Jan. 28, 1941. C. B. SEYMOUR 2,229,822

VACUUM SPARK ADVANCE

Filed July 27, 1938 3 Sheets-Sheet 1

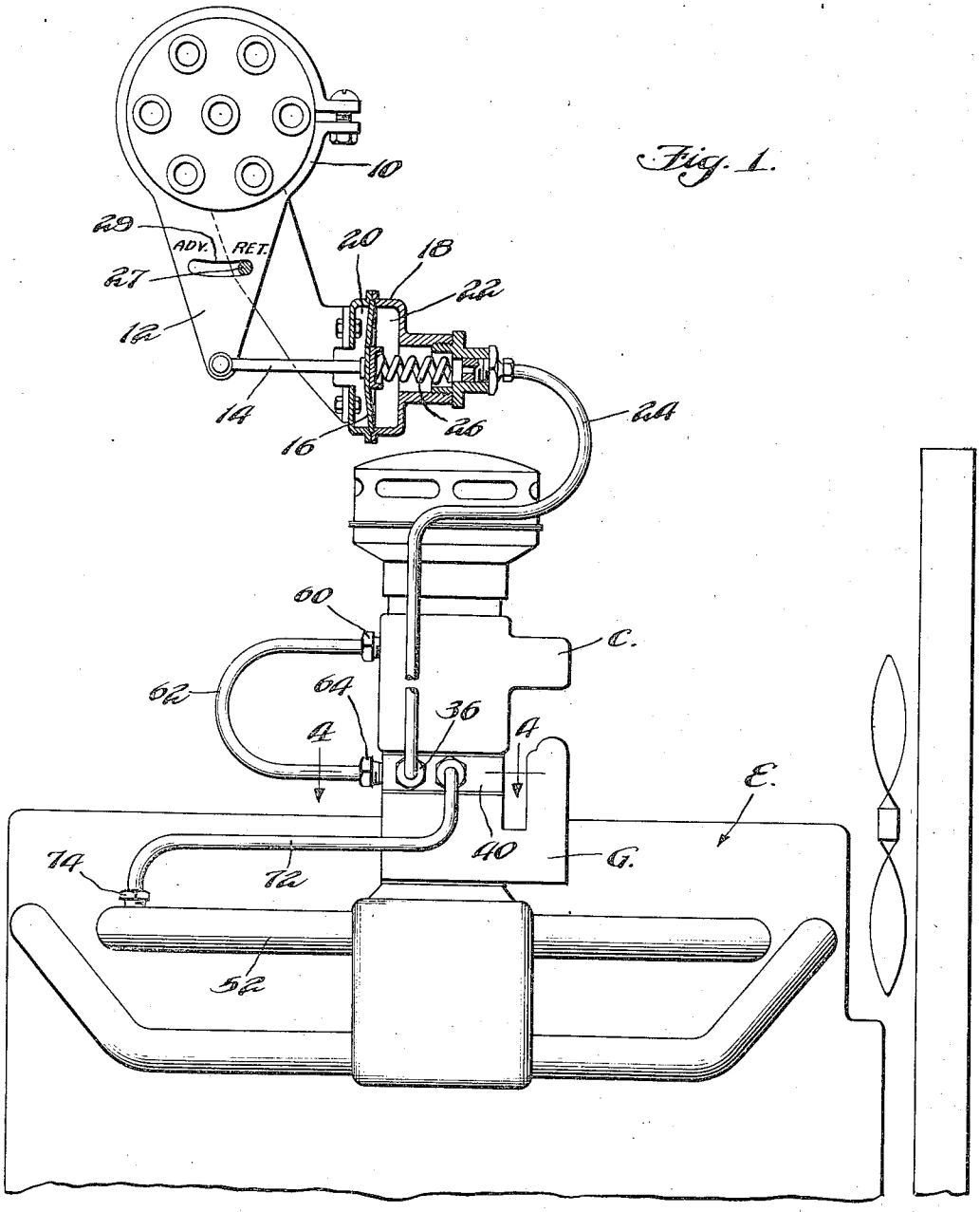


Fig. 1.

Inventor
Clayton B. Seymour
By Gardner & Hitzeman
Attys.

Jan. 28, 1941. C. B. SEYMOUR 2,229,822

VACUUM SPARK ADVANCE

Filed July 27, 1938 3 Sheets-Sheet 2

Fig. 4.

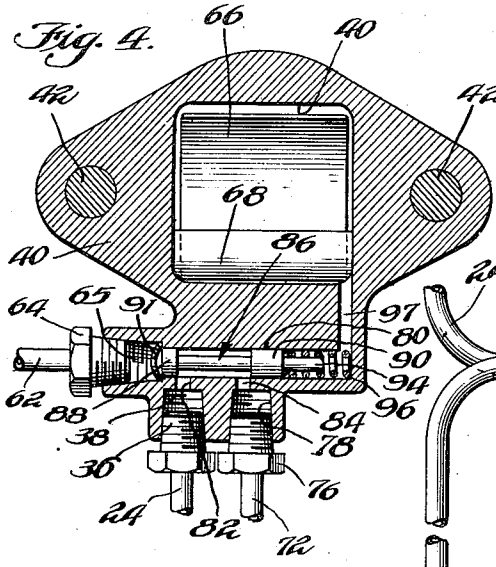


Fig. 5.

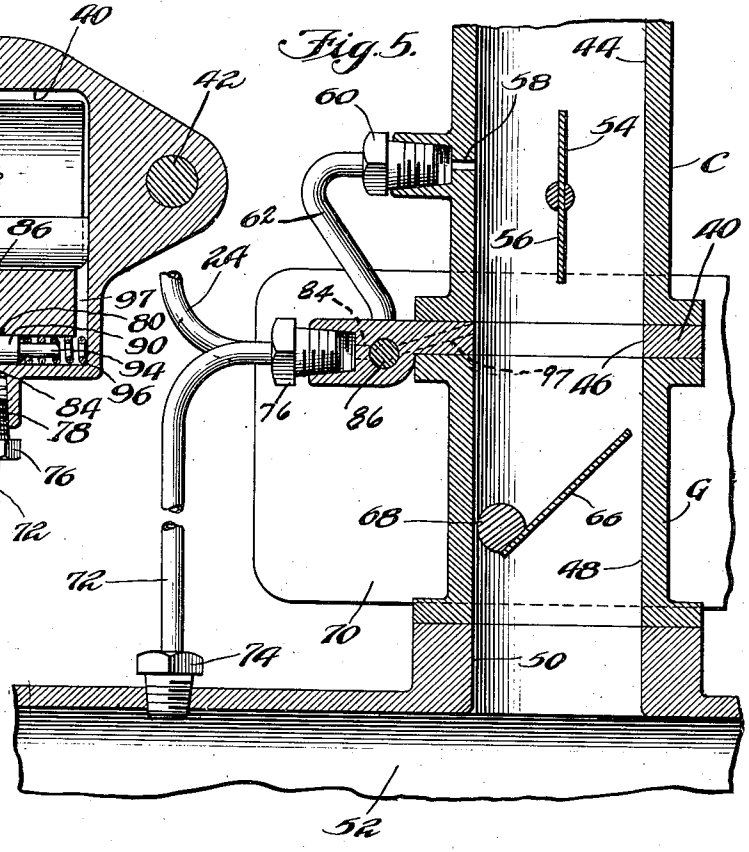


Fig. 2.

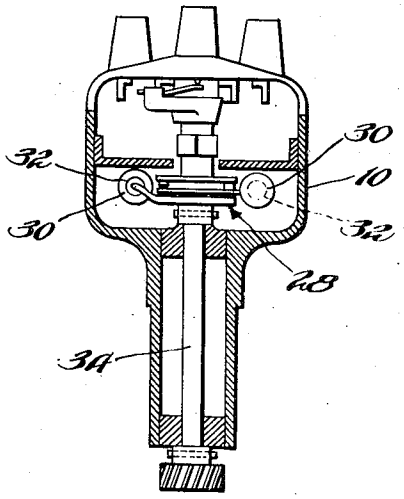
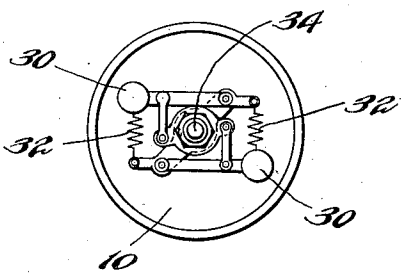


Fig. 3.



Inventor
Clayton B. Seymour
By Gardner & Hitzeman
Attys.

Jan. 28, 1941. C. B. SEYMOUR 2,229,822

VACUUM SPARK ADVANCE

Filed July 27, 1938 3 Sheets-Sheet 3

Fig. 6.

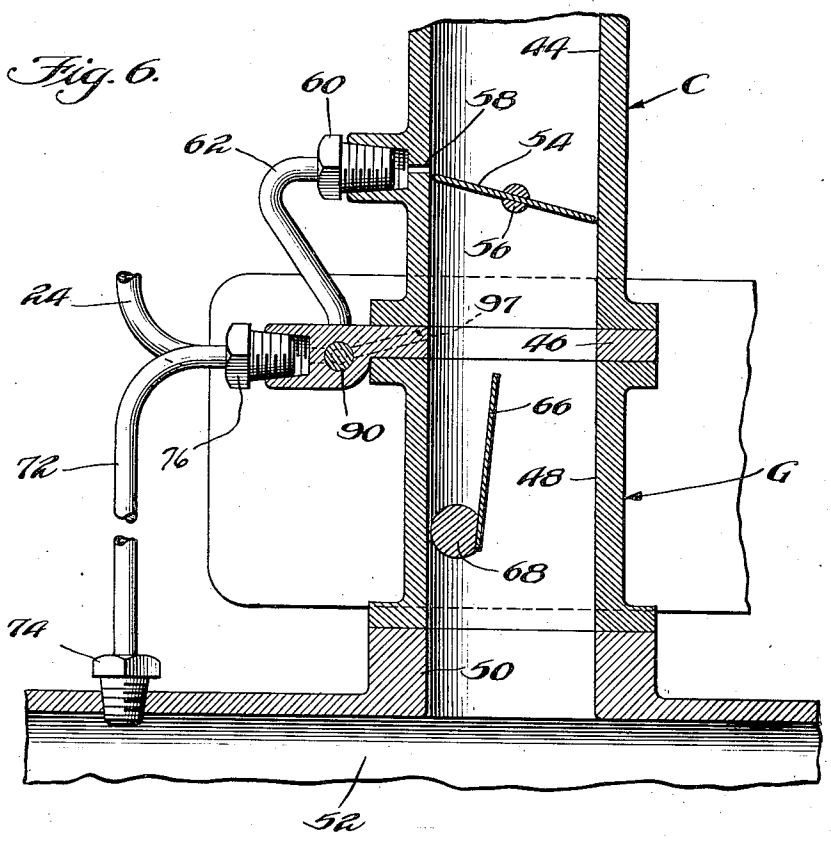
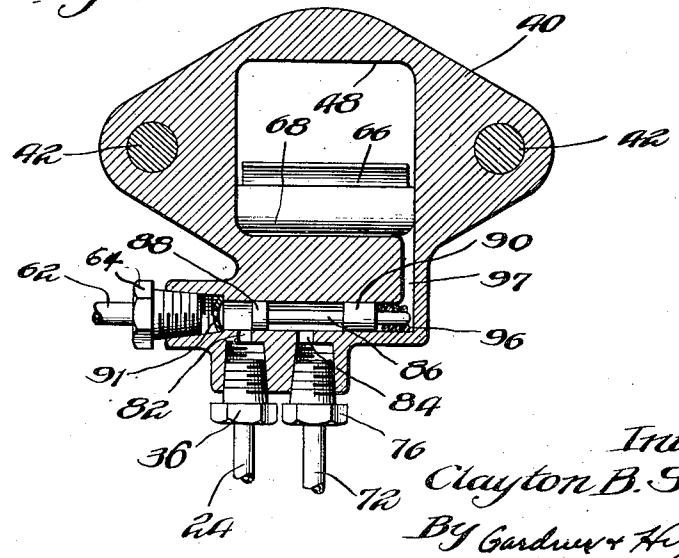


Fig. 7.



Inventor
Clayton B. Seymour
By Gardner & Fitzmaurice
Attys.

Patented Jan. 28, 1941

2,229,822

UNITED STATES PATENT OFFICE

2,229,822

VACUUM SPARK ADVANCE

Clayton B. Seymour, Chicago, Ill., assignor to Hoof Products Company, a corporation of Illinois

Application July 27, 1938, Serial No. 221,598

7 Claims. (Cl. 123—117)

My invention relates to improvements in automatic spark advance mechanism for internal combustion motors.

My invention relates more particularly to improved mechanism of the type described adapted to be operated by the vacuum or sub-atmospheric pressure in the intake manifold of the motor to vary the spark in accordance with the load on the motor and thus assist the usual mechanical or centrifugally operated spark advance mechanism commonly used today. Internal combustion engines of the automotive type have for a number of years been universally equipped with an automatic device embodied in the ignition distributor to advance the spark automatically. This device was of the centrifugal type and the amount of advance depended entirely on speed, the spark advance increasing as the speed increased, and there was no provision made for varying the spark at a constant speed and a variable load. The method was quite satisfactory as long as the car was driven on a level road, but while climbing a hill, coasting or driving down a slight incline at the same speed, the constant spark advance provided by the device incorporated in the distributor did not permit the engine to run sufficiently smooth. Thus if the spark was adjusted initially for good fuel economy at "light load" it would tend to introduce knocking at "heavy load," and if the amount of spark advance was sufficiently reduced to prevent knocking at "heavy load," the fuel economy and smoothness at "light load" became unsatisfactory.

Recently a device has been developed and applied to several well-known automobiles which, in addition to the regular centrifugal spark advance incorporated in the distributor, provides means for varying the spark in accordance with the load on the engine. Such a device generally takes the form of a diaphragm or piston connected by a conduit to the intake manifold. The movement of this diaphragm is resisted by a spring and the motion thereof is transmitted to the arm of the ignition distributor, the arrangement being generally such that the higher the vacuum the greater the amount of the spark advance. The conduit from the diaphragm has usually been connected to the carburetor at a point adjacent the carburetor valve where with the carburetor valve closed the conduit is open to atmospheric condition in the carburetor above the valve but adapted upon movement of the valve to be transferred to the motor side thereof where it is subject to the reduced pressure in the intake manifold. Although this type of vacuum spark advance has been generally satisfactory, it was found lacking in performance under some conditions. Also, with the advent of suction controlled or vacuum operated governors and their widespread adoption by automobile owners and other users of internal combustion motors, the operation of the above mentioned type of vacuum spark advance mechanism was prevented. This was due to the fact that with a governor valve disposed in the intake manifold on the motor side of the carburetor valve, and with a governor valve controlling the flow of fuel to the motor, the pressure conditions formerly present adjacent the carburetor valve changed and under certain conditions were transferred to a point between the intake manifold and the governor valve. Consequently, mechanism was provided for automatically transferring the location of the diaphragm conduit connection with the intake manifold from a point near the carburetor valve to a point near the governor valve, whenever the governor valve assumed control of the flow of fuel to the motor. Several different types of such mechanism are on the market today.

Certain disadvantages, however, flow from the above type of constructions. Whenever it is necessary to repair, alter or replace the carburetor, the diaphragm conduit must be disconnected and reconnected. When the governor is removed for repair, alteration or replacement, the diaphragm conduit must be disconnected and reconnected. And an essential of this mechanism is that all connections must be air tight. Therefore, extra care must be used in all this assembly and disassembly to insure proper operation of the vacuum spark advance.

With the above and foregoing objections to the present construction definitely constituted, the principal object of my invention is to provide an improved vacuum spark advance operating mechanism in the nature of a unit adapted to be inserted in the conduit to the intake manifold between the carburetor and the governor.

A further object of the invention is to provide a unit of the type described capable of connecting the vacuum spark advance to a point in the carburetor conduit adjacent the valve therein or directly to a point in the intake manifold.

A further object of the invention is to provide an improved spark advance operating unit that automatically establishes communication between the diaphragm of the spark advance and the pressures in the carburetor or the intake manifold to advance or retard the spark in direct relation to the load and the speed of the engine,

particularly when a governor is inserted between the carburetor and the intake manifold.

A further object of the invention is to provide an improved unit of the class described capable of automatic operation to connect the diaphragm of the vacuum spark advance to the pressure in the intake manifold or at a point adjacent the carburetor valve.

A further object of the invention is to provide a unit capable of insertion between the carburetor and the governor, capable of operating the vacuum spark advance under certain conditions by the variance in pressure in the conduit between the carburetor valve and the governor valve.

Other objects and advantages will be more apparent from the following description wherein reference is had to the accompanying three sheets of drawings upon which

Fig. 1 is generally a diagrammatic view illustrating the automatic spark advance the carburetor, governor and internal combustion engine with my improved unit disposed between the carburetor and the governor;

Fig. 2 is a vertical sectional view through a conventional type of distributor;

Fig. 3 is a plan view of the same with the cover removed showing the centrifugal means for advancing the spark;

Fig. 4 is a plan sectional view through my improved vacuum spark advance unit taken generally on the lines 4—4 of Fig. 1;

Fig. 5 is a diagrammatic sectional view taken through the carburetor unit governor and intake manifold showing generally the air conduits which form the connections between the same. Fig. 5 is a view showing an actual operating condition where the carburetor valve is open and the governor valve is in control of the flow of fuel mixture to the internal combustion engine;

Fig. 6 is a generally diagrammatic view similar to Fig. 5 showing an actual operating condition as for example, when the internal combustion engine is running at an idling speed and the governor is not controlling the flow of fuel mixture to the engine; and

Fig. 7 is a plan sectional view similar to Fig. 2 with the parts in a changed position in accordance with the condition shown in Fig. 6, and is taken generally on the line 7—7 of Fig. 6.

In the embodiment of my invention which I have illustrated, I have shown a conventional distributor 10 having the usual arm 12 pivotally connected to a rod 14 attached to one side of a diaphragm 16. The diaphragm 16 may be mounted in a housing 18 having its chamber 20 open to atmosphere and a chamber 22 on the opposite side of the diaphragm connected to a conduit 24. A coiled spring 26 normally holds the diaphragm in the position shown in Fig. 1, or in what is known as a retarded position, a pin 27 and slot 29 in the arm 12 determining the extent of movement of the rod 14. The above construction is well known in the art and for that reason will not be described in further detail herein.

The distributor 10 is provided with the usual type of centrifugal spark advance 28 which includes the weights 30 normally held in the position shown in Fig. 3 by the springs 32 but which, when the distributor driveshaft 34 revolves at a continual increasing rate of speed fly outwardly and in the usual manner advance the timing of the ignition.

In the usual construction of automotive engines, the conduit 24 is directly connected to a port located slightly above the throttle valve in the conduit of a down-draft carburetor. In this manner, as the speed of the engine increases, the suction produced below the carburetor valve will effect the diaphragm 16 to advance or retard the spark in direct ratio to the load and speed at which the vehicle is operating. This is usual in well-known constructions and has been commercially used for a considerable length of time. However, as previously explained, when a governor is employed with the usual internal combustion engine the pressure conditions formerly present adjacent the carburetor valve change and are transferred to a point beyond the governor valve, thus rendering ineffective the operation of the diaphragm 16 by reason of the fact that the pressure conditions in the conduit at the carburetor valve will be more or less atmospheric.

In the construction which I have provided, I extend the conduit 24 to a bushing 36 suitably mounted in a screw-threaded opening 38 in a unit 40 that is securely fastened in position between the carburetor C and a vacuum operated governor G by the usual fastening bolts 42. The carburetor C, unit 40, and governor G may have the aligned substantially square conduits 44, 46 and 48 respectively communicating with the opening 50 to the intake manifold 52 of the internal combustion engine E.

The carburetor C may be provided with the usual balanced butterfly valve 54 mounted for rotation upon a suitable shaft 56 which when it is moved to a closed or idling position is located slightly below a vent 58 in the side of conduit 44. The vent 58 communicates through the bushing 60 with a conduit 62 that is connected at its other end to a bushing 64 in the unit 40. The governor G may be provided with an unbalanced valve 66 secured to a rotatable shaft 68 which extends from the governor housing 70. The governor mechanism which is in the housing may be of the usual type shown in the patent to Addison C. Hoof, No. 1,966,722.

The conduit 72 may be connected to the intake manifold 52 by a suitable bushing 74. The opposite end of the conduit may be connected to the unit 40 by a similar bushing 76 screw-threadedly mounted in the opening 78.

The unit 40 is provided with means for effecting communication between the various conduits 24, 62 and 72. This means may include a passageway 80 aligned with the screw-threaded opening 65. A pair of drilled openings 82 and 84 provide communication between the conduits 24 and 72 with the passageway 80.

A slidable valve member 86 is adapted to be mounted in the passageway 80. This valve may be formed with the enlarged portions 88 and 90 and the reduced portions 92 and 94. A coiled spring member 96, positioned against the enlarged shoulder 93, normally holds the valve in the position shown in Fig. 4 against the open-headed cap 91 at the end of passageway 80. A drilled opening 97 connects the end of passageway 80 with the conduit 46 through the unit 40.

The operation of the unit in conjunction with the diaphragm 16 of the automatic spark advance will now be described. In the position shown in Figs. 4 and 5, the vehicle, which is driven by an internal combustion engine, may be travelling along at a governed speed of for example forty miles an hour. To obtain this condition of operation, the carburetor valve 54 will be in the wide open position shown in Fig. 5 and the governor valve 66 will be in the partially closed position

shown in the same figure. It will be obvious that the condition in the conduit 44 of the carburetor, 46 of the unit, and 48 of the governor above valve 66 will be generally atmospheric. As a result there will be no suction through conduit 62 or through the passageway 97, and the spring member 96 will move the valve 86 to the position shown in Fig. 4. In this position of the valve 86, conduit 24 from the distributor will be connected directly through the unit 40 to the conduit 72 attached to the intake conduit of the engine. In this position the diaphragm 16 will then be in direct control of the pressure condition in the intake conduit 52 and because this is sub-atmospheric due to the position of governor valve 66, the spark will be advanced in direct relation to the sub-atmospheric condition in the intake manifold.

In Figs. 6 and 7 I have illustrated the conditions which are present when the automotive engine is idling; such a condition as for example where the vehicle is parked at a curb or the engine is running in any other manner without load. The manually operated carburetor valve 54 will thus be in a closed position with the valve slightly below the vent 58 so that the conduit 62 will be subject to atmospheric pressure. The governor valve 66 will be in generally wide open position, shown in Fig. 6.

With the carburetor valve closed, as described, there will be a certain amount of suction or a sub-atmospheric condition below the carburetor valve 54 in the conduit 44 of the carburetor, 46 of the unit 40 and 48 of the governor. By reason of the sub-atmospheric condition below the carburetor valve 54, suction through the passageway 97 will overcome the resistance of spring 96 and move the valve 86 to the position shown in Fig. 7. This movement will effect a communication between the diaphragm 16 of the distributor through the conduit 24 and the conduit 62 with the atmospheric condition prevailing above the carburetor valve and as a result there will be no advance of the spark. It will be noted, however, that as soon as there is sufficient movement of the carburetor valve to an open position to place the vent 58 below the edge of the carburetor valve, that the suction at this point in combination with the compression of spring 96 will be sufficiently great to immediately move valve 86 back to the position shown in Fig. 4, thus connecting the conduit 24 directly to the intake manifold, thereby securing a spark advance consistent with the condition in the intake manifold.

From the above and foregoing description it will be apparent to those skilled in the art that I have provided a comparatively simple unit capable of insertion between the carburetor and the governor of any of the standard carburetors and governors in commercial use to-day which will effectively keep the control of the automatic spark advance under the condition present in the intake manifold in any and all stages of operation except when the carburetor valve is closed and the engine is idle.

While I have illustrated and described a specific embodiment of my invention, it will be apparent to those skilled in the art that changes and modifications may be made in the exact details shown and I do not wish to limit myself in any particular. Rather what I desire to secure and protect by Letters Patent of the United States is:

1. In an internal combustion engine, in combination a fuel intake conduit, a manually actuated throttle valve therein, an automatically actuated throttle valve in said conduit, ignition mechanism, vacuum operated means to adjust said mechanism to vary the timing of the spark and means for placing said vacuum means in communication with said fuel intake conduit at said manually actuated throttle valve when the throttle valve is substantially closed and for placing said vacuum means in communication with said conduit on the engine side of said governor valve when said manual valve is open, said means including a unit having a conduit forming part of said intake conduit and located between said manual and automatically actuated valve.

2. In an internal combustion engine, in combination a fuel intake conduit, a manually actuated throttle valve therein, an automatically actuated throttle valve in said conduit, ignition mechanism, vacuum operated means to adjust said mechanism to vary the timing of the spark, means for placing said vacuum means in communication with said fuel intake conduit at said manually actuated throttle valve or for placing said vacuum means in communication with said conduit on the engine side of said governor valve when said manual valve is open, said means comprising a unit located between said manual and automatically actuated valves, and a valve therein operated by the pressure differential on the two sides of said throttle valve, said valve connected to the fuel intake conduit at said manual throttle, also on the engine side of said automatically operated throttle valve and also between said valves.

3. In an internal combustion engine, in combination a fuel intake conduit, a carburetor valve mounted therein, an automatically actuated governor valve in said conduit, ignition mechanism, vacuum operated means to adjust said mechanism to vary the timing of the spark, and a separable unit interposed in the conduit and including a transfer valve arranged to place said vacuum means in communication with said conduit at a point on the engine side of said governor valve when said manual valve is open and in communication with said conduit at said carburetor valve when said manual valve is at or near closed position, said unit positioned between the manual valve and the automatically actuated valve and in communication with said intake conduit between said carburetor and governor valves and also on the engine side of said governor valve.

4. In an internal combustion engine, in combination a fuel intake conduit, a carburetor valve mounted therein, an automatically actuated governor valve in said conduit, ignition mechanism, vacuum operated means to adjust said mechanism to vary the timing of the spark, and a transfer valve arranged to place said vacuum means in communication with said conduit at a point on the engine side of said governor valve when said manual valve is open and in communication with said conduit at said carburetor valve when said manual valve is at or near closed position, said transfer valve position between the manual valve and the automatically actuated valve and operable to connect the vacuum operated means to the intake conduit at the carburetor valve or beyond the governor valve depending on the differential in pressure on the two sides of the carburetor valve.

5. In an internal combustion engine, in combination an intake conduit, an intake manifold at the end of said conduit, a manual throttle valve in said conduit, an automatic governor

throttle valve in the conduit on the engine side of the manual throttle valve, an ignition device for said engine, vacuum operated means for adjusting said ignition device to advance the time of sparking, a vacuum take-off in said conduit adjacent the manual throttle valve, a vacuum take-off in the intake manifold beyond said governor valve, and means to connect either take-off to said vacuum operated means, said means including a unit forming part of said intake conduit and interposed between the two valves and having a valve member operable by differential pressure on the two sides of the manual throttle valve.

6. In an internal combustion engine equipped with ignition mechanism and vacuum operated means for adjusting the same to vary the spark advance, the combination with a manual throttle in the intake conduit, an automatic governor having a throttle in the intake conduit on the engine side of the manual throttle, a vacuum take-off aperture adjacent the manual throttle, a vacuum take-off connected to the conduit on the engine side of the governor throttle, and a valve to connect either aperture to said vacuum operated means, said valve operable by pressure differential on the two sides of the manual throttle.

7. For use in combination with an internal combustion engine comprising an ignition mechanism, vacuum operated means to adjust said mechanism to vary the timing of the spark, and a fuel intake conduit having a manifold and a carburetor throttle valve therein; the improvement which comprises a unit adapted to be separably arranged in said intake conduit between said manifold and said throttle valve and providing a valveless port adapted to form a portion of said fuel intake conduit in operative position, said unit being provided with an automatic transfer valve, said valve having a portion communicating with said port and being provided with means for association with the conduit adjacent said throttle valve whereby to control the position of the transfer valve in accordance with the differential in pressure on the two sides of the throttle valve, said unit comprising conduit means for connecting said valve with said vacuum operated means, and conduit means for connecting said valve with the intake manifold vacuum, said valve being adapted in one operative position to place the vacuum operated means in communication with the intake manifold and in another position to place said vacuum operated means in communication with said intake conduit adjacent the throttle valve.

CLAYTON B. SEYMOUR.