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SECONDARY THROTTLE OPERATOR FOR TWO-STAGE CARBURETORS

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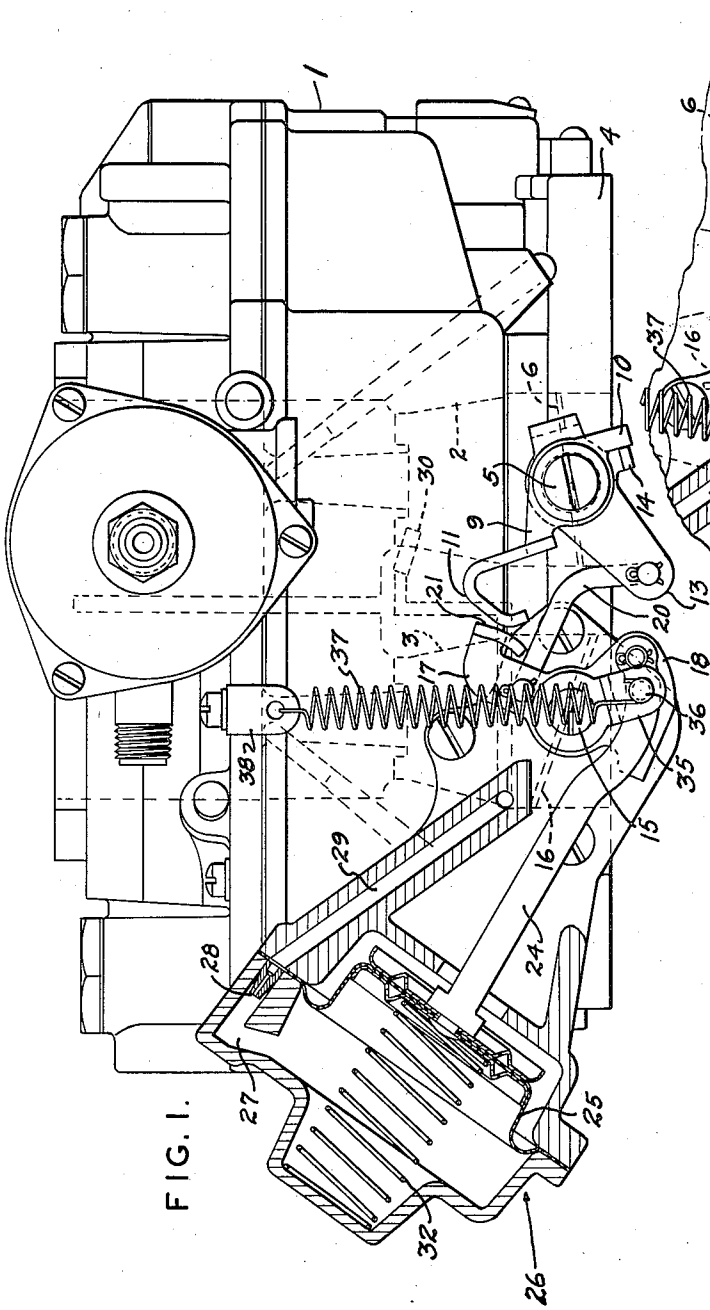


FIG. 1.

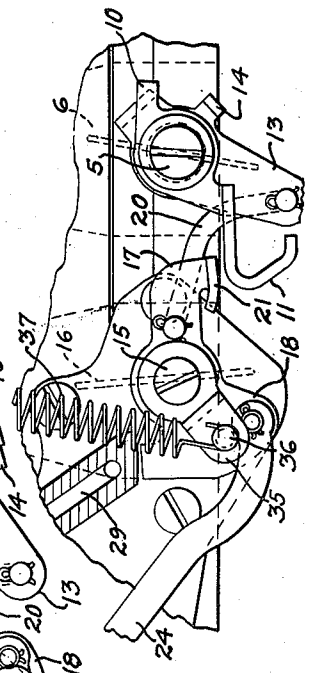


FIG. 2.

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SECONDARY THROTTLE OPERATOR FOR TWO-STAGE CARBURETORS

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15 Claims. (Cl. 261—23)

This invention relates to carburetors and, more particularly, to a novel mechanism for automatically operating the throttle in a secondary stage of a multi-stage carburetor.

This invention is particularly applicable to operate the secondary throttle of a four-barrel carburetor such as shown in the patent to Bicknell 2,640,472, but it may be adapted to automatically operate the throttle or throttles in any carburetor. In many prior mechanisms for this purpose, the secondary throttle is either an unbalanced valve opened by air pressure or suction acting directly thereon, or is a balanced valve connected with a suction motor deriving its power from the carburetor venturi or the manifold. In both instances, it is usual practice to hold the automatic valve closed by a constantly acting force. Because there are only two forces acting in such mechanisms, it is difficult to calibrate initial action, degree of response, and the rate of response.

According to this invention, a third control is added to the mechanism which can exert a force acting either with or against either of the control forces previously described. This facilitates adjustment to suit engine operation, and uniform responses after the adjustment is once made.

Further objects and advantages will appear from the reading of the specification in connection with the accompanying drawings, which illustrate one form of the invention, and in which:

Fig. 1 is a side elevation of a four-barrel carburetor with parts in section and illustrating the position of these parts with the secondary throttles closed.

Fig. 2 is a fragmentary view showing the position of the parts with the secondary throttles open.

In Fig. 1 is shown a side view of a conventional four-barrel, multi-stage type of carburetor such as shown in greater detail in the abovementioned patent to Bicknell. Since the features of such carburetors are well known, and the invention here pertains only to a mechanism for operating the throttles, the details of the four-barrel carburetor are not illustrated or here described, because they form no part of the present invention. Accordingly, the description here will be confined to the throttle operating mechanism.

Within the main body 1 of the carburetor are a pair of primary mixture conduits 2, and a pair of secondary mixture conduits 3. (Only one in each pair is shown.) The throttle body portion of the carburetor 4 journals a primary throttle shaft 5 mounting primary throttles 6, one of which is shown in Fig. 1. The primary throttle shaft 5 is provided with a suitable lever (not shown) for manual control by the operator. This lever is generally mounted on the opposite side of the carburetor from that shown in Fig. 1. Throttle shaft 5 carries a lever 9 fixed thereto, which has a downwardly extending lug 10 and an oppositely positioned cam surface 11. Journaled on the primary throttle shaft is a lever 13 with an integrally formed, outwardly projecting finger 14 in abutting relation with the lug 10 on the lever 9.

Secondary throttle shaft 15 mounts a pair of throttles 16 within the secondary mixture conduit 3, one of which is shown. Fixed on the throttle shaft 15 is a bell crank having opposite extending arms 17 and 18. A link 20 interconnects the arm 13 on the primary throttle shaft with the arm 17 of the bell crank on the secondary throttle shaft. This arm of the bell crank carries a cam surface 21 which cooperates with the cam surface 11 to prevent opening of the secondary throttles 16 until the primary throttles 6 have reached a predetermined open position. The opposite arm 18 of the bell crank is connected with a link 24 to the diaphragm 25 of a suction motor generally indicated as 26. A suction passage 27 contains a metering restriction 28, and is connected by a series of passages 29 with a port 30 in the venturi of the primary mixture conduits. Although in this illustration a single suction connection is shown for the suction motor 26, the particular system for supplying suction may be any one of the types such as shown in a prior application of Harold A. Carlson and Olin J. Eickmann, Serial No. 345,048, of March 27, 1953, now U. S. Patent No. 2,718,387 dated September 20, 1955, or in a prior application of Harold A. Carlson, Serial No. 419,381, of March 29, 1954, now U. S. Patent No. 2,793,843 dated May 28, 1957. The particular suction system, including its connections, form no part of the present invention.

The action of the suction motor 26 is resisted by a spring 32, which is compressed between the diaphragm and the inner casing wall of the suction motor 26.

The end of the secondary throttle shaft 15 also carries a fixed lever 35 with a pin 36 forming an anchor for one end of a spring 37. The other end of the spring hooks into an eye 38 in a bracket secured to the body of the carburetor. The arm 35 is so arranged with respect to the throttle shaft 15 that in the closed position of throttles 16 the spring 37 tends to maintain the throttles 16 closed. However, during initial opening movement of the throttles 16, the arm 35 will rotate clockwise, first to a position in which the eye 38, shaft 15, and anchor 36 are in a line of centers. It follows that, during the initial movements of the lever 35 clockwise, spring 37 will exert decreasing influence in a direction to close the throttles until this dead-center position aforementioned is reached, in which it exerts no effort in either direction. As the arm moves beyond the dead-center position, however, the spring 37 exerts an increasing force with the progressive movement of the arm 35 and in a throttle-opening direction. Fig. 2 illustrates this over-center travel of the spring 37 from one side of the throttle shaft 15 to the opposite side, as the secondary throttles 16 open.

By different lengths of lever arm 35 and by varying the tension of the spring 37, it is possible to completely overcome the resistance of the spring 32 by the force exerted by the spring 37 within a range of throttle opening. At the same time, it is likewise possible to use the effort of both springs 32 and 37 to tightly close the secondary throttles 16 and hold them closed. With such an arrangement, the choice of strength of spring 37 with respect to 32 enables calibration of the mechanism to obtain any desired rate of throttle opening. In other words, the spring 37 can be arranged to overcome the resistance of the spring 32, either in part or wholly, in any part of the range of throttle opening after the lever 35 passes the dead-center position.

Operation

When the primary throttles 6 are closed, lug 10 abuts finger 14, urging lever 13 in a clockwise direction so that secondary throttles 16 are maintained closed through the connection 20 between the levers 13 and 17.

Opening movement of the throttles 6 will rotate cam

surface 11 across the face of cam surface 21 and, so long as these two cam surfaces are in engagement, the secondary throttles 16 are held closed regardless of the action of the suction motor 26. As soon as the cam surface 11 passes out of contact with the follower surface 21, which can be arranged at any predetermined primary throttle opening, then secondary throttles 16 are free to open under the influence of the suction motor 26. However, the co-action of the cam surfaces 11 and 21 prevent the secondary throttles from opening to a greater degree than the opening of the primary throttles.

As the primary throttles are closed, the secondary throttles are likewise closed due to the interaction between the cam surfaces 11 and 21, so that both sets of throttles 6 and 16 reach the closed position sequentially.

In the closed position of the throttles 16, both springs 32 and 37 act in a closing direction, as shown in Fig. 1. Increased velocity through the primary mixture conduits 2 creates static depression at the port 30, which will be sufficient to initiate operation of the suction motor 26. By proper calibration of the metering orfice 28 and springs 32 and 37, it is possible to so adjust the mechanism that the suction motor 26 begins to operate at predetermined engine speeds and throttle openings. As suction increases at the port 30, the effort exerted by the suction motor 26 will also increase, and lever 35 will move to the dead-center position, in which the spring 37 has no effect upon the operation. From this point on, in the opening movement of the secondary throttles, spring 37 will oppose the resistance of spring 32. With such a mechanism, there will be a slight delay until the throttles reach a position where the lever 35 passes the dead center. After this point, the opening movement can be as rapid as desired, depending, of course, upon the degree in which the effort exerted by the spring 37 overcomes the resistance of the spring 32. For example, the mechanism can be so adjusted that a snap action is attained; that is, once the secondary throttles start to open, they open more and more rapidly until they reach full-open position, in spite of the fact that their opening may decrease the suction effective at the port 30, and thus the effort exerted by the suction motor 26.

Thus, the addition of the over-center type of spring 37 makes possible the calibration of the throttle opening mechanism for initial action, degree of response, and rate of response.

Certain structures have been described herein which will fulfill all the objects of the present invention, but it is contemplated that other modifications will be obvious to those skilled in the art which come within the scope of the invention as defined by the appended claims.

We claim:

1. In a multi-stage carburetor having primary and secondary mixture conduits, the combination of a manually operated primary throttle in said primary mixture conduit, a secondary throttle in said secondary mixture conduit, and mechanism for operating said secondary throttle, said mechanism comprising means responsive to suction during operation of an engine tending to open said secondary throttle, means for applying an opposite force tending to close said secondary throttle, and means acting independent of said first two means and movable over a predetermined dead center position for applying a force tending to open said secondary throttle only when said suction responsive means moves said throttle from closed position to a partially open position beyond said dead center position.

2. In a multi-stage carburetor having primary and secondary mixture conduits, the combination of a manually operated primary throttle in said primary mixture conduit, a secondary throttle in said secondary mixture conduit, and mechanism for operating said secondary throttle, said mechanism comprising means responsive to suction during operation of an engine for applying a force tending to open said secondary throttle, means for applying an opposite force tending to close said secondary throttle, and biasing means acting independent of said first two means, said biasing means being operable to yieldably resist initial opening movement of said secondary throttle and being operative for applying a force tending to open said secondary throttle only after said suction responsive means has moved said secondary throttle from closed position beyond a predetermined partially open position.

3. In a multi-stage carburetor having primary and secondary mixture conduits, the combination of a manually operated primary throttle in said primary mixture conduit, a secondary throttle in said secondary mixture conduit, and mechanism for operating said secondary throttle, said mechanism comprising means responsive to suction during operation of an engine for applying a force tending to open said secondary throttle, means for applying an opposite force tending to close said secondary throttle, and spring means acting independent of said first two means and having its axis movable over a dead center position to yieldably resist movement of said secondary throttle from either its open or closed positions.

4. In a multi-stage carburetor having primary and secondary mixture conduits, the combination of a manually operated primary throttle in said primary mixture conduit, a secondary throttle in said secondary mixture conduit, and mechanism for operating said secondary throttle, said mechanism comprising means responsive to suction during operation of an engine for applying a force tending to open said secondary throttle, means for applying an opposite force tending to close said throttle, and biasing means acting independent of said first two means and having a dead center inoperative position when said secondary throttle is in partially open position, said biasing means being operable to close said throttle during its final closing movement and to open said secondary throttle during final opening movement thereof.

5. In a multi-stage carburetor having primary and secondary mixture conduits, the combination of a manually operated primary throttle in said primary mixture conduit, a secondary throttle in said secondary mixture conduit, and mechanism for operating said secondary throttle, said mechanism comprising means responsive to suction during operation of an engine for applying a force tending to open said secondary throttle, means for applying an opposite force tending to close said secondary throttle, and biasing means acting independent of said first two means, said biasing means being movable over a dead center for applying a force first tending to resist the action of said suction responsive means within one range of secondary throttle movement, and then tending to oppose said means applying an opposite force within another range of movement of said secondary throttle.

6. In a multi-stage carburetor having a mixture conduit, a suction actuated throttle in said mixture conduit, means constantly applying a force to said throttle opposing the force of suction, and means active after a predetermined limited range of open positions of said throttle has been traversed for applying a force to said throttle in a direction tending to aid the action of suction to open the throttle.

7. In a multi-stage carburetor having primary and secondary mixture conduits, the combination of a manually operated primary throttle in said primary mixture conduit, a suction actuated secondary throttle in said secondary mixture conduit, means constantly applying a force to said secondary throttle opposing the force of suction, and biasing means movable over a dead center position acting on said secondary throttle tending to oppose the action of suction within one range of secondary throttle positions, and to aid the action of suction within another range of positions of said secondary throttle.

8. In a multi-stage carburetor having primary and secondary mixture conduits, the combination of a manually operated primary throttle in said primary mixture

conduit, a suction actuated secondary throttle in said secondary mixture conduit, means constantly applying a force to said secondary throttle opposing the force of suction, and an over-center mechanism including a resilient means connected with said secondary throttle and movable over a dead center position for applying a force to said secondary throttle in a direction tending to aid the action of suction.

9. In a multi-stage carburetor having primary and secondary mixture conduits, the combination of a manually operated primary throttle in said primary mixture conduit, a suction actuated secondary throttle in said secondary mixture conduit, yielding means applying a force to said secondary throttle opposing the force of suction, and over-center means including a biasing means operable only after initial opening of said secondary throttle by suction for producing an additional force sufficient to overcome said yielding means and produce a snap opening action of said secondary throttle.

10. In a multi-stage carburetor for an internal combustion engine, primary and secondary mixture conduits, a manually operable primary throttle in said primary mixture conduit, a secondary throttle in said secondary mixture conduit, one means operable responsive to suction during operation of an engine to open said secondary throttle, another means yieldably resisting opening of said secondary throttle, means initially coacting with said other means to yieldably resist opening of said secondary throttle and coacting with said one means for applying a force to open said secondary throttle after the latter has been opened a predetermined distance from its closed position toward its open position.

11. In a multi-stage carburetor for an internal combustion engine, primary and secondary mixture conduits, a manually operable primary throttle in said primary mixture conduit, a secondary throttle in said secondary mixture conduit, one means operable responsive to suction during operation of an engine to open said secondary throttle, another means yieldably resisting opening of said secondary throttle, and means acting independently of said one means and said other means and alternately coacting therewith to yieldably resist opening of said secondary throttle from its closed position and for applying a force to open said secondary throttle only after said one means has moved the secondary valve a predetermined distance from its closed position toward its open position.

12. In a multi-stage carburetor for an internal combustion engine, primary and secondary mixture conduits, a manually operable primary throttle in said primary conduit, a secondary throttle in said secondary conduit, a motor operable responsive to suction in said primary conduit for opening said secondary throttle, means yieldably resisting opening of said secondary throttle, a lever secured to said secondary throttle, and means including a tension spring interconnecting the free end of said lever to another portion of the carburetor located to permit the axis of said spring to cross the axis of rotation of said lever during movement of the secondary throttle from closed to open position.

13. In a multi-stage carburetor, primary and secondary mixture conduits, primary and secondary throttle valves, respectively, therein, said secondary throttle valve being of a type to be automatically opened with increases of engine speed after said primary throttle has been substantially opened, and means yieldingly resisting the first part of the opening movement of said secondary throttle valve, said means being pivotally supported and positioned to pass over center during continued opening of said secondary throttle so as to thereafter tend to open said secondary throttle.

14. In a multi-stage carburetor, primary and secondary mixture conduits, a manually operable primary throttle in said primary conduit, a secondary throttle in said secondary conduit, biasing means movable over a dead center position to yieldably resist movement of said secondary throttle from either its closed or full open positions.

15. In a multi-stage carburetor, primary and secondary mixture conduits, primary and secondary throttle valves, respectively, therein, said secondary throttle valve being of a type to be automatically opened with increases of engine speed after said primary throttle has been substantially opened, and over center means operatively connected to the secondary throttle so as to yieldingly resist the first part of the opening movement of said secondary throttle valve, said means being positioned to pass over center during continued opening of said secondary throttle so as to thereafter tend to open said secondary throttle.

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