March 19, 1963 T. F. CRAMER 3,081,757

MULTI-STAGE GOVERNED FUEL DEVICE

Filed April 7, 1958 2 Sheets-Sheet 1

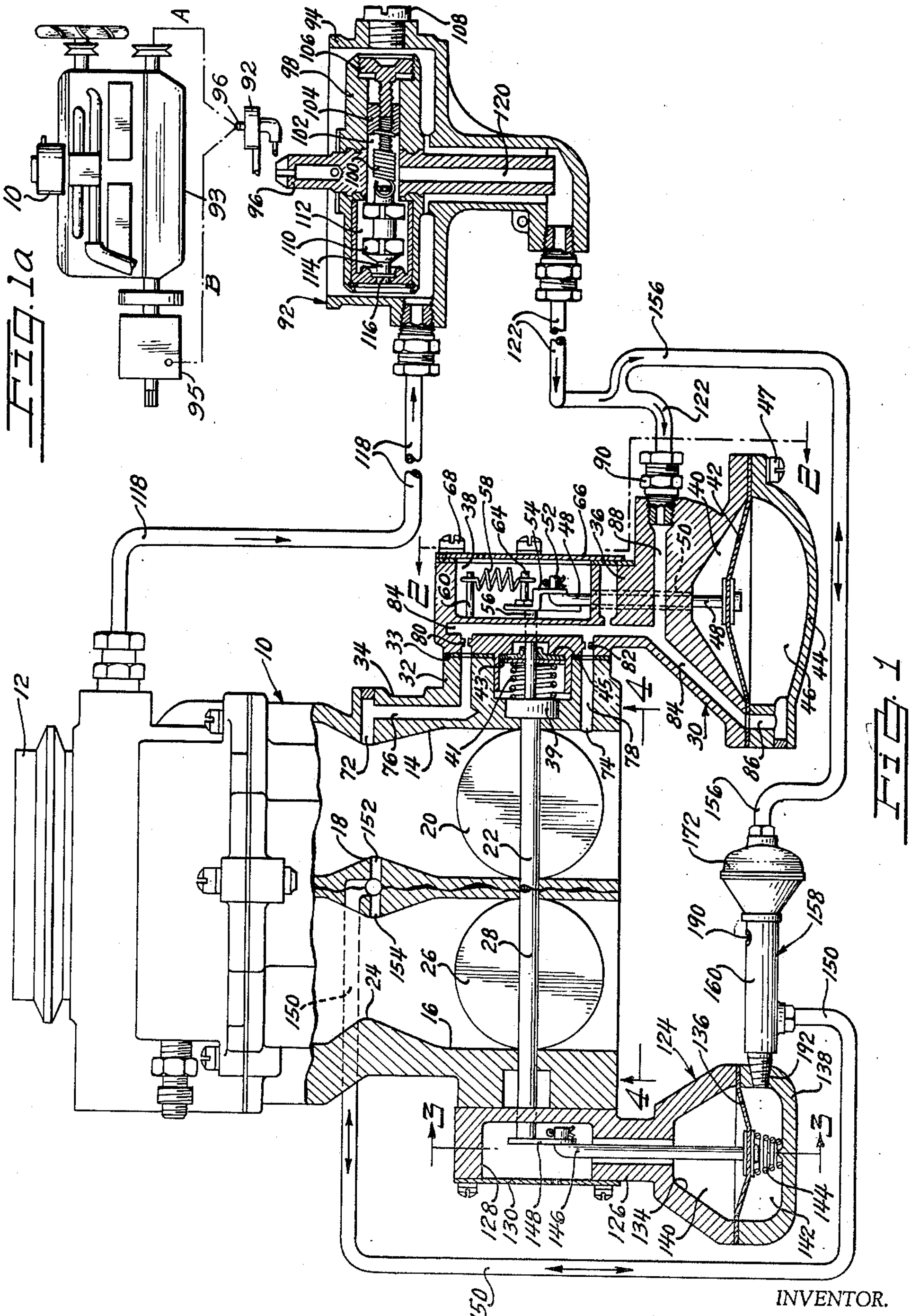

FIG. 1a

FIG. 1

INVENTOR.

THOMAS F. CRAMER

BY

Walter Potoroka, Jr.

ATTORNEY

March 19, 1963 T. F. CRAMER 3,081,757

MULTI-STAGE GOVERNED FUEL DEVICE

Filed April 7, 1958 2 Sheets-Sheet 2

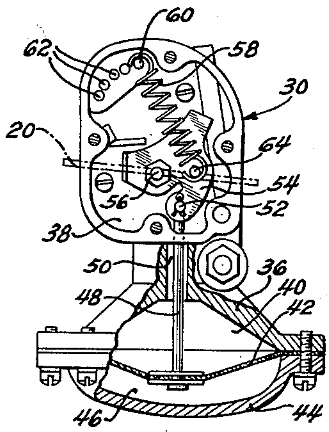

Fig. 2

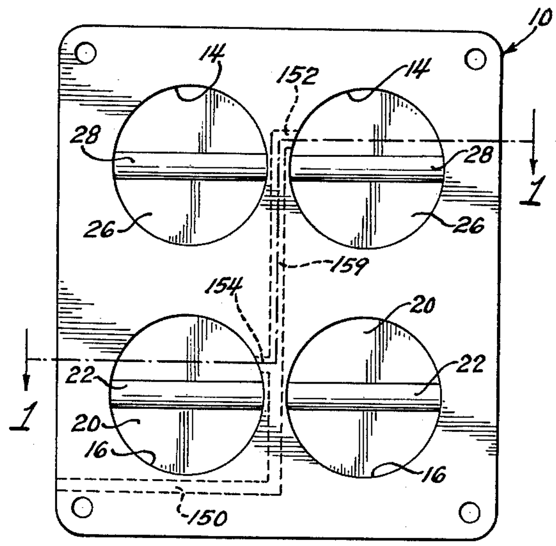

Fig. 4

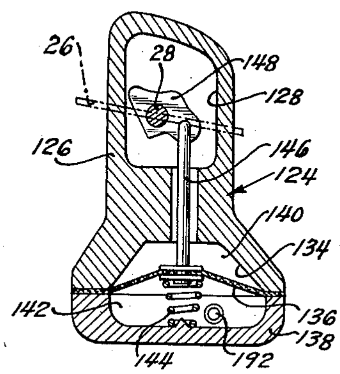

Fig. 3

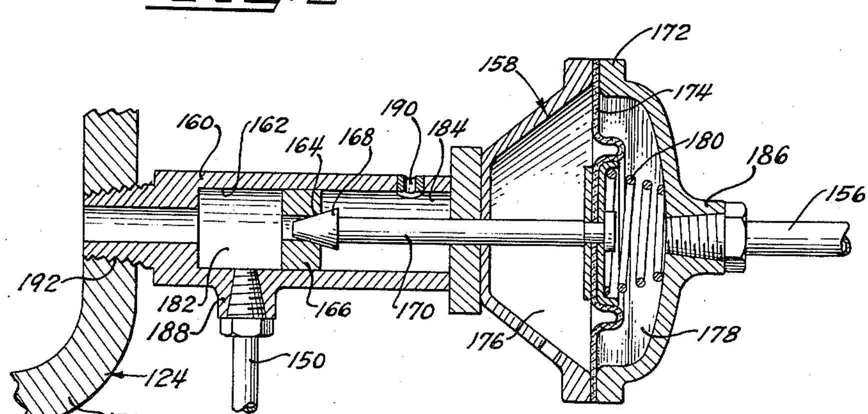

Fig. 5

INVENTOR.

THOMAS F. CRAMER

BY

Walter Potoroka, Sr.

ATTORNEY

United States Patent Office

3,081,757

Patented Mar. 19, 1963

3,081,757

MULTI-STAGE GOVERNED FUEL DEVICE

Thomas F. Cramer, Warren, Mich., assignor to Holley Carburetor Company, Van Dyke, Mich., a corporation of Michigan

Filed Apr. 7, 1958, Ser. No. 726,778
3 Claims. (Cl. 123—103)

This invention relates to governors for internal combustion engines, and more particularly to governors for internal combustion engines requiring dual or multi-stage carburetion.

Increasing horse power of automotive internal combustion engines has necessitated the use of two-stage carburetion as provided by the well known two or four barrel carburetor in which the throttle plate (or plates) controlling the flow of fuel-air mixture through the primary barrel (or barrels) is manually operated and the secondary throttle plate (or plates) is automatically opened against a spring tending to hold it closed by a suction device having a diaphragm actuated by primary and/or secondary venturi vacuum. The secondary barrels thus supplement the primary barrels when the capacity of the latter is exceeded.

In truck or other applications where it is desired to govern the speed of the engine and/or the speed of the vehicle, a second suction device actuated by primary venturi and/or manifold vacuum is provided to override the manual operation of and to close the primary throttle plate or plates, the intensity of the governing vacuum being controlled by a speed sensitive valve adapted to close an air bleed when the governed engine and/or vehicle speed is reached.

It has been found, however, that governor performance becomes erratic just slightly after governing action takes place. This is because the secondary throttle plates, which may be fully open at the start of governing, do not close rapidly enough. Therefore, the primary throttles will "over-close" before the secondary throttles fully respond to the change in air flow past the carburetor venturi.

It is now proposed to provide a governor system for an internal combustion engine utilizing dual or multi-stage carburetion which will be free of the above objections to present governors. This is accomplished in the present embodiment of the invention by connecting the vacuum effective to positively close the primary throttle plates when governed speed is reached to a pressure responsive valve which will in turn bleed atmospheric pressure into the vacuum side of the secondary throttle diaphragm assembly, thus causing the secondary throttles to close with or ahead of the primary throttles.

In the drawings:

FIGURE 1 is a side elevational view with portions thereof in cross section of a four-barrel carburetor provided with a governor embodying the invention;

FIGURE 1*a* is a schematic illustration of a vehicle engine and transmission illustrating the manner in which the governor control valve may be connected;

FIGURE 2 is a side elevational view, with portions thereof in cross section, taken on the plane of line 2—2 of FIGURE 1 and looking in the direction of the arrows;

FIGURE 3 is a cross sectional view taken on the plane of line 3—3 of FIGURE 1 and looking in the direction of the arrows;

FIGURE 4 is a bottom plan view taken on the plane of line 4—4 of FIGURE 1 and looking in the direction of the arrows; FIGURE 4 illustrates the manner in which the carburetor shown by FIGURE 1 is cut away to illustrate the primary and secondary throttle plates.

FIGURE 5 is a vertical cross-sectional view taken

through the axis of the element shown in elevation at the bottom of FIGURE 1.

Referring now to FIGURE 1, a four-barrel carburetor 10 of the type referred to above and having an air intake 12 is cut away as shown by FIGURE 4 to expose one of the primary barrels 14 and one of the secondary barrels 16. The primary barrel 14 is provided with a restriction or venturi 18 and a manually operated throttle plate 20 mounted on the shaft 22 which extends through the other primary barrel in which is mounted a throttle plate identical to throttle plate 20. The secondary barrel 16 is also provided with a venturi 24 and a throttle plate 26 mounted on the shaft 28 which extends through the other secondary barrel in which is mounted another secondary plate.

While a particular four-barrel carburetor is shown for purposes of illustration, it will be apparent that the invention is equally applicable to two-barrel or other multi-stage carburetors.

A suction device 30 commonly referred to as a governor diaphragm assembly is mounted on the boss 32 and gasket 33 extending from the carburetor throttle body 34. The assembly 30 includes a casting or other body 36 formed to provide recesses 38 and 40. The recess 40 is covered by means of a flexible diaphragm 42 which is secured to the body 36 by means of a cover member 44 formed to provide an air tight chamber 46 of which the flexible diaphragm 42 forms a wall. The cover member may be secured by any suitable means such as screws 47.

As shown by FIGURES 1 and 2, the diaphragm 42 has secured to the center thereof in the conventional manner a rod 48 passing through passages 50 in the body 36 and having a laterally extending end 52 pivotally secured to the lever 54 which is rigidly secured to the end 56 of the primary throttle shaft 22 extending into the chamber 38. The shaft 22 is mounted in the anti-friction bearing 39, and a spring 41 is disposed between the bearing 39 and the steel and leather washers 43 and 45 to provide a seal. A tension spring 58 fixed between the adjustable pin 60 mounted in one of the holes 62 in the body 36 and the fixed pin 64 secured to the lever 54 tends to hold the primary throttle plate 20 in the open position so long as and to the degree that the usual foot throttle (not shown) is depressed. This is accomplished by a well known dog clutch arrangement, which is not shown since it does not constitute any part of the invention and which permits governor action described below to override the foot throttle control. An atmospherically vented cover plate 66 may be secured by screws 68 to housing 36 thereby protecting the mechanism within chamber 38.

The orifice 72 at the primary venturi 18 and the orifice 74 below the primary throttle plate 20 are connected by means of the passages 76 and 78 having fixed restrictions 80 and 82 respectively with the passage 84 in the body member 36 and the passage 86 in the cover member 44 which lead to the chamber 46. A passage 88 connecting with passage 84 terminates in an opening in the body 36 adapted to receive a threaded fitting 90.

Located at any desired position on the engine is a governor valve assembly 92 comprising a stationary housing 94 adapted to be mounted on the engine and containing a shaft 96 driven in any suitable manner in proportion to engine or vehicle speed. This alternative drive is illustrated by FIGURE 1*a* wherein the shaft 96 of governor valve assembly 92 may be connected to be driven either by the engine 93 through a drive A or by the transmission 95 (vehicle speed) through a drive B. Mounted for rotation with the shaft 96 is a laterally extending sleeve 98 having a spring 100 mounted within the axial passage 102 in the sleeve in any suitable manner, such as in the internally threaded member 104, so that the spring 100 is adjustable axially by means of the adjustment screw **106** which is reached by removing the access screw **108**. The other end of the spring **100** is secured to the governor weight **110** movable axially within the chamber **112** against the spring **100** and having at the free end thereof a valve **114** adapted to close the orifice **116** when the weight **110** is forced outwardly due to the rotation of the shaft **96** and the sleeve **98** in accordance with the engine speed. The engine or vehicle speed at which the orifice **116** will be closed is dependent, of course, upon the adjustment of the spring **100**. It is apparent, also, that some other governor valve structure may be employed.

Conduit **118** between the air intake **12** of the carburetor **10** and the housing **94** and conduit **122** between the housing **94** and the passage **88** in the body **36** are provided so that when the engine or vehicle is operating at a speed not sufficient to close the orifice **116**, engine vacuum will draw clean air through the conduit **118**, into the housing **94**, through the orifice **116** and into the chamber **112**, through the passage **102** and the axial passage **120** in the shaft **96** and thence through the conduit **122** to the governor diaphragm assembly **30**. When the engine reaches governed speed, the orifice **116** is closed and the air bleed through conduit **122** is cut off. When this occurs, vacuum in the chamber **46** urges the diaphragm **42** downwardly, as in FIGURE 2, against the spring **58** to close the primary throttle plates **20**.

A secondary throttle diaphragm assembly **124** is mounted at the opposite side of the throttle body **34**. This assembly comprises a body **126** having a recess **128** vented to the atmosphere through a plate **130** secured by screws **132** and a recess **134** closed by a flexible diaphragm **136** which is secured to the body **126** by means of a cover **138** formed to provide oppositely disposed chambers **140** and **142** between which the flexible diaphragm **136** forms a movable wall. The chamber **142** contains a compression spring **144** positioned between the cover **138** and the rod **146**, which is secured to the center of the diaphragm **136**, so that the spring **144** urges the rod **146** upwardly to rotate the lever **148** secured rigidly to the secondary throttle shaft **28** counter-clockwise, as in FIGURE 3, and close the secondary throttle plates **26**. A conduit **150** extending between the chamber **142** and the vacuum passages **152** and **154** opening to the primary and secondary venturis **18** and **24** enables primary and/or secondary venturi vacuum to evacuate the chamber **142** and displace the diaphragm **136** downwardly, as in FIGURE 1, against the spring **144** to open the secondary throttle **26**. The force of the spring **144** is selected so that the secondary throttle plate **26** will start to open at any predetermined venturi vacuum.

The structure described above, or its equivalents, is well known in the art, and proper governing action depends upon the particular degree of closing of the throttle plates **20** and **26** when the engine or vehicle has reached a predetermined governing speed so as to diminish or cut off the flow of motive fluid to the engine. However, in the case of dual carburetion as described above, the automatic closing of the secondary throttle plates **26** lags behind that of the primary throttle plates **20**, particularly at governed engine speeds at which the secondary plates **26** are not fully open so that linkage (not shown) usually effective to positively close the secondary plates **26** with the primary plates **20** does not come into operation. While this is desirable or tolerable in the normal function of the dual carburetor whereby during acceleration additional fuel-air mixture is supplied to the engine when the primary barrels have reached their capacity, it is highly objectionable for the purposes of governing, since uncontrollable amounts of excessive motive fluid may continue to be supplied through the secondary barrels **16** for some period of time after the primary barrels **14** have been partially closed. This causes hunting, since the primary throttle plates have to first close farther than would otherwise be required to compensate for the open secondary plates and then open when the secondary plates finally close.

In order to remedy this objection, a pressure responsive bleed valve assembly **158** is connected to chamber **142** of diaphragm assembly **124**. The bleed valve assembly **158** is comprised of a body portion **160** having therein a generally cylindrical cavity **162** having formed therein a valve seat **164** comprising a suitable projection **166** which also divides the cavity into separate chambers **182** and **184**. A valve member **168**, operatively connected to a stem **170**, is adapted to coact with the seat **164** so as to at times prevent flow therethrough. The body **160** is suitably secured to a diaphragm assembly having a housing **172** in which a diaphragm **174** is secured to form chambers **176** and **178**. The chamber **178** contains a spring **180** normally biasing the diaphragm **174** to the left and is subjected to governor vacuum, while chamber **176** is suitably vented to the atmosphere. An internally threaded projection **186** on housing **172** may be adapted to receive conduit **156** which leads from the vacuum conduit **122**. A second internally threaded projection **188** formed on body **160** receives conduit **150** in such a manner so as to be in communication with chambers **182** and **142**. Chamber **184** is normally vented to the atmosphere by means of a calibrated restriction **190**.

With the above construction, the operation of the invention is readily apparent. Whenever governed speed is reached, the engine vacuum is employed to close the primary throttles **20**; at the same time this vacuum is directed to chamber **178**, causing the stem **170** and valve **168** to move off of seat **164**. This permits atmospheric pressure to be bled into chambers **182** and **142** through restriction **190**, thereby reducing the vacuum in chamber **142** and permitting the spring **144** to close the secondary throtles **26** ahead of the primary throttles **20**. Such closing of the secondary throttle plates eliminates the objections discussed above.

While but one embodiment of the invention is disclosed, it is to be understood that other modifications may be made and that no limitations not necessitated by the following claims are intended.

What I claim is:

1. In a carburetor for an internal combustion engine having primary and secondary induction passages with venturis formed therein, throttle valves controlling the flow of combustible mixture through said passages, first pressure responsive means responsive to the vacuum created at said primary venturi for controlling the position of said secondary throttle valves, second pressure responsive means responsive to both primary venturi vacuum and engine vacuum for limiting the degree to which said primary throttles may be opened, and third pressure responsive means arranged in parallel with said second pressure responsive means for at times increasing the pressure within said first pressure responsive means.

2. In an internal combustion engine, a primary intake passage having a venturi and a throttle valve for controlling the flow of motive fluid therethrough, a secondary intake passage having a venturi and a throttle valve therein, resilient means for normally holding said secondary throttle valve closed, a first suction device actuated in part by primary venturi intake vacuum for opening said secondary throttle valve against said resilient means, a vacuum governor including a second suction device actuated by primary venturi intake vacuum for closing said primary throttle valve, a third suction device actuated by the same vacuum as said second suction device, said third suction device having means when actuated for rendering said first suction device inoperative, a speed responsive bleed valve for rendering said second and third suction devices inoperative at speeds below governed speed, and operative at speeds above governed speed to allow said resilient means to close said secondary throttle valve at the same time as said primary throttle valve is closed by said governor.

3. A vacuum governor for controlling the speed of an internal combustion engine having primary and secondary intake passages, each of said intake passages having a throttle valve for controlling the flow of motive fluid therethrough, comprising a first suction device actuated by primary intake and/or engine manifold vacuum for closing said primary throttle valve when said engine reaches governing speed, a second suction device actuated in part by secondary intake vacuum for opening said secondary throttle valve, said secondary throttle valve being normally closed by resilient means opposing said second suction device, a third suction device actuated by the same vacuum as said first suction device, and said third suction device being adapted by its connection to said second suction device to render said second suc-

tion device inoperative and to allow said resilient means to close said secondary throttle valve simultaneously with said primary throttle valve when said engine reaches governing speed.

References Cited in the file of this patent

UNITED STATES PATENTS

2,399,080	Udale	Apr. 23, 1946
2,431,816	Mallory	Dec. 2, 1947
2,452,698	Strebinger	Nov. 2, 1948
2,708,979	Reynoldson	May 24, 1955
2,766,024	Smitley et al.	Oct. 9, 1956
2,783,032	Carlson et al.	Feb. 26, 1957