between the throttle valve and engine, valve mechanism for said second named conduit, means positively connected to said throttle valve for movement therewith during the opening and closing of said throttle valve, said means serving as a connection between said throttle valve and said valve mechanism for positively closing said valve mechanism when the throttle valve is in idle position, said means and valve mechanism cooperating when the valve mechanism is closed to positively limit the closing movement of said throttle valve, said valve mechanism closing off said second conduit when the engine is idling, said first conduit providing a continuous communication between the suction device and the intake passageway on the atmosphere side of the throttle valve.

12. The combination as set forth in claim 11 wherein the intake passageway has a venturi on the atmosphere side of the throttle valve and the first named conduit connects the suction device with the venturi.

13. The combination as set forth in claim 11 including an ignition timer connected to said suction device and controlled thereby to advance and retard the ignition spark, and said aforesaid means being adjustable and constructed and arranged so that the idle position of the throttle valve can be adjusted while said valve mechanism is closed without changing the spark timing of the engine when it is idling.

14. In an internal combustion engine having an intake passageway and a throttle valve therein controlling the flow of motive fluid into the

engine, in combination ignition means comprising a cam, a circuit breaker arm, a contact on said arm, a relatively fixed contact, an engine driven cam, movable supporting means for said breaker arm and said relatively fixed contact, said means being adjustable angularly about said cam, a suction device connected to said supporting means for adjusting the same angularly about said cam, a conduit connecting said suction device with the intake passageway on the atmosphere side of said throttle valve, a second conduit connecting said suction device with the intake passageway on the engine side of said throttle valve when open, valve means for closing off said second conduit, said valve means including an adjustable stop for the throttle valve when in idle position, said stop being adjustable to vary the idle position of the throttle valve without changing the spark timing of said engine, and means for opening said valve mechanism when the throttle valve is moved from idle position.

15. In an internal combustion engine having an intake passageway and a throttle valve controlling the flow of motive fluid through said passageway into the engine, the combination comprising a servo-motor in the form of a suction chamber having a flexible wall the outer side of which is subjected at all times to atmospheric pressure, a conduit connecting said suction chamber into the intake passageway on the engine

side of said throttle valve at all positions of the throttle valve, valve means for controlling communication between the said intake passageway and said suction chamber through said conduit, and adjustable means interconnecting said throttle valve and said valve means whereby said throttle valve and valve means open and close in unison and for closing said valve means whenever the throttle valve is in idle position, said interconnecting means being constructed and arranged so that it can be adjusted to vary the idle position of the throttle valve without affecting the opening or closing of the said valve means, and spark ignition means actuated by said servo-motor to advance the spark as the vacuum established in said suction chamber increases and retard the spark as the vacuum in said suction chamber decreases.

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