The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to a reserve fuel control system for vehicles; more particularly it is directed to a system for use on airplanes having multiple fuel tanks.

One of the objects of the invention is to provide a fuel control system for airplanes, automobiles, launches and other vehicles having multiple fuel tanks, which is adapted to be manually controlled for placing one of the tanks in communication with the carburetor and to cut off the other tanks from communication with the carburetor and to automatically cause one of the other tanks to be placed in communication with the carburetor through a fuel pump with the carburetor of the engine of the vehicle upon a preceding tank becoming empty.

Another object of the invention is to provide an automatic and manual fuel control system which may be readily attached to vehicles now in use having multiple fuel tanks, which is substantially simple in construction and operation and which is durable and not liable to get out of order.

Briefly stated, this invention consists of a plurality of fuel tanks including a main tank provided on a vehicle, a selector valve adapted to be manually operated to cause one fuel tank and then another to be placed in communication through a fuel pump with the carburetor of the engine of the vehicle, and to cut off the other tanks from communication with the carburetor and fuel pressure operated means connected in communication with a fuel tank with the carburetor through the fuel pump and also with the carburetor without passing through the fuel pump for causing the last mentioned tank to be automatically placed in communication with the carburetor through the fuel pump upon another tank becoming empty of fuel or substantially so, and the fuel flowing to the carburetor through the fuel pump having been reduced to a predetermined amount and to prevent communication of the fuel tank with the fuel pump upon the fuel pressure being increased by the changing over from a tank which has become empty to a tank containing fuel.

With the above and other objects and advantages in view, the invention consists of certain features of construction and operation of parts which will hereinafter appear, and in which—

Fig. 1 is a side elevation, partly in section of the invention, adapted to be applied to a vehicle having a plurality of fuel tanks; and

Fig. 2 is a cross-sectional view of a valve used in carrying out the invention.

In the illustrated embodiment characterizing the invention, the carburetor 1 of an airplane engine or the like is connected to a fuel supply pipe 2, which leads from the carburetor to fuel pump 3 and thence communicates with a control passage or outlet 4 formed in a selector or distributing multi-way valve 5, which is rotatable in the valve casing or body 6, as illustrated in Fig. 2. The valve 5 is provided with a handle 7, whereby the valve may be manually turned to a selective position. The body 8 of the valve 5 is provided with inlet ports 7, 8 and 9, which are connected in communication with a plurality of fuel tanks, including a main tank 10 and reserve tanks 11 and 12 by conduits 13, 14 and 15, respectively.

The selector valve 5, which is rotatably mounted in the casing 6 is provided with a fuel passage-way 16 which leads from the outlet port 4 of the valve to the outer periphery thereof, whereby upon rotational movement of the valve communication between one and then another of the fuel tanks is established through the passage-way 16 and outlet port 4 of the valve through the supply pipe 2, through the fuel pump 3 and hence to the carburetor 1.

To automatically cause the fuel in the reserve tank 11 to be placed in communication through the fuel pump 3 with the carburetor 1 upon the main tank 10 or the other reserve tank 12 becoming empty of fuel, a fluid pressure operated by-pass valve 17 and branch conduits 18 and 19 are provided in the system, which by-passes the fluid around the selector valve 5. The by-pass valve 17 comprises casing 20, which is closed at its bottom end by a cap 21 and is provided with a partition 22, which forms an upper and lower compartment 23 and 24, respectively, within the casing. The upper compartment 23 of the casing is smaller than the lower compartment 24 and is placed in communication with the conduit 14 leading from the reserve tank 11 to the reserve tank 12 by means of the branch conduit 18 and the lower compartment 24 is placed in communication with the supply pipe 2 by the branch conduit 19 which extends from the supply pipe at 25 to the upper end at 26 of the lower compartment.

The partition 22 is provided with a beveled opening 27 which is controlled by a valve 28, having a beveled surface 29 adapted to engage the partition opening, the said valve 28 being 55
mounted on the upper end of a bellows 30. The bellows 30, which may be made of resilient metal or other suitable collapsible material is open at its lower end, and it is threadably secured to the lower end of the casing 20 and is placed in communication with the supply pipe 2 leading to the carbureter 1 by means of a branch conduit 31 which is connected at one end with the supply pipe 2, and at the other end with the carbureter 1 and the fuel pump 3 with the other end of the conduit 31 extending up through the cap 21 into the bellows 30. An adjustable coil spring 33, which is in tension is provided in the bellows 30, the upper end of the spring being suitably secured to the upper end of the bellows and the lower end thereof encircling the free end of the conduit 31 extending into the bellows and is adapted to engage the inner surface of an adjusting nut 34 which is screw-threadably mounted on the cap 21 being adapted to adjust the tension of the spring, so as to permit the bellows 30 to collapse prior to the complete drop in pressure of the fuel pump, whereby the valve 28 is caused to uncover the valve opening 29 for admitting fuel into the branch conduit 16 leading from the by-pass valve 17 to the fuel supply pipe 2, and thus preventing any introduction of air into the system including the fuel pump.

In the operation of the invention: assuming that the tanks 1, 4 and 2, have been filled with fuel, and the valve 15 operated to cause the fuel passageway 16 of the valve to be in communication with the main fuel tank 10 whereby the fuel in the main tank is caused to flow through the conduit 13 through the inlet port 1 of the valve casing 5 into the outlet port 4 of the valve, and thence into the supply pipe 2 through the fuel pump 3 into the carbureter 1; some of the fuel in the supply pipe is forced by the fuel pump through the conduit 31 into the bellows 30, thereby causing the bellows to be expanded upwardly against the action of the coil spring 33 which causes the valve 28 on the upper end of the bellows to be moved upwardly into engagement with the opening 27 in the partition 23 of the casing 20. The fuel in the reserve tank 11 is caused to enter the branch conduit 16 leading from the conduit 14 into the upper compartment 23 of the casing. As the fuel in the main tank 10 is used, the amount of fuel which is delivered by the fuel pump 3 to the carbureter 1 and forced into the bellows 30 is gradually reduced, thereupon the action of the coil spring 33 and removing the valve 28 from the opening 27 in the partition of the casing, thus causing the fuel from the reserve tank 11 to enter the lower compartment 24 of the casing 20 and in turn pass into the branch conduit 16 leading to the supply pipe 2. Upon an increase of fuel in the supply pipe from the reserve tank 11, the pressure of the fuel from the fuel pump is increased, thus causing the fuel pump to force some of the fuel in the supply pipe into the lower end of the casing 20, thus causing the bellows to expand and force the valve 28 on its upper end into engagement with the partition opening 27 of the casing, whereby any fuel from the upper compartment 23 of the casing is prevented from entering the conduit 16 leading to the supply pipe 2 from the lower compartment 24 of the casing. This cycle of operation is repeated until the selector valve 5 is manually rotated by the handle 7 to cause the fuel passageway 16 of the valve to be in communication with the other reserve tank 12, in which case the fuel pump 3 will force some of the fuel in the supply pipe into the bellows to thus hold the valve 28 against the partition opening 27 until the fuel in the reserve tank 12 is used up, whereby the by-pass valve 17 again operates to permit the fuel from the reserve tank 11 to again supply its fuel to the carbureter through the fuel pump.

It will thus be seen that a highly novel and efficient form of a fuel control system for vehicles is provided, which is well adapted for the purpose indicated. I have herein described certain features of construction and operation of parts, it is nevertheless to be understood that various changes may be made therein without departing from the spirit or scope of the invention.

Having described by invention, what I claim as new and wish to secure by Letters Patent is:

1. In a fuel supply system for aircraft and the like having a plurality of fuel containers, a main fuel supply conduit, branch conduits connecting the main conduit to the several containers, and means controlling the fuel from the containers and automatic means bypassed from one of the containers around the first mentioned means to the main fuel supply conduit and adapted to be operated in response to the exhaustion of fuel of any other container for supplying the fuel from the container bypassed around the manually operated means to the main conduit, said automatic means including a fluid pressure operated device.

2. In a fuel supply system for aircraft and the like having a plurality of fuel containers, a main fuel supply conduit, branch conduits connecting the main conduit to the several containers, a multi-way valve controlling the fuel delivery from the containers into the main supply conduit, manual control means connected to operate said valve directed to connect said containers in succession to supply fuel to the main conduit and means connected indirectly from one of said containers around said manual control means to automatically connect said last mentioned container to the main conduit as the fuel supply in any of the other containers is exhausted.

3. In a fuel supply system for aircraft and the like having a plurality of fuel containers, a main fuel supply conduit, branch conduits connecting the main conduit to the several containers, manually operated means controlling the fuel from the containers and automatic means bypassed from one of the containers around the manually operated means to the main conduit and adapted to be operated in response to the exhaustion of fuel from any other container for supplying the fuel from the container by-passed around, the manually operated means to the main conduit, said automatic means including a valve opening, an expandible and collapsible member connected to communicate with the main fuel conduit, valve means controlled by the bellows and adapted to control the valve opening, whereby by fuel from the container by-passed around to the manually controlled valve may supply its fuel to the main conduit and cut off the fuel supply from the by-passed container until the manually control means is operated to connect another container in connection with the main supply conduit.

4. In a fuel supply system for aircraft and the like having a plurality of fuel containers, a main
fuel supply conduit, branch conduits connecting the main conduit to the several containers, manually operated means controlling the fuel from the containers and automatic means bypassed from one of the containers around the manually operated means to the main conduit for supplying the fuel from the last mentioned container to the main conduit, said automatic means comprising a casing including a partition member, an upper and lower compartment in the casing formed by the partition member, said upper compartment connected to be supplied with fuel from the last mentioned container and said lower compartment connected to supply fuel from the upper compartment to the main conduit, a valve opening in the partition of said casing, a fluid pressure operated valve, including a bellows connected to be actuated in response to the exhaustion of the supply of fuel from any connected container to operate the valve and thereby open the valve opening in said partition to connect the by-passed container to supply its fuel to the main conduit and to close the valve opening upon a fresh supply of fuel being applied to the main conduit.

5. In a fuel supply system for aircraft and like having a plurality of fuel containers, a main fuel supply conduit, branch conduits connecting the main conduit to the several containers, means controlling the fuel from the containers and automatic means for by-passing fuel from one of the containers around the first mentioned means, said automatic means including a casing, a bellows mounted in the casing and connected to be actuated in response to the exhaustion of the supply of fuel from any connected container and a retractable spring adjustably mounted on the casing and adapted to assist in the operation of the bellows.

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