March 12, 1946. L. D. BOYCE 2,396,551

SWITCH DEVICE

Original Filed June 15, 1940

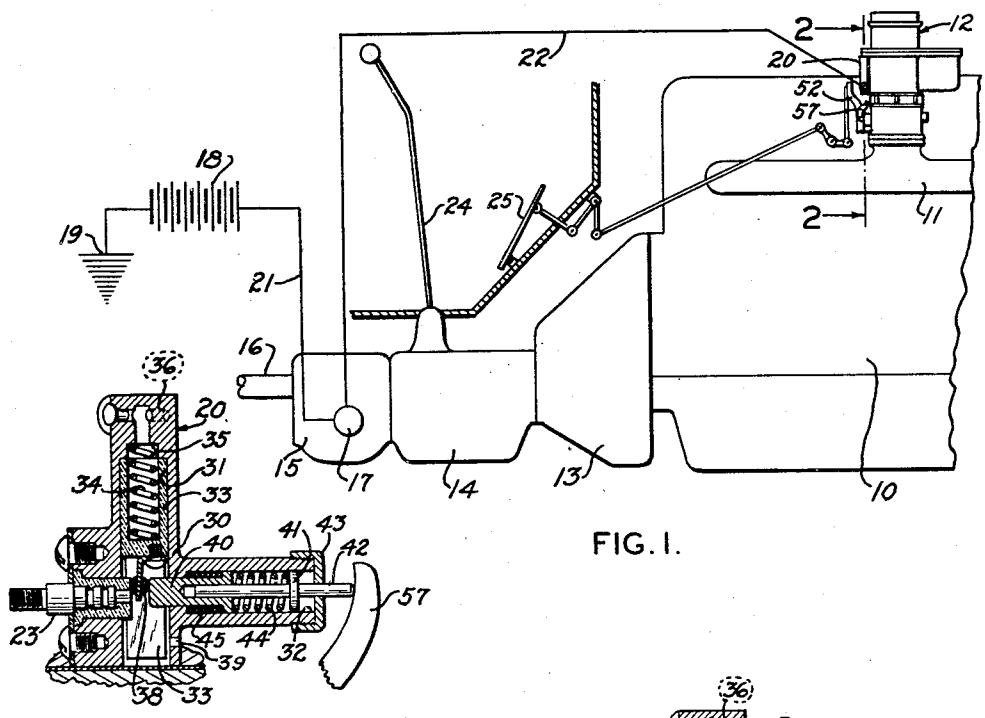

FIG. 1.

FIG. 4.

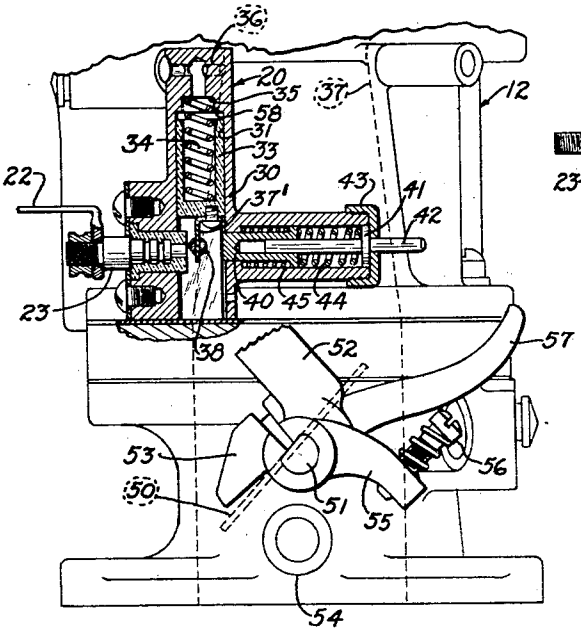

FIG. 2.

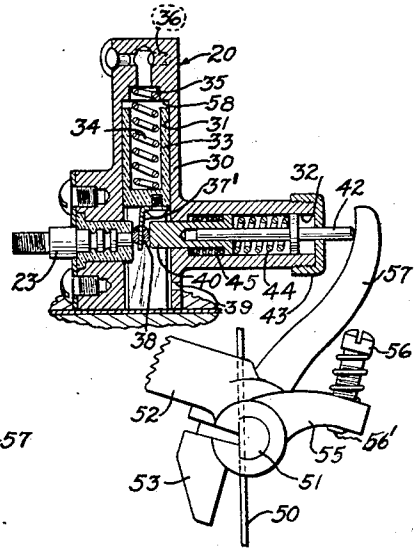

FIG. 3.

INVENTOR

LEONARD D. BOYCE

Donald M Rich

ATTORNEY

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SWITCH DEVICE

Leonard D. Boyce, Maplewood, Mo., assignor to Carter Carburetor Corporation, St. Louis, Mo., a corporation of Delaware

Original application June 15, 1940, Serial No. 340,819. Divided and this application February 12, 1941, Serial No. 378,651

5 Claims. (Cl. 200—59)

This invention relates to transmission control mechanisms for automotive engines and consists particularly in novel means for preventing operation of the so-called over-drive throw-out when the vehicle is travelling at such a rate of speed that the consequent increased speed of the engine would endanger the parts thereof.

This application is a division of my co-pending application, Serial No. 340,819, filed June 15, 1940.

Where the transmission gearing for an automobile is provided with a so-called "over-drive," which is engaged automatically when the vehicle is travelling at higher than a predetermined speed, it is desirable to provide for greater power and faster acceleration particularly in case of an emergency as when the vehicle, though travelling in over-drive, must suddenly be speeded to pass another car. This result is now attained in some instances by automatically reshifting to a higher or more powerful gear ratio when the throttle pedal is fully depressed. It has been found that with such arrangements, where the vehicle is travelling at 45 miles an hour or faster, the transmission cannot be safely returned to third gear, as above described, due to the consequent excessive engine speed.

Accordingly, it is an object of the present invention to provide means for preventing reshifting of the transmission gearing to third gear from over-drive when the car is travelling at faster than a predetermined rate of speed, say 45 miles an hour.

A more detailed object is to provide in the circuit for controlling an over-drive throw-out solenoid, a switch which is jointly controlled by the carburetor throttle valve and a device actuated by greater than a predetermined degree of suction in the carburetor mixture conduit anterior to the throttle. This suction device is sensitive to operation of the engine at approximately the speed where it is undesirable to throw-out the over-drive, to render the throttle control ineffective to close the switch. These objects and other more detailed objects hereafter appearing are attained substantially by the structure illustrated in the accompanying drawing in which:

Fig. 1 is a diagrammatic view showing portions of an automobile engine including the carburetor and transmission with the invention applied thereto.

Fig. 2 is an enlarged view of a portion of the carburetor shown in Fig. 1 but taken at 90° thereto, the over-drive throw-out switch being sectioned on line 2—2 of Fig. 1 for clearer illustration.

Fig. 3 is a sectional view of the switch as in Fig. 2 but showing the switch contacts engaged.

Fig. 4 is a view similar to Fig. 3 but showing the switch contacts rendered ineffective to complete the over-drive throw-out circuit.

Fig. 1 shows at 10 a portion of an internal combustion engine of the automotive type including an intake manifold 11 mounting a carburetor generally indicated at 12. A clutch and change speed transmission gearing of any suitable form are mounted, respectively, in housings 13 and 14 secured to the rear portion of the engine. The transmission is provided with over-drive mechanism located within a housing 15 forming a rearward extension on housing 14 and directly connected to the usual propeller shaft 16 for driving the rear axle. A solenoid device 17 is mounted on the side of the over-drive housing 15, and, when energized, functions in a known manner to throw-out the over-drive or, in other words, return the transmission gearing from over-drive position to third or the next higher and more powerful gear ratio.

Solenoid 17 is controlled by an electrical circuit including storage battery 18 having one terminal grounded, as at 19, and a switch device generally indicated at 20 mounted upon the carburetor 12. The storage battery and switch are connected to solenoid 17, respectively, by leads 21 and 22, the latter being connected to an insulated terminal 23 forming one of the contacts of switch 20 (Figs. 2, 3 and 4). The detailed construction of the solenoid as well as the over-drive and other parts of the transmission do not in themselves, constitute the present invention and are not illustrated. For convenience I have shown a manual shift lever 24 for shifting the transmission gearing through the usual reverse, and first, second and third forward gears, but this shifting may be effected by other suitable means. As is well known, the over-drive portion of the transmission is automatically engaged responsive to predetermined output speed of the transmission mechanism or, in other words, wheel speed.

Heretofore, the control circuit for the over-drive throw-out solenoid 17 has been controlled solely by a throttle actuated switch so that whenever the throttle pedal 25 is fully depressed, this solenoid is energized for automatically reshifting from over-drive to third gear. In the present invention I incorporate an additional suction control for the solenoid switch which renders the switch ineffective to energize the solenoid under

predetermined suction conditions. This switch includes an angular body portion 30, the legs thereof being hollowed as at 31 and 32. Hollow leg 31 forms a cylinder for slidably receiving a cup-shaped piston 33 normally urged downwardly by a coiled spring 34 seated against an inner surface of the piston and a shoulder 35 formed in the upper portion of the cylinder. A passage 36 connects the cylinder above piston 33 to the interior of the carburetor barrel or mixture conduit preferably at the throat of venturi 37 (Fig. 2). A port 38 connects the cylinder below the piston to atmosphere and this port may lead to the air inlet horn of the carburetor so that the air will be drawn through the usual air cleaner (not shown). Secured to the undersurface of piston 33 is an angular spring clip 37', the projecting leg of which carries a metallic ball or enlargement 38 adjacent, but normally slightly spaced from the inner extremity of switch contact 23 (Fig. 2). The body 30 of the switch device is grounded through the carburetor, intake manifold, and engine block, but piston 33 is formed of insulating material to prevent shorting of switch contact 23.

The other hollowed arm of the switch body slidably receives a hollowed switch actuating plunger 40 and a collar 41 formed on a pin 42 slidably received within plunger 40 and extending longitudinally through a screw cap 43 secured to the end of this leg of the switch body. Collar 41 is normally urged outwardly against cap 43 by a coiled spring 44 and plunger 40 is similarly urged outwardly by a coiled spring 45 whereby a yielding one-way connection is formed between the switch plunger and pin 42. One of the primary features of the instant invention is the relationship between the spring 44 and the spring 45. The spring 44 has a compressive strength of approximately one pound to three pounds greater than the compressive strength of the spring 45. This results in a one to three pound limitation on the pressure which may be applied to the contact points 38. These contact points are frequently made of silver and would be deformed by the excessive pressure which might be exerted by the pressure of the driver's foot on the accelerator. The spring arrangement is such as to resist inward movement of the control member 40 after the throttle has been opened to a predetermined position so as to contact the switch points and compact spring 45. Thereafter, a conscious effort of the operator will be required to compress spring 44 and telescope rod 42 into member 40.

Pivotally mounted in the carburetor mixture conduit posterior to venturi 37 is a butterfly throttle valve 50 which may be manually operated in the usual manner by means of a suitable arm 52 (not shown) rigidly attached to throttle shaft 51. Also formed on throttle arm 52 is an extension 53 positioned to engage stop 54 to fix the wide open position of the throttle valve, and a second arm 55 carrying an adjustable screw 56, the end 56' of which engages the stop 54 to fix the closed position of the throttle valve. A third arm 57 formed rigidly with throttle crank 52 is positioned to engage switch contact pin 42 when the throttle valve is substantially fully opened (Figs. 3 and 4) to urge this pin and switch contacting plunger 40 inwardly against enlargement 38 carried by piston 33 and to urge this enlargement in the direction of switch contact 23. Spring 34 is adjusted so as to maintain piston 33 in its lowermost position, as in Fig. 3, whenever the suction at the throat of venturi 37 is less than approximately 1.8 inches of mercury, which corresponds with a vehicle speed of approximately 45 miles an hour. When this degree of suction is exceeded at the throat of the carburetor venturi, that is, when the vehicle is travelling in excess of 45 miles an hour, piston 33 will be lifted against spring 34 into engagement with shoulder 58 formed in the wall of cylinder 31 so as to raise enlargement or ball 38 and prevent contact of switch terminal 23 thereby (Fig. 4). Thus, when the predetermined venturi suction is exceeded, the switch is automatically rendered ineffective to energize the overdrive throw-out solenoid 17. Whenever the suction in venturi 37 is less than approximately 1.8 inches of mercury, ball 38 will be positioned so that when plunger 40 is forced inwardly due to the throttle valve being fully opened, switch contact 23 will be grounded through this enlargement, plunger 40 and the switch body so as to complete the solenoid control circuit and cause reshifting of the transmission mechanism from over-drive to third gear.

By means of the illustrated structure, the overdrive, which is automatically engaged at a wheel speed of, say 35 miles an hour, may be thrown out whenever the driver demands maximum power and fully opens the throttle valve, but at vehicle speeds in excess of 45 miles an hour, when it would be unsafe to reshift the gearing from over-drive to a higher ratio of engine to wheel speed, such reshifting is automatically prevented. Thus, it is possible to use a higher third gear ratio than heretofore so as to attain better power and acceleration at the lower speeds.

The invention may be modified in various respects as will occur to those skilled in the art and the exclusive use of all such modifications as come within the scope of the appended claims is contemplated.

I claim:

1. In a switch device for use in connection with an internal combustion engine intake conduit, a body having a chamber and means to transmit suction in the intake conduit thereto, an element movable in said chamber responsive to varying suction conditions therein, an electrical terminal member in the wall of said chamber, a switch control member extending into said chamber and spaced from said terminal member, and a flexible projection on said suction responsive element adapted to be interposed between said members under predetermined suction conditions in said chamber so as to render said control member, when actuated, operative to complete an electrical circuit passing in part through said terminal member and said projection.

2. In a switch device for use in connection with an internal combustion engine intake conduit, a body having a chamber and means to transmit suction in said conduit thereto, an element movable in said chamber responsive to varying suction conditions therein, an electrical terminal member in the wall of said chamber, a switch control member extending into said chamber and spaced from said terminal member, and a resilient projection on said suction responsive element normally spaced from said terminal member regardless of the position of said element, said projection including electrical conducting means and being adapted to be interposed between said members under predetermined suction conditions in said chamber so as to be moved against said terminal member upon actuation of said control member to complete an electrical circuit passing

in part through said terminal member and said projection.

3. In a switch device for use in connection with an internal combustion engine intake conduit, a body having a chamber and means to transmit suction in said conduit thereto, an element movable in said chamber responsive to varying suction conditions therein, an electrical terminal connection in the wall of said chamber, a movable electrical contact device extending into said chamber and constantly spaced from said terminal connection, and a flexible projection on said suction responsive element including electrical conducting means normally spaced from said terminal connection regardless of the position of said suction responsive element, said projection being adapted to be interposed between said connection and said contact device under predetermined suction conditions in said chamber so as to be moved by said contact device, upon actuation thereof, into engagement with said terminal connection to complete a circuit between said connection and said device.

4. In combination with an internal combustion engine having a throttle-valve-controlled intake system and mechanism for adjusting the throttle valve; electrical circuit controlling means comprising a first electrical conductor; a second electrical conductor mounted for flexing movement and bodily movable relative to the first said conductor from a first position to a second position; a third electrical conductor movable from a first position to a second position; said second conductor when in its said first position being flexed to electrically connect said first and third conductors in response to movement of said third conductor to its second position; said second conductor when in its said second position being disposed out of electrically connecting relationship with said first and third conductors; means actuated by said throttle adjusting mechanism for moving said third conductor; and means responsive to pressure variation in said intake system for moving said second conductor to its said second position.

5. In a device of the class described, a carburetor having a conduit, a throttle valve in said conduit, an operating member for said valve, a relatively stationary electrical conductor, a movable electrical conductor element adapted to be disposed in contactable relationship with respect to said fixed conductor, a plunger element adapted for movement by said valve operating member for moving said movable conductor element in contact with said stationary conductor, mechanism for moving said plunger element as aforesaid in response to operation of said valve operating member, means providing a ground for one of said elements, and a spring opposed suction device responsive to predetermined suction in said conduit at a point anterior to said valve for moving said movable conductor element to a position thereof out of said contactable relationship.

LEONARD D. BOYCE.