Sept. 6, 1938. J. H. K. McCOLLUM ET AL 2,129,358

VACUUM POWER CLUTCH

Filed Dec. 20, 1930 3 Sheets-Sheet 1

Fig. 1.

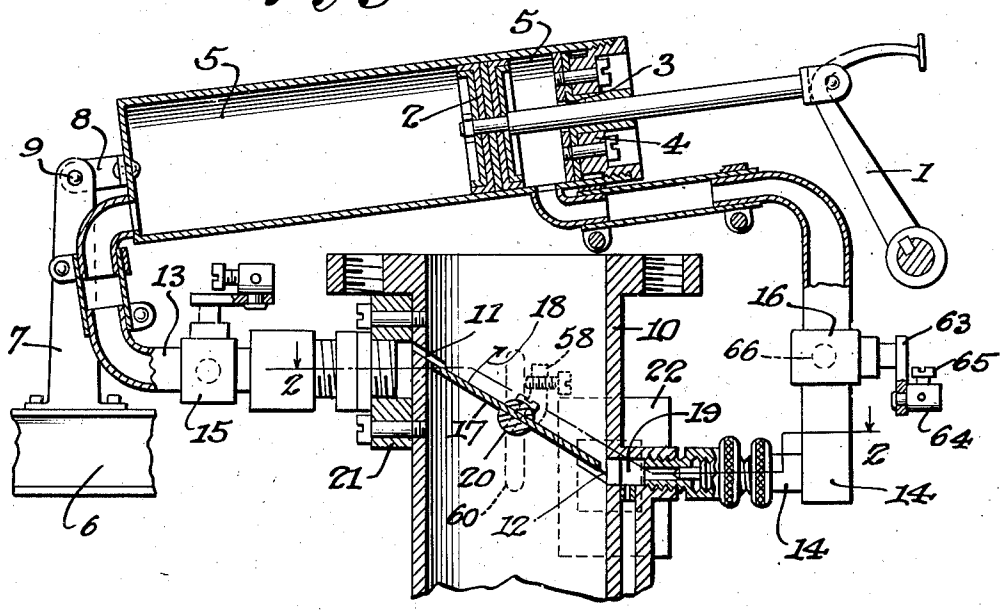



Fig. 2.

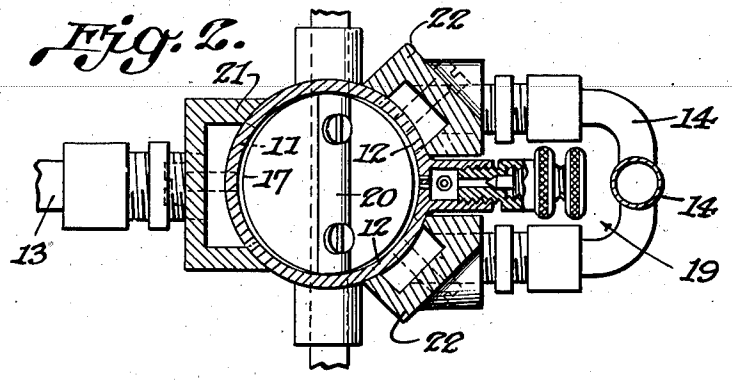



Fig. 3.

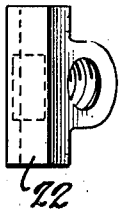



Fig. 4.

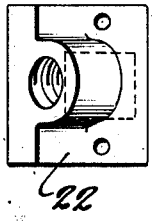
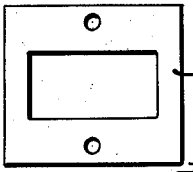



Fig. 5.




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VACUUM POWER CLUTCH

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Fig. 6.

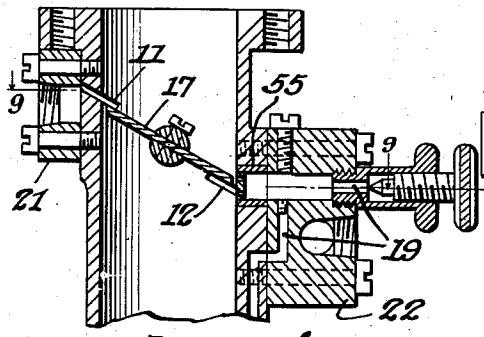



Fig. 7.

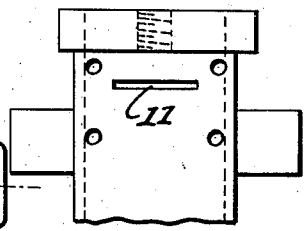



Fig. 8.

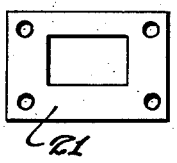



Fig. 9.

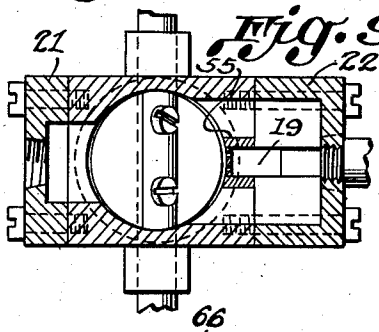



Fig. 10.

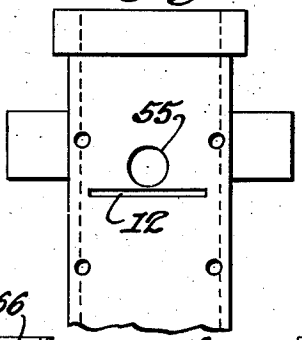



Fig. 11.

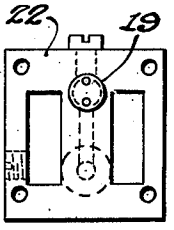



Fig. 12.

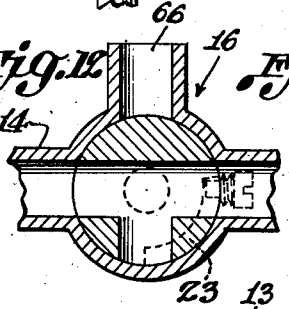



Fig. 13.

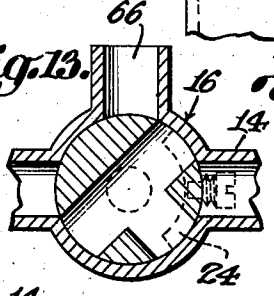



Fig. 14.

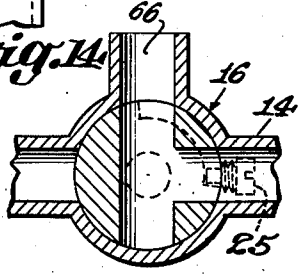



Fig. 15.

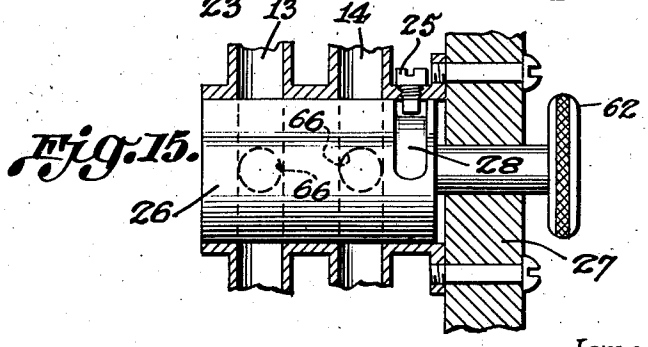
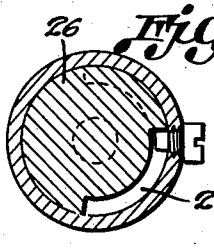



Fig. 16.




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VACUUM POWER CLUTCH

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Fig. 17.

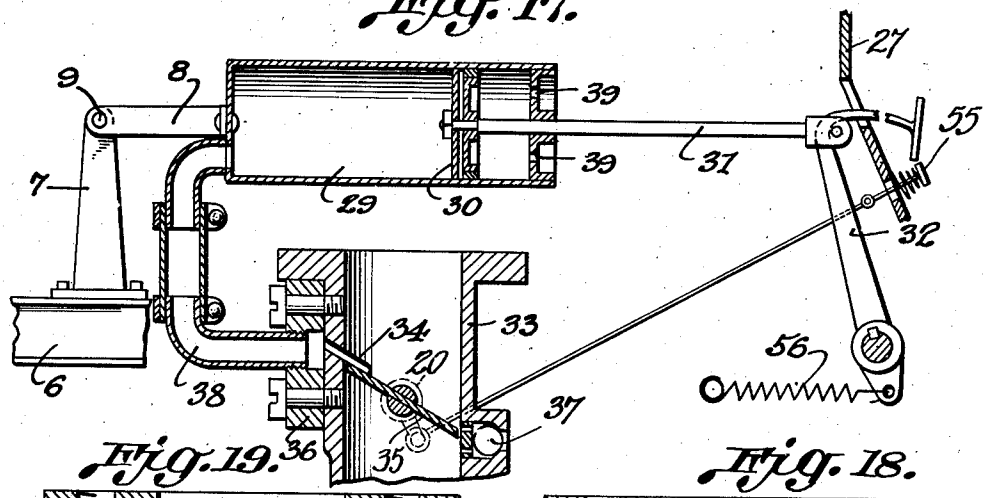



Fig. 19.

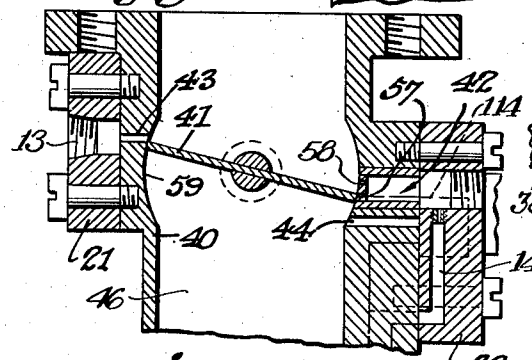



Fig. 18.

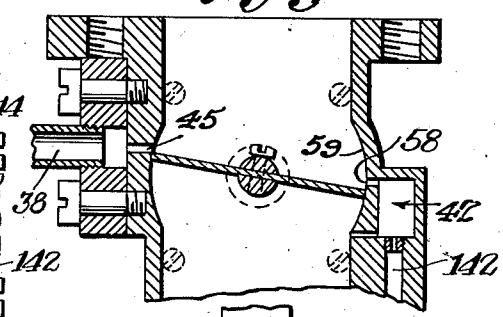
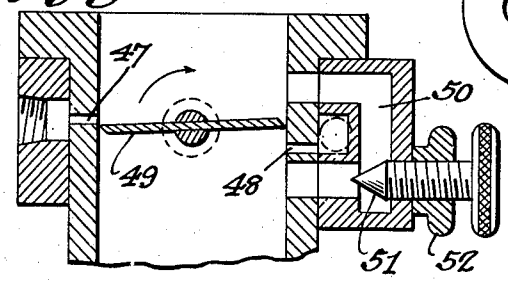



Fig. 22.



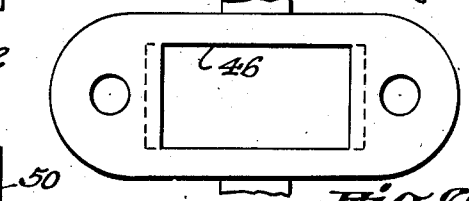




Fig. 20.

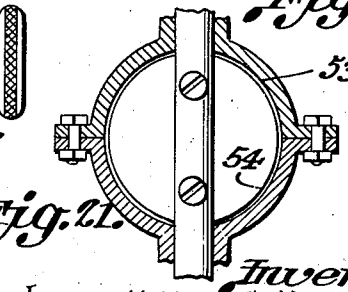



Fig. 21.

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Patented Sept. 6, 1938

2,129,358

# UNITED STATES PATENT OFFICE

2,129,358

## VACUUM POWER CLUTCH

James Harry Keighley McCollum and Henry John De Neville McCollum, Long Branch, N. J., assignors to A. Parker-Smith, New York, N. Y., as trustee

Application December 20, 1930, Serial No. 503,768

16 Claims. (Cl. 192—.01)

Our invention relates to improvements in vacuum power clutches and the objects of our improvements are, first, to provide a thoroughly reliable mechanism which automatically engages and dis-engages the clutch, second, to provide a mechanism which automatically causes the motor vehicle to free-wheel or coast whenever the foot pressure is removed from the accelerator.

The best form of apparatus at present known to us embodying our invention, together with sundry modifications thereof, are illustrated in the accompanying three sheets of drawings in which:

Fig. 1 is a side elevation and partial section, with parts broken away, showing a clutch-actuating, double-acting, vacuum-operated servo-motor, with our invention applied thereto.

Fig. 2 is a section taken on irregular line 2 of Fig. 1.

Figs 3 and 4 are detail perspective views of twin valve port casings, and

Fig. 5 is a face view of another valve port casing.

Fig. 6 is a vertical section of part of another carburetor with modified forms of valve port casings for a double-acting servo-motor;

Fig. 7 is a side elevation of the upper portion of the carburetor shown in Fig. 6, with a valve port casing removed;

Fig. 8 is a detail face view of such casing;

Fig. 9 is a horizontal section on line 9—9 of Fig. 6;

Fig. 10 is an elevation of the other side of the carburetor with the valve port casing on that side removed, and

Fig. 11 is a face view of such second port casing.

Figs. 12, 13 and 14 are enlarged detail cross sections of a two-way cut-off valve which is shown in three different positions.

Fig. 15 is a longitudinal section, and

Fig. 16 a cross section of a dual cut-off valve of such type.

Fig 17 is a side elevation of a single-acting, vacuum-operated, servo-motor with my invention applied thereto, parts being shown in section and others broken away.

Fig. 18 is a vertical section of the upper portion of the mixture conduit for a carburetor having a rectangular internal cross section, with walls curved around the throttle valve and ports for operating a single-acting servo-motor;

Fig. 19 is a similar view of a carburetor of this type with ports for operating a double-acting servo-motor; and

Fig. 20 is an end view of the mixture tube and its flange, with other parts removed.

Fig. 21 is a cross section of a carburetor having a cylindrical mixture conduit and a circular throttle valve, and

Fig. 22 is a vertical section of the upper portion of the mixture conduit of a carburetor of circular internal cross section embodying our invention and having a circular butterfly throttle valve cooperating with a special form of idling jet apparatus, said carburetor having a single port for operating a single-acting vacuum servo-motor. Throughout the drawings like reference characters indicate like parts.

Referring to Figs. 1 to 5, a common form of clutch pedal 1 is there shown connected to the piston 2 of a double-acting, vacuum-operated, servo-motor comprising a cylinder 5 pivotally supported at its left-hand end by lug 8 pivoted at 9 to a pedestal 7 set on a portion of the chassis 6, and at the other end by the piston rod passing through gland 3 in cylinder head 4 and having its free end pivoted to said clutch pedal. The left-hand end of cylinder 5 is connected by flexible conduit 13 to the casing 21 for port 11 in the left-hand side wall of the mixture conduit 10 of a carburetor having the usual butterfly throttle valve 17 of slightly elliptical outline mounted on shaft 20 and opening by turning in the direction of the arrow 18. Whenever said throttle valve is turned in a counterclockwise direction for closing it, such movement will be stopped in position for idling the engine when stop-arm 58 strikes stop-rib 60. From the right-hand end of cylinder 5 extends a similar conduit 14, branched at its other end to connect with the twin port-casings 22, 22, which cover twin ports 12, 12 in the right-hand side wall of said mixture conduit. These ports and port casings 12 and 22 are thus made double to straddle the idling jet apparatus 19.

Each of the conduits 13 and 14 is preferably provided with a two-way shut-off valve 15, or 16, of a common type illustrated in Figs. 12, 13 and 14 as each comprising a valve plug 23 bored to form passages at right angles one to another which may register either with both sections of the connecting conduit (as 14), or with one of said sections and the casing port 66 open to the atmosphere. When this valve plug 23 is rotated within the 90 degree limits fixed by stop screw 25 cooperating with quadrant slot 24 cut in its circumference, as by means of a crank such as 63 (Fig. 1) having a perforated crank pin 64 in which a Bowden wire may be clamped by set-

screw 65, the ends of cylinder 5 may be connected either with carburetor ports 11 and 12 (Fig. 12) or with the atmosphere (Fig. 14) or closed completely (Fig. 13).

As shown in Figs. 15 and 16 the two valves 15 and 16 may be combined in one, the casing 61 of which is connected to both conduits 13 and 14 and mounted on the instrument board or dash 27 of the motor car. A quadrant slot 28 in the plug 26 of this dual valve again cooperates with a stop screw 25 to limit the turning of the valve, which may be manipulated by knurled head 62.

The carburetor shown in Figs. 6 to 11 is similar to that shown in Figs. 1 and 2 except that it has another form of port casings and bearing surfaces therefor, and also has a different kind of an idling jet apparatus 19, set in a circular port 55 bored in the wall of the carburetor back of the port 12.

In Fig. 17, the cylinder 29 of the single-acting servo-motor is open to the atmosphere at its right-hand end through the ports 39, 39 in the cylinder head which merely serves as a guide for the piston rod 31, the free end of which is pivoted to the clutch pedal 32. The other end of cylinder 29 is connected by conduit 38 to the port casing 36 on the carburetor mixture conduit 33 bolted over the port 34 which cooperates with the throttle valve 35, as do the ports marked 11 in Figs. 1 and 6. As the servo-motor shown in Fig. 17 is single-acting, a spring, conventionally shown at 56, is needed to close the clutch, while, with the double-acting servo-motor shown in Fig. 1, such spring might be dispensed with, though, of course, the regular clutch springs (not shown) would usually be retained. In Fig. 1 the piston 2 is equipped with oppositely disposed packing leathers, as shown, to enable it to have an airtight fit with the cylinder walls against suction in either direction, while piston 30 in Fig. 17 requires only one such packing leather, as there shown. In this figure, 37 represents a modified form of idling jet apparatus differing from that at 19 shown in Figs. 1 and 6.

In all of the forms of the invention above described, the initial movement of the throttle valve 17 begins to open it so as to permit the more rapid passage of combustible mixture to the motor, thereby accelerating the latter, the mixture conduit having the usual cylindrical cross section, and the valve 17 having a cooperating, slightly elliptical outline, but in Figs. 18 and 19 the mixture conduit 40 has a rectangular cross section, as shown at 46 in Fig. 20, and the side walls of the conduit are curved about the ports as shown at 59, 59, so that the throttle valve 41 (which is rectangular in plan outline) does not open the passage 46 till after it has crossed either port 43 (Fig. 19) or 45 (Fig. 18) which respectively communicates with conduit 13 or 38. Similarly, valve 41 opens port 44, and/or the smaller port 57 (Fig. 19), both of which latter communicate with conduit 14 (Fig. 1) before the passageway 46 through the mixture conduit 40 is opened by the movement of said valve 41. The chamber 114 shown in broken lines as being back of the section plane in Fig. 19 allows air to pass from conduit 14 to either or both of said ports 44 and 57, as well as to the idling jet port 58, when any one or more of them is subjected to suction from the intake manifold. Fuel is supplied to the idler, indicated generally at 42, from the usual idling well 142, through the small port at the upper end thereof which opens into the said idler apparatus 42. Consequently the usual mixture of air and fuel may be discharged through idler jet port 58 into the carburetor when throttle valve 41 is in its idling position, shown in Figs. 18 and 19.

In Figs. 21 and 22 is shown a further modification of the invention applicable to carburetors having the usual mixture conduit 53 of circular cross section, the throttle valve 49 (Fig. 22) also having a circular outline as shown at 54 in Fig. 21, instead of the usual slightly elliptical shape. Such a valve will cooperate with the ports 47 and 48 for operating a double-acting servo-motor such as shown in Fig. 1, and as the circular throttle valve gives only a very small opening for the passage of the combustible mixture on its initial movement, as compared with the elliptical valve, the opening and closing of ports 47 and 48 can be effected by this circular valve without materially changing the speed of the motor. Consequently, the result obtained with the curved walls 59 shown in Figs. 18 and 19 is also secured with this cheaper construction. Idling is effected in this construction by the flow of a small amount of the regular combustible mixture through the by-pass 50 around the completely closed throttle 49, the amount of such mixture so delivered being adjusted by the needle valve 51 held in adjusted position by lock nut 52.

When the carburetor throttle is in the idling position shown in Fig. 1, atmospheric pressure is in cylinder 5 on the right hand side of piston 2 and the full manifold vacuum is in the cylinder 5 on the left hand side of the piston 2 so that the clutch is fully disengaged. When the carburetor throttle 17 is moved in the direction indicated by arrow 18, the intake manifold vacuum changes its action from the left hand end of cylinder 5 to the right hand end of cylinder 5 so that the pressure on the right hand side of the piston 2 between said piston 2 and cylinder head 4 is the same as the pressure in the intake manifold and the pressure in the cylinder 5 between the left hand end of said cylinder 5 and piston 2 is practically that of the outside atmosphere, so that the engagement of the clutch will be as rapid as desirable, as the throttle 17 is gradually opened by being moved in the direction of the arrow 18, the pressure in the right hand end of the cylinder will be always less than the pressure in the left hand end of the cylinder until the throttle 17 is wide open when the pressure in both ends of the cylinder 5 will be the same. When the throttle valve is in the idling position shown in Fig. 1, the port 11 will be between the throttle valve 17 and the engine and the port 12 will be between the throttle valve 17 and the intake end of the carburetor. The valves 15 and 16 are used to connect the ports 11 and 12 by means of the passageways or pipes 13 and 14 to the cylinder 5 or to connect both ends of the cylinder 5 to the atmosphere and at the same time close communication from the atmosphere to the ports 11 and 12 so that the clutch can be manually operated in the usual manner when desired. The valves 15 and 16 can be used to partially throttle the passageways connecting the ports 11 and 12 with the cylinder 5 to give desirable speed of disengagement and engagement of the clutch. The arrangement shown in Figs. 1, 2, 3, 4 and 5 is that used when applying the mechanism to existing carburetors, such as we have done on our model D. A. Dodge automobile, which has a Stromberg carburetor. In commercial manufacture it will be more practical to arrange the carburetor as shown in Figs. 6, 7, 8, 9, 10 and 11, with flanges on the outside of the carburetor barrel having flat surfaces to

which the valve casings 21 and 22 will be bolted, as shown. The slot 12 in this case can be machined with a cutter, as can also be the slot 11. Then the hole 55 can be drilled, into which the idling apparatus 19 is inserted when the casing 22 is bolted in place and the passageways or pipes 13 and 14 are then connected to the port casings 21 and 22. The dual two-way valve shown in Fig. 15 attached to the dash board 27 of the car can be used in place of the valves 15 and 16 and the carburetor ports 11 and 12 and cylinder 5 can be piped to the valve 26 shown in Fig. 15. As shown in Fig. 17 a single acting vacuum cylinder 29 and piston 30 and single carburetor port 34 piped by pipe 38 to cylinder 29 can be used provided the spring 56 is made strong enough to overcome the pull on the piston 30 due to the vacuum in the carburetor between the venturi and the engine. Figs. 18, 19 and 20 show a form of carburetor in which the throttle can be moved a certain amount without increasing the idling speed of the engine. This is designed for the purpose of allowing the clutch to be engaged with the engine idling and running the car at the speed at which the idling setting of the carburetor would run same. In Fig. 19 the port 57 and the port 44 are both connected to the space in the valve casing 22 which is connected by pipe 14 to the cylinder 5, the purpose of the port 57 which is small is to give a slow engagement of the clutch, the port 44 which is large causes a rapid engagement of the clutch. With a little practice in connection with the form shown in Fig. 1, fast clutch disengagement and varied speed of clutch engagement to suit all conditions of running can be easily obtained.

This vacuum power clutch mechanism, of course, causes the motor vehicle to free-wheel or coast whenever the pressure of the foot is removed from the accelerator and allows the driver to use the left foot for the brake and the right foot for the accelerator 55 when starting from a standstill on up grades or at any other time when such action is desirable. Among the advantages of the invention may be mentioned the simplification of, and reduction in number of parts required for use in, the combined control mechanism for adjusting the delivery of combustible mixture to the carburetor uptake 10, and of atmospheric or subatmospheric pressures to the conduit 13 or 38, variations in which pressures energize the vacuum-operated servo-motor which actuates the clutch-control lever 1 or 32. By the use of our present invention both these functions are dominated by simple oscillation of the valve shaft 20 (Figs. 1 and 2) about its axis. Consequently there is needed only a single, simple connection to the usual accelerator pedal (not shown) for so oscillating said shaft. This simplification results not only in economy of first cost, but also renders the invention convenient in application to motor cars which may already have much other apparatus located under the engine hood; some of which might interfere with the installation of any separate chain of operative connections from the accelerator to any other valve installed for controlling the varying degrees of pressure to be established in such conduit 13 or 38 from time to time for energizing the servo-motor; in addition to that already in use for controlling the carburetor throttle. When our present invention is used, such original carburetor control connection from the accelerator performs a double function, since it also controls the action of the servo-motor.

By way of analyzing the novel, basic principles of construction and operation of our invention, it may be observed that it consists essentially in superimposing on, and combining with, the usual carburetor having a valve 17, 35, 41, or 49, which is oscillatory about a fixed axis (that of shaft 20), additional means such as a port 11, 34, 43, or 47, and its connecting passages for controlling the degree of air pressure in a conduit (such as 13 or 38) which is connected to the cylinder (such as 5 or 29) of a vacuum-energized servo-motor which automatically actuates the clutch lever 1 or 32. Such port and passage means, being disposed in radial relation to the axis of shaft 20, can be operated by the same oscillations of the throttle valve that control the flow of combustible mixture to the carburetor uptake 10, either sequentially (as shown in Figs. 18 and 19) or practically simultaneously, as shown in Figs. 1, 6, 17 and 22.

Various changes could be made in the details of the several modified constructions here shown as constituting specific embodiments of the above outlined basic idea of means without departing therefrom if the relative arrangement of essential elements and/or mode of operation herein set forth be retained and substantially the same results be produced in substantially the same way,—so long as such modifications come within the definitions of the appended claims, or some of them.

The position of the parts shown in Figs. 1 and 17 is the position they will be in with the parts set for idling but with the engine not running. Having now fully described our invention what we claim is;—

1. In a vacuum power clutch mechanism, in combination, a double-acting pneumatic power producing device, a carburetor having a throttle valve, and provided with ports in its casing cooperating with each edge of said valve, together with a separate connection from each of said ports to one of two oppositely disposed portions of the interior of said power producing device; whereby said power producing device is controlled by motion of said throttle valve with reference to said ports.

2. In a vacuum power clutch mechanism, in combination, a pneumatic power producing device, a carburetor having a throttle valve and ports, said pneumatic power producing device being controlled by the co-operation of said throttle valve and said ports.

3. In a vacuum power clutch mechanism, in combination, a double-acting pneumatic power producing device, a carburetor having a throttle valve and ports, means for connecting said carburetor to said double-acting pneumatic power producing device, said pneumatic power producing device being controlled by the co-operation of said throttle valve and said ports.

4. In a vacuum power clutch mechanism, in combination, a pneumatic power producing device operable by variations of vacuum therein, a carburetor having a throttle valve and ports, means for connecting said carburetor to said pneumatic power producing device, said pneumatic power producing device being controlled by the co-operation of said throttle valve and ports for producing rapid disengagement of and variable engagement of said clutch mechanism.

5. In a vacuum power clutch mechanism, in combination, a double-acting pneumatic power producing device, a carburetor having a throttle valve and ports, a clutch actuating member,

means connecting said carburetor and said double-acting pneumatic power producing device, said double-acting pneumatic power producing device being controlled by the co-operation of said throttle valve and said ports for producing rapid clutch disengaging movement of and variable clutch engaging movement of said clutch actuating member.

6. In a vacuum power clutch mechanism, in combination a supporting frame, a double ended cylinder having a double-acting piston, a clutch pedal connected to said piston by means of a piston rod properly packed, a carburetor having a throttle valve and ports, one of said ports being connected to one end of said cylinder by suitable piping, the other of said ports being connected to the other end of said cylinder by suitable piping, valves in said piping, said cylinder being suitably connected to said supporting frame, and said throttle valve and ports co-operating so as to control said double-acting piston.

7. In a vacuum power clutch mechanism, in combination, a clutch pedal, a cylinder and piston, a motor vehicle frame, a carburetor having a throttle valve and ports, piping connecting said ports and said cylinder, valves in said piping, the motion of said piston being controlled by the co-operation of said throttle valve and ports when said valves are adjusted to permit the passage of air through said piping.

8. In a vacuum power clutch mechanism, in combination, a pneumatic power producing device capable of being operated by variations in the degree of vacuum therein, a supporting frame, a clutch operating lever, said pneumatic power producing device being suitably mounted on said frame and connected to said lever, a carburetor having a throttle valve and ports, said ports being connected by passageways to said pneumatic power producing device, and said pneumatic power producing device being controlled by the action of said throttle valve and ports.

9. In a vacuum-power clutch-operating mechanism comprising a clutch-actuating member, and a pneumatic power-producing device operatively connected to the said member, the combination, with said above described apparatus, of a carburetor having a mixture conduit and a throttle valve mechanism for controlling the flow of air through said conduit in which the wall of said conduit is provided with a port adjacent the edge of said valve when the latter is in closed position, and on that side of said valve edge toward which it moves when the valve opens, and a conduit exterior of said valve, said throttle valve mechanism being provided with means for retarding the flow of gases through said mixture conduit until after said valve edge has moved across said port in said conduit wall.

10. In a vacuum-power, clutch-operating mechanism comprising a clutch-actuating member, and a pneumatic power-producing device operatively connected to said member, the combination, with said above described apparatus, of a carburetor having a mixture conduit and a throttle valve controlling the flow of a combustible gaseous mixture therethrough, in which carburetor a wall of said conduit is provided with a valve port extending therethrough adjacent one edge of said throttle valve when the latter is in closed position, and located on that side thereof toward which it moves when opened to permit a flow of said gaseous mixture through said conduit; said valve port being connected to said pneumatic power-producing device and the wall surface of said conduit adjacent said valve edge being curved to correspond to the path of travel of said valve edge; whereby said edge when opening will move across said port before said valve is opened to permit such flow of mixture through said conduit.

11. In a vacuum-power, clutch-operating mechanism comprising a clutch-actuating member, and a pneumatic power-producing device operatively connected to said member, the combination, with said above described apparatus, of a carburetor having a mixture conduit and a throttle valve mounted on an axis extending across a portion thereof intermediate of its opposite edges and across said conduit, the walls of which latter are provided with a valve port adjacent one edge of said valve when it is in closed position and located on that side of said edge toward which it must move to open said conduit to a flow of gaseous mixture through it past said valve, and an idling port located in said conduit walls adjacent the other edge of said valve and on the side thereof from which it will move away during such throttle opening; said above mentioned valve port being connected to said pneumatic power-producing device and the inner wall of said mixture conduit having that portion of its surface in which said first mentioned valve port is located so curved as to substantially conform to a surface which would be generated by the swinging of the adjacent curved edge of the butterfly throttle valve; whereby said port may be crossed by said valve edge without further increasing the area of throttle opening in the carburetor.

12. The combination, with a vacuum-operated apparatus for actuating the clutch mechanism of a motor car, of a carburetor having a mixture conduit of rectangular cross section with a butterfly throttle valve of cooperating rectangular outline pivoted therein, the walls of said conduit adjacent the swinging ends of said valve when it is closed each being curved to an arc of the same radius as that of the adjacent valve end, and one of said curved wall sections having a port in its face connected to said vacuum-operated apparatus; whereby, whenever a valve end swings past said port, variations of air pressure are created in said vacuum-operated apparatus without opening said throttle valve.

13. The combination, with a vacuum-operated servo-motor connected to the clutch mechanism of a motor car, of a carburetor for said car having a butterfly throttle valve, a port in one wall adjacent one edge of said valve when the latter is closed which is connected to said servo-motor, and a port for an idling jet in its opposite wall adjacent the other edge of said valve when the latter is closed.

14. The combination, with the intake of a carburetor, a throttle valve for controlling the flow of combustible mixture to said intake which is oscillatory about a fixed axis, and a conduit in which varying degrees of air pressure are to be established from time to time, of means communicating with said intake and disposed in co-operative valvular relation with said throttle valve for controlling the degree of pressure in such conduit, said means being operative for such purpose during at least portions of the period of movement of said throttle valve and adapted to effect such changes in air pressure in said conduit sequentially with reference to

changes in the flow of combustible mixture through said carburetor intake.

15. In an automobile having a carburetor controlled by an oscillatory throttle valve, an accelerator pedal, a clutch-actuating lever and a servo-motor for automatically operating the same, the combination, with said above described apparatus, of a member oscillatory about the axis of said valve operatively connected directly to said accelerator and adapted to control both the position of said throttle and all automatic movements of said servo-motor; whereby the use of separate control connections from said accelerator to said throttle and to said servo-motor may be dispensed with, said carburetor and servo-motor being so constructed and arranged that an initial movement of said member will set said servo-motor in action before any opening of said throttle valve is caused thereby.

16. In an automobile having a carburetor controlled by an oscillatory throttle valve, an accelerator pedal, a clutch-actuating lever and a servo-motor for automatically operating the same, the combination, with said above described apparatus, of a member oscillatory about the axis of said valve operatively connected directly to said accelerator and adapted to control both the position of said throttle and all automatic movements of said servo-motor; whereby the use of separate control connections from said accelerator to said throttle and to said servo-motor may be dispensed with, said carburetor and servo-motor being so constructed and arranged that an initial movement of said member will set said servo-motor in action before any opening of said throttle valve is caused thereby, while a reverse movement thereof will close said throttle valve before said servo-motor is set in action.

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