

June 5, 1956

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THROTTLE CONTROL FOR TWO-STAGE CARBURETOR

Filed April 27, 1953

2 Sheets-Sheet 1

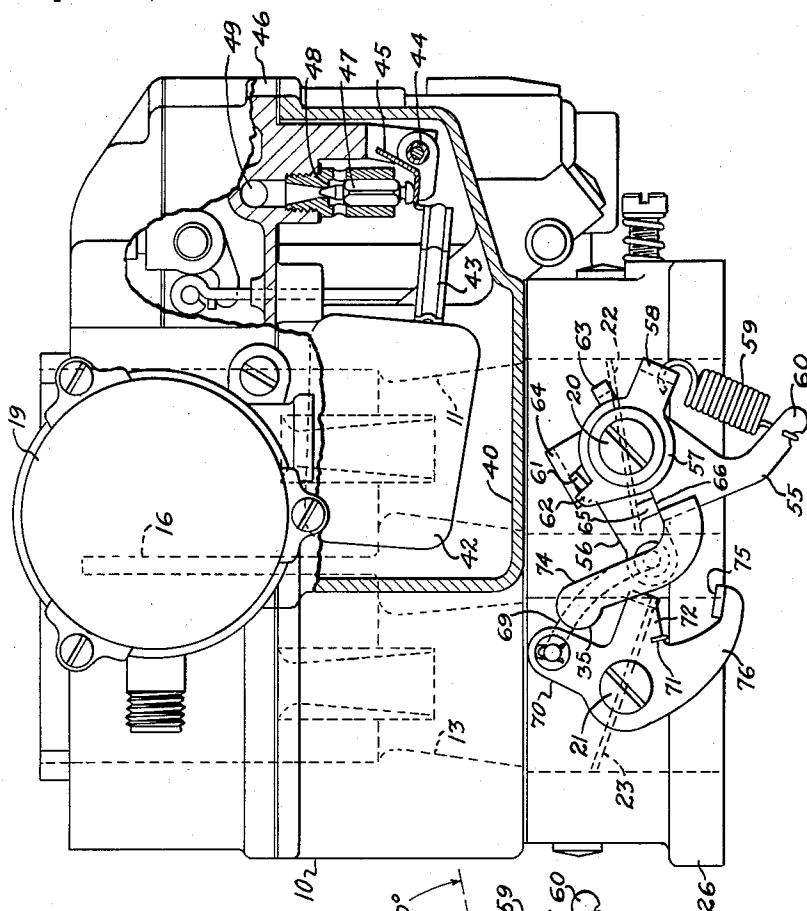


FIG. 1.

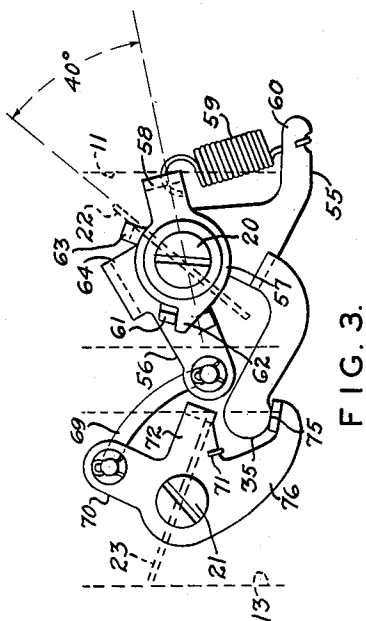
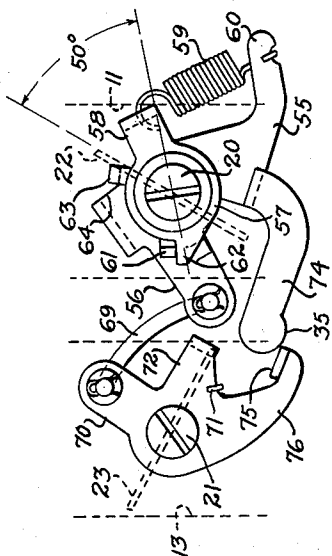


FIG. 3.



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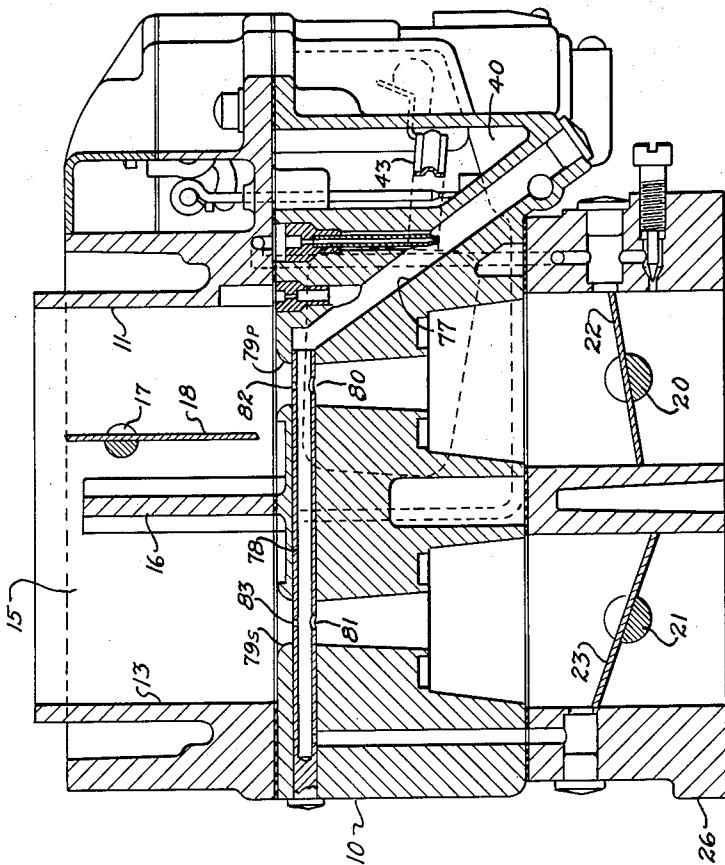


FIG. 2.

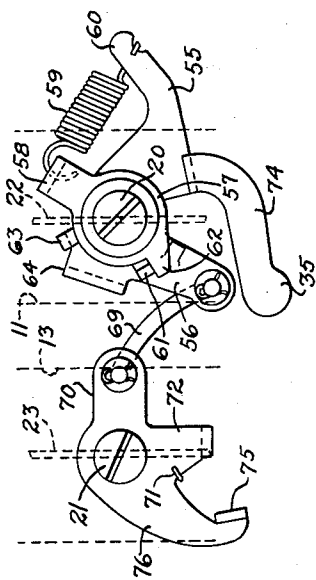


FIG. 5.

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THROTTLE CONTROL FOR TWO-STAGE CARBURETOR

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Application April 27, 1953, Serial No. 351,421

7 Claims. (Cl. 261—23)

This invention relates to multi-barrel, multi-stage carburetors, and, more particularly, to mechanism for operating the throttles in the secondary stages from the throttles in the primary stages.

In the multi-stage carburetors of the type above described, the secondary throttles remain closed during the greater part of the range of initial opening of the primary throttles. In other words, the secondary throttles ordinarily remain closed during the range of motor vehicle speeds below 60 miles an hour for normal loads on a level road. Generally, a lost motion connection permits the primary throttles to open part way before the secondary throttle actuating mechanism is engaged and the secondary throttles begin to open. The secondary throttles are then fully opened during the last part of opening movement of the primary throttles.

A throttle mechanism such as that above is described in detail in my co-pending application with James T. W. Moseley, Serial No. 263,291, filed December 26, 1951, now Patent No. 2,715,522, issued August 16, 1955.

Since full opening of the secondary throttles is accomplished by fractional opening movement of the primary throttles, it will be realized that the angular velocity of the secondary throttles must be much more rapid than the corresponding angular velocity of the primary throttles, and this requires a multiplication gearing for driving the secondary throttles from the primary throttles. It follows that, in the normal use of the accelerator pedal control for the primary throttles, the initial opening of the secondary throttles is very abrupt, due to this type of gearing between the throttles.

It will also be understood by those skilled in the carburetor art that the secondary throttles must be opened before a depression can occur in the secondary venturi, and that there necessarily will follow a certain time lag after the secondary throttles are opened before the secondary fuel nozzles will function. This lag in the action of the fuel nozzles which occurs on secondary throttle opening, taken with the abrupt opening action of the secondary throttles, is thought to produce a sudden leaning of the fuel-air ratio during the lag, followed by a full power mixture when the nozzles begin to operate. It is also believed that this variation in mixture ratio due to lag produces what amounts to a flat spot in carburetion, which is distinctly noticeable in engine response to throttle opening.

It has been discovered that if a slow initial opening of the secondary throttles of only a slight amount occurs first, before multiplication gearing for opening the secondary throttles becomes effective, a smooth transition can be produced between primary and secondary stage operation. Accordingly, the instant invention is a modified form of throttle linkage designed to be used between the primary and secondary throttles in a multi-stage carburetor such as disclosed in my prior application above identified. This modification provides a mechanism which causes very gradual opening of the secondary throttles to occur during opening of the primary throttles and just

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prior to the action of the aforesaid throttle linkage between the two throttles. The slight opening of the secondary throttles produced by this mechanism is preferably sufficient to bring the secondary fuel nozzles into operation, and eliminates the undesirable lag in fuel nozzle operation and its effect on engine performance. This novel operation may be produced by a single cam and follower, or it may be, as illustrated here, a distinct mechanism in addition to that employed in my prior joint application. The action of the separate mechanism may produce intermittent secondary throttle operation, or continuous but non-uniform motion, as the case may be, but in all cases the secondary throttle cracking occurs prior to any continuous movement of the secondary throttle toward full open.

In the drawings:

Fig. 1 is a side elevational view of the carburetor showing the throttle interconnecting mechanism of the instant invention.

Fig. 2 is a vertical longitudinal section through two barrels of the carburetor shown in Fig. 1.

Fig. 3 is a detail view illustrating the action of the throttle actuating mechanism shown in Fig. 1, when the primary throttle is partly open.

Fig. 4 is a view similar to Fig. 3, illustrating the position of the throttles as the primary throttle is progressively opened from the position in Fig. 3.

Fig. 5 is a view similar to Fig. 3 illustrating the throttle actuating mechanism with both throttles fully open.

The drawings illustrate a four-barrel, downdraft carburetor with a body 10. As shown in Figs. 1 and 2, body 10 includes two forward, primary-stage mixture conduits 11 (only one of which is shown), and two rear or secondary-stage mixture conduits 13 (only one of which is shown). These conduits are arranged in symmetrical relation in a compact group and supplied with air through a rectangular shaped air horn structure 15 provided with a transverse partition 16. At the forward side of the partition is journaled a choke shaft 17 mounting an unbalanced choke valve 18. The choke shaft is controlled by any suitable type of automatic choke control mechanism within the housing 19 of Fig. 1. This mechanism is described in my above-identified joint application. Extending across both primary and secondary mixture conduits are throttle shafts 20 and 21 mounting a pair of primary stage throttle valves 22 and a pair of secondary stage throttle valves 23, respectively. Each pair of primary throttles 22 moves as a unit; likewise, each pair of secondary throttles 23 moves as a unit. Only one valve in each pair is illustrated because the arrangement and parts are symmetrical. A flange 26 surrounding the lower end of the conduits is provided for attaching the carburetor to the usual engine intake manifold. As shown in Fig. 1, the carburetor is provided with the usual fuel bowl having two identical float chambers 40, one of which is not shown. These chambers are interconnected by a restricted passage in which is located the supply point for two fuel nozzle systems. Float chamber 40 contains a float 42 mounted on a float control arm 43 pivoted on a shaft 44 supported by a structure depending from the float bowl cover 46. Finger 45 on the arm 43 engages and actuates a needle valve 47, which, in turn, controls the supply of fuel past valve seat 48 from a common inlet 49 for both float chambers 40. Float 42 and needle valve 47 maintain a substantially constant fuel level within the fuel bowl of the carburetor.

The carburetor includes, in addition to the above described structure, fuel metering means, economizer, and acceleration pump, all of which is identical with the construction fully described in my co-pending application with Olin J. Eickmann, Serial No. 345,048, filed on March 27, 1953, now Patent No. 2,718,387, issued Sept.

20, 1955. It is not believed necessary, therefore, to again describe the fuel system in detail here, since it forms no part of, nor is it necessary for a complete understanding of, the present invention. It is sufficient to point out that the fuel is supplied through the usual metering system to inclined fuel passages 77, and thence to fuel tubes 78, which extend transversely of the throats of venturi 79P and 79S. Since the carburetor contains two primary and two secondary mixture conduits, there will be two fuel passages 77 and two fuel tubes 78, but, since the structure of both pairs of primary conduits and both pairs of secondary conduits are identical, only one primary and secondary will be described.

Mixture tube 78 is provided with fuel nozzles 80 and 81 and vents 82 and 83, all in a manner as described in my aforesaid copending application with Olin J. Eickmann.

This invention resides in mechanism for operating the secondary throttles 23 from the primary throttles 22, which will now be described. It will be understood that the opposite end of the throttle shaft 20 (not shown) is connected by means of a linkage for manual operation by the usual accelerator pedal of the motor vehicle. In Fig. 1, the primary throttle shaft 20 carries a pair of levers 55 and 56 loosely pivoted thereon. A small disc-like arm 57 rigid with the primary throttle shaft 20 has an angular finger 58 resiliently connected by means of a coiled tension spring 59 to the extremity of a projection 60 on lever 55. This spring normally maintains an outwardly turned finger 61 on lever 55 in contact with an abutment 62 on disc-like arm 57, which is fixed with respect to the primary throttle shaft 20. Lever 55 also has an inwardly turned, peripheral finger 63, which lies in the same vertical plane as a portion 64 of lever 56. Inner loose lever 56 also has a lug 65 on its outer face to be engaged by an elbow 66 on lever 55 to positively urge the lever 56 in a clockwise direction. Lever 56 is connected at its extremity by a link 69 to a crank arm 70 rigid with the corresponding extremity of secondary throttle shaft 21. A torsion spring 71 has one end hooked about arm 72 of throttle-operating lever 70 and its opposite end anchored to the body 10 of the carburetor. This normally urges the secondary throttle valves toward their closed position.

So far, the structure described for operating the throttles is substantially identical with that described in my co-pending application with James T. W. Moseley, above identified.

The structure for cracking the secondary throttle 23 will now be described. This mechanism includes an arm 74 formed integral with the lever 55 which overlies a face 75 formed on the arm 76 of secondary throttle operating lever 70.

As described in my aforesaid application with James T. W. Moseley, the resilient interconnection 59 between the arms 57 and 55 is for the purpose of permitting the full opening of the throttles 22 when the secondary throttles are locked closed by a latch controlled by the automatic choke mechanism, all as described in my aforesaid application. In the present invention the same feature is retained because both arm 74 and link 69 are connected to the primary throttle shaft 20 through spring connector 59. Thus the spring can expand to permit independent operation of the primary throttles. When this latch is inoperative, however, the operation of the secondary throttles is through arm 74 engaging face 75, and through the linkage 56, 69 and 70 connecting the throttles, as illustrated in Figs. 3 to 5 of the drawings.

Turning now to Fig. 3, the primary throttle is shown partially open and, for purposes of illustration only, the amount of opening is indicated as 40 degrees. In this figure, secondary throttles 23 are still closed, but arm 74 has engaged face 75 on arm 76 of secondary throttle operating lever 70. Further movement of the primary throttle shaft 20 will produce movement of the secondary

throttle shaft 21 and throttles 23. This further movement of the primary throttle shaft 20 is indicated in Fig. 4. For the purpose of illustration only, the throttles 22 are shown as rotated an additional 10 degrees, so that they are now open 50 degrees. As a result of this additional 10 degrees movement of throttle 22, arm 74 has forced arm 76 to a slightly displaced position of only two or three degrees from that shown in Fig. 3, thereby cracking the secondary throttles 23 a slight amount sufficient to bring into operation the secondary fuel nozzles 81. A comparison of the amount of movement of the secondary with the primary illustrates clearly the gear reduction effected. Cam-contoured face 35 has more of a wiping action with face 75 than an opening movement on the throttles 23. The particular contour chosen for the face 35 is wholly arbitrary, depending upon the requirements of the particular carburetor. Further movement of the primary throttle 22 beyond the position indicated in Fig. 4 brings the lug 63 into contact with the abutment 64 to actuate the secondary throttles 23 through lever 56, link 69, and arm 70. At the same time, further movement of the primary throttles 22 to the position in Fig. 5 disengages the face 35 from the face 75, whereby exclusive control of secondary throttle position is obtained through the linkage described above. Of course, movement of the primary throttles 22 in a closing direction produces sequential closing of first and secondary throttles, and then the primary throttles, in a manner in reverse of the action during opening. When the primary throttle is fully closed, elbow 66 engages shoulder 65 to lock the secondary throttles closed.

I claim:

1. In a multi-stage carburetor having primary and secondary mixture conduits and primary and secondary throttles for said mixture conduits, the combination of a connection for manual operation of said primary throttle, mechanism for fully opening said secondary throttle during the final range of opening movement of said primary throttle, and means between said throttles including a driving part movable with said primary throttle and a driven part connected to said secondary throttle engaged by said driving part to partially open said secondary throttle prior to operation of said mechanism.

2. In a multi-stage carburetor having primary and secondary mixture conduits and primary and secondary throttles for said mixture conduits, the combination of a connection for manual operation of said primary throttle, a mechanism for fully opening said secondary throttle during the final range of opening movement of said primary throttle, and a gearing between said throttles including a driving part fixed to and movable with said primary throttle, and a driven part fixed to said secondary throttle and engaged only within an intermediate portion of the path of movement of said driven part on actuation of said primary throttle to partially open said secondary throttle before operation of said mechanism.

3. In a multi-stage carburetor having primary and secondary mixture conduits and separate throttles for said mixture conduits, the combination of a mechanism for sequentially opening said primary and secondary throttles acting in different ranges of opening movement of said primary throttle to provide distinctly different relative rates of opening for said secondary throttle by uniform movement of said primary throttle, comprising a manual operator for said throttles, a variable ratio gearing between said throttles, and means in said gearing for timing the sequential operation of said throttles including a lost motion connection and a cam and lever for initially cracking said secondary throttle.

4. In a multi-stage carburetor having primary and secondary mixture conduits and separate throttles in said mixture conduits, the combination of a mechanism for sequentially opening said primary and secondary throttles acting in different ranges of opening movement of said primary throttle to produce intermittent movement dur-

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ing opening of said secondary throttle by uniform movement of said primary throttle, comprising a manual operator for said primary throttle, a variable ratio gearing between said throttles, and means between said manual operator for said throttles and said gearing for timing the sequential operation of said throttles including a cam and follower.

5. In a multi-stage carburetor having primary and secondary mixture conduits and separate throttles in said mixture conduits, the combination of a mechanism for sequentially opening said primary and secondary throttles acting in different ranges of opening movement of said primary throttle to produce intermittent movement during opening of said secondary throttle by uniform movement of said primary throttle, comprising a manual operator for said primary throttle, a variable ratio gearing between said throttles, and means between said manual operator for said throttles and said gearing for timing the sequential operation of said throttles including a cam and follower and a multiplication linkage.

6. In a multi-stage carburetor having primary and secondary mixture conduits and separate throttles in said mixture conduits, the combination of mechanism for sequentially opening said primary and secondary throttles acting in different ranges of opening movement of said primary throttle to provide continuous but non-uniform opening of said secondary throttle by uniform movement of said primary throttle, comprising a manual operator

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for said throttles including a variable ratio gearing, sequentially operating parts in said gearing for driving said secondary throttle, and means in said gearing for timing the sequential operation of said throttles including a pair of lost motion connections in said gearing.

7. In a multi-stage carburetor having primary and secondary mixture conduits and separate throttles in said mixture conduits, the combination of mechanism for sequentially opening said primary and secondary throttles acting in different ranges of opening movement of said primary throttle to provide continuous but non-uniform opening of said secondary throttle by uniform movement of said primary throttle, comprising a manual operator for said throttles including a variable ratio gearing, sequentially operating parts in said gearing for driving said secondary throttle, and means in said gearing for timing the sequential operation of said throttles which includes a cam and follower and a multiplication linkage.

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