Dec. 29, 1936. E. A. ROCKWELL 2,065,909

FLUID PRESSURE THROTTLE CONTROL FOR ENGINES

Filed Sept. 30, 1931 2 Sheets-Sheet 1

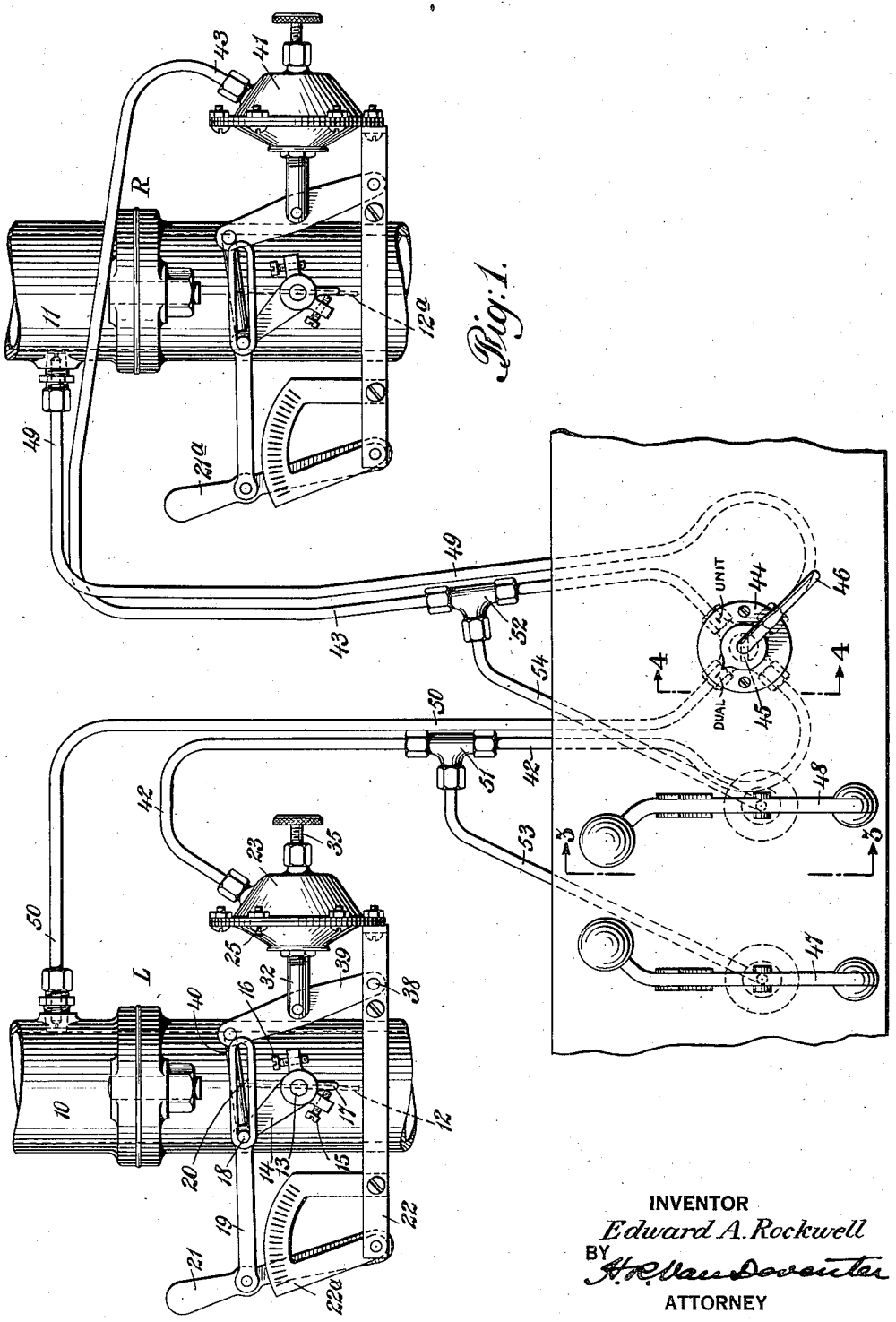


Fig. 1.

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Fig:2.

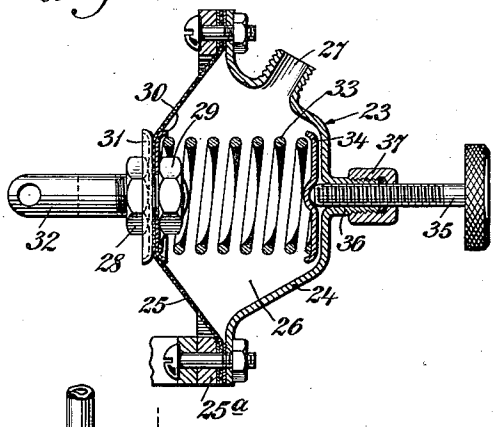
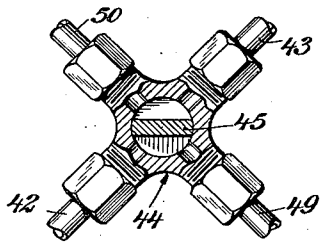


Fig:5.



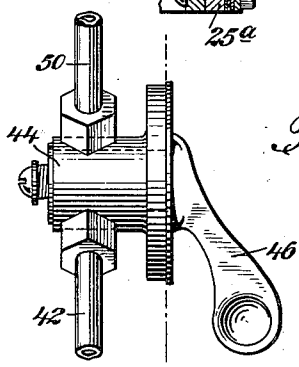


Fig:4.

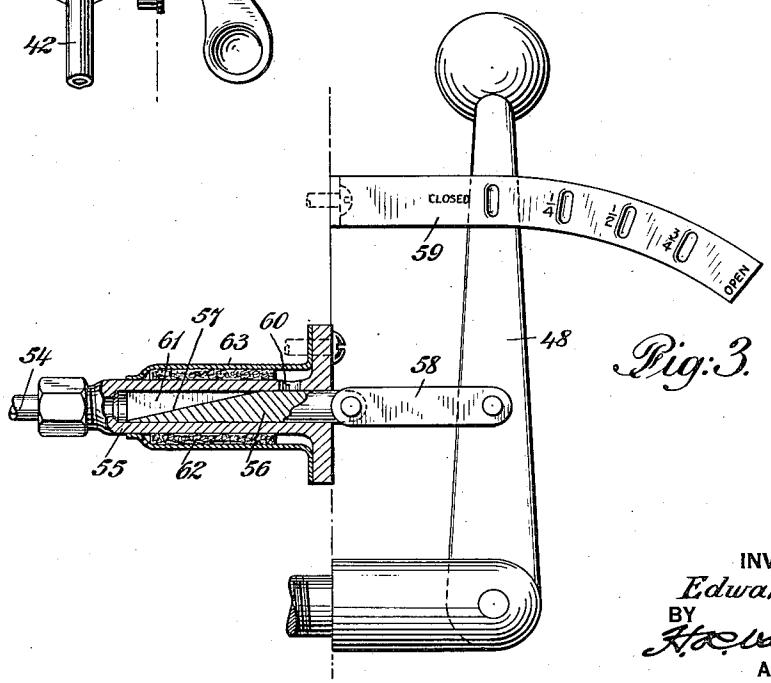


Fig:3.

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UNITED STATES PATENT OFFICE

2,065,909

FLUID PRESSURE THROTTLE CONTROL FOR ENGINES

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Application September 30, 1931, Serial No. 566,007

4 Claims. (Cl. 137—153)

This invention relates to a fluid pressure throttle control for engines, and more particularly to a control suitable for use with the invention disclosed in the pending application for patent, Serial Number 556,763, filed August 13th, 1931.

The said application relates to a method of and apparatus for controlling engines, and describes among other features two engines each having a fuel intake throttle valve and a pressure responsive device whereby each throttle valve is controlled by the pressure in the intake manifold of the engine. The said application also shows a manual control for each throttle and said manual controls and pressure responsive devices are adapted to be set and adjusted by mechanical means operated by hand such as Bowden wires and the like.

In some instances such mechanical means are undesirable, especially where the cables or wires must be of considerable length or have abrupt bends, and one of the objects of the present invention is to provide a throttle control of the type described wherein all mechanical means such as Bowden wires, bell cranks, chains, wire cables of any description and the like, are eliminated between the hand control levers and the throttle control device.

Another object is to provide a throttle control that is fluid operated.

A further object is to provide a fluid operated throttle control with a manual control which can be used without affecting the adjustment of the fluid operated control.

Other objects of the invention will be apparent from the following specification.

In order to illustrate this invention as applied to a single engine and two engines, a preferred form of the apparatus will be described, it being understood that the details herein shown and described are not intended to be limitative of the invention.

By way of illustration, the invention will be described as applied to the engines of a motor boat. In motor boats equipped with twin screw propellers it is customary to directly connect each propeller to an engine shaft, the engines not being interconnected in any way. It is also customary to provide each engine with an independent hand throttle control.

Such a known arrangement is shown in the accompanying drawings and to which has been added the additional apparatus necessary to illustrate a preferred embodiment of the present invention. In these drawings:

Figure 1 is a view of the fuel intakes or manifolds of two engines, R, L and their associated throttle valves as commonly used, together with the necessary apparatus to control or govern either or both engines in accordance with this invention;

Figure 2 is a view, partly in section, of a pressure responsive control unit showing a preferred device for use in connection with the engines, Figure 1;

Figure 3 is a side view of the throttle levers looking in the direction of the arrow 3, Figure 1;

Figure 4 is a view of the governor valve lever looking in the direction of arrows 4—4, Figure 1; and

Figure 5 is a sectional view of the governor valve as used on the engines, Figure 1.

The engines may be of any type and for the sake of illustration, it will be assumed they are of the well-known "Liberty" type equipped with the usual intake manifolds 10 and 11 for each engine, but it will be understood that these manifolds may be of any type of fuel intake or charge forming device communicating with the engine cylinders, and that instead of the throttle valve to be presently described this valve may be any form of control device or valve for admitting the charge of fluid, gas, vapor or mixture for operating the engine. The term "throttle valve" as herein used therefore denotes any type of control valve.

It will be understood that the upper ends of the manifolds communicate with the engine cylinders (or there may be one intake for each cylinder) and that the lower ends of the manifolds below the throttle valve 12, Figure 1, are connected to any suitable form of carburetor or other charge forming device. With such an arrangement, as the load on the engines decreases, the depression in the manifolds above the throttle valves shown in dotted lines at 12 and 12a will increase, and it has been found that this depression or subatmospheric pressure in the manifolds varies in a fixed characteristic with the torque load on the engines. This force is utilized to operate the pressure responsive control devices to be presently described.

Referring to the engine L, the usual throttle valve 12 is rigidly secured to a shaft 13 in any suitable manner. To the outer end of this shaft is secured the lever 14 having in projections therein the adjusting screws 15, 16 adapted to engage a fixed projection 17 conveniently formed on the outer wall of the manifold. By setting screws 15, 16 the maximum and minimum opening of the throttle valve 12 can be adjusted.

A pin 18 projecting from lever 14 engages arm 19 having a slot 20 therein in which the pin is free to move when the lever 14 just described is actuated by the automatic control to be presently described. A hand lever 21 is suitably mounted—for example on the bracket 22 attached to the manifold—and this handle being connected to the arm 19 can be used to set the throttle 12. By pushing lever 21 to the right, Figure 1, (throttle 12 being in the wide-open position shown in the figure) arm 19 will push the pin 18 and lever 14 connected thereto to the right. This rotates shaft 13 secured to lever 14 and closes the throttle. Lever 21 may be held in any desired position by any suitable means such as the usual notched quadrant 22*a*.

The pressure responsive device 23 comprises a unit structure as shown in Figure 2 having a casing 24 the front of which is sealed by a diaphragm 25 of suitable flexible material. The diaphragm is clamped in any suitable manner such as by the ring 25*a* and screws or rivets therethrough, to the casing 24 and forms therewith a sealed chamber 26 having a pipe connection 27 in communication therewith. Secured to the diaphragm by any suitable means such as the nuts 28, 29 and washers 30, 31 is the outwardly projecting arm 32.

A spring 33 is located between washers 30 and 34 and tends to press diaphragm 25 outwardly. An adjusting screw 35 is mounted in the threaded neck 36 of the casing and the stem of this screw is provided with the air-tight packing or gland nut 37. By means of screw 35 the tension of the spring 33 and the pressure on the inner face of the diaphragm 25 can be regulated.

The device 23 is mounted upon a suitable support such as one end of the bracket 22 which may also support one end 38 of lever 39 to the center of which is connected the arm 32 of the control device. A link member 40 is connected at one end to lever 39 and the other end of same fits over pin 18.

All of the foregoing parts are the same on both engines. The control units on the engines R and L, Figure 1, are designated respectively as a whole by the numerals 23 and 41, it being understood that the construction and operation of these units are identical.

The control units 23 and 41 are connected via pipes 42, 43 with a valve 44 which may have two positions. The movable member 45 of this valve is rigidly connected to a lever 46 and the valve is located at any suitable position preferably remote from the engine and adjacent the hand control levers 47, 48.

When lever 46 is in the position "dual" as shown in Figure 1, the valve member 45 rigidly connected thereto is in the position shown in Figure 5 and the control unit 23 on engine L is connected via pipe 42 and through the valve 44, and via the pipe 49 to the intake manifold 11 of engine R; and the control unit 41 on engine R is connected via pipe 43 and valve 44, and pipe 50 to the intake manifold 10 of engine L.

If the governor control lever 46 is moved to the "unit" position, valve 44 will connect pipe 42 to pipe 50 and pipe 43 to pipe 49 so that each control unit will be connected to the intake manifold of the engine with which it is directly associated.

T's 51, 52 are placed in pipes 42, 43 as shown, and connect via pipes 53, 54 with the bleed valves shown in Figure 3, each valve comprising a body portion 55 bored to admit a piston 56 having a tapered portion 57. The outer end of the piston connects to lever 58 which is connected to one of the hand levers 48. This lever may be provided with a suitable quadrant 59. When the lever 48 is moved from the "closed" position, piston 56 is withdrawn until the tapered portion 57 of the same passes the intake port 60 thereby admitting air to the chamber 61 to which one of the pipes, for example 54, is connected. The amount of air admitted will be in proportion to the position of the lever 48 and the taper 57 on piston 56. The air entering at 60 is filtered through suitable material such as wool 62 held in a perforated metal or gauze casing 63. This prevents dirt entering the system.

Assuming that it is desired to automatically control either engine—for example engine L, the lever 46 is set on "unit" in which event the valve member 45 will permit of free passage between pipes 42 and 50, thereby connecting chamber 26 of the control unit 23 directly to the intake manifold 10.

The hand throttle lever 47 is now closed and the screw 35 in control unit 23 adjusted until the tension on spring 33 therein is such that diaphragm 25 carrying the arm 32 acts through lever 39 and link 40 on lever 14, bringing the projecting screw 15 on same against the boss 17, as shown in Figure 1. The throttle valve 12 is now open, or in the position it may be set by hand by lever 21 and the control unit 23 is ready to control the throttle should there be any tendency for the engine to speed up due to a decrease in load.

Assuming that the load on the engine decreases, the depression within the manifold 10 increases and this causes a decrease in pressure in pipe 50, pipe 42 and chamber 26 within the control unit 23. This causes the diaphragm 25 (due to atmospheric pressure on the outer surface thereof being greater than the pressure in chamber 26) to move inwardly, which movement via the arm 32, lever 39 and link 40 is communicated to the lever 14, thereby causing the screw 15 to leave the boss 17. As the lever 14 is rigidly secured to shaft 13 and the throttle valve 12, the action just described of the control unit will close the throttle valve 12. Complete closure of the throttle valve may be prevented by the setting of the adjusting screw 16 and the limit through which the control unit may move the lever 14 and the throttle is limited by the relative adjustment of the screws 15 and 16.

From the foregoing, it will be obvious that the control unit 23 will function over a certain range limited by means of the adjusting screws as just described, and that the motor will always automatically throttle down as the load on same decreases.

As the amount of depression in the intake manifold 10 is always a function of the load on the motor, it will be seen that this invention obtains a perfect load control which is sensitive and accurate, which is entirely free from rapidly revolving parts requiring adjustment and lubrication and is independent of many conditions such as altitude which seriously affect other known forms of control.

When it is desirable to control two engines, the lever 46 is placed in the "dual" position, in which event the valve 44 is in the position shown in Figures 1 and 5, and the control unit 23 on engine L is connected to the manifold 11 of engine R, and the control unit 41 on engine R

is connected to the manifold 10 of engine L. The hand throttle levers 47 and 48 are set to the desired positions to handle the respective load on each engine. These levers are usually positioned close together so that they can be manipulated together, but it is often necessary to have one engine at a different setting from the other in order to compensate for differences such as frictional losses, differences in engines due to age, difference in the propellers connected to the engines or because of certain weather and other conditions, but in any event, the engines are set by hand to operate together as desired and when so set, the control unit 23 of engine L is governed by the conditions in the manifold of engine R and unit 41 of engine R by conditions in the manifold of engine L.

Assuming that engines R and L are in a motor boat making a turn, and that the load on engine L decreases, obviously the depression in manifold 10 will increase and this increased suction will be applied to the chamber of the control unit 41 on engine R and the diaphragm of said control unit will be drawn inwardly, thereby closing the throttle of engine R and slowing it down.

In the event that the load on engine R decreases, it will cause the control unit 23 to function in connection with engine L, from which it will be obvious that the motor with the least load will always be throttled down or controlled by the motor with the most load (within the limits set by the hand throttles 47, 48 or 21 and 21*a*) and that the range over which the automatic control operates may be varied from time to time by a resetting of the hand throttles 47, 48 in order to meet running conditions, but that once set for any condition, the two engines will automatically control their speed relation to each other.

This invention has the advantage of producing a differential action on a pair of engines which is highly advantageous in connection with motor boats, airplanes or the like.

The operation of the hand throttles 47, 48 is the same with the valve 44 in any position. By moving either of the levers 47, 48 air is admitted to the chambers 26 of the units 23, 41. As the admission of this air will vary the pressure in said chambers, the operation of the control devices is governed thereby. The hand control levers 47, 48 may, therefore, be set to obtain any desired running condition and the automatic control devices will function within this range subject to this hand setting, which can be easily varied from time to time.

The levers 21, 21*a* can also be used to easily and quickly set the throttles for minimum opening.

The control units herein described operate as by the resultant of two pressures—one that of the intake manifold and the other a uniform pressure, in this case the atmosphere. This uniform pressure, however, may be any other source of uniform pressure such as a weight, spring, a pressure chamber in which the pressure may be varied, or the like.

With some types of carburetors, especially the down draft type, it is necessary in starting to have the throttles substantially wide open.

This is accomplished, referring to Figure 1, as follows: With the engines operating on "dual" when they stop the vacuum dies in the R manifold 11, and the spring in the governor valve 23 (on the L manifold) via the projecting arm 32, the lever 39, the link 40, and the lever 14, opens the throttle valve 12 (shown dotted in the figure).

Likewise, the vacuum dies in the L manifold and allows the governor valve 41 to open the throttle 12*a* in the R manifold 11. As soon as the engines start the vacuum in the manifold 11 causes the governor valve 23 to close the throttle valve 12 to a point limited by the setting of the hand throttle lever 21*a*, and at the same time the vacuum in the L manifold causes the governor valve 41 to close the throttle valve 12*a* to a point limited by the setting of the hand lever 21.

With the lever 46 thrown on "unit" when the engines stop the vacuum in the manifold 10 of the L engine causes the governor valve 23 to open the L engine throttle valve 12; likewise the vacuum in the manifold 11 of the R engine causes the governor valve 41 to cause the throttle valve 12*a* of the R engine to open, and when the engines start up again the throttle valves close to points corresponding to the individual settings of the hand throttle levers 21 and 21*a*.

What is claimed is:

1. In an apparatus of the class described, in combination with an engine having an intake manifold, a valve therein, a control unit mounted adjacent said valve, said unit including a chamber and a diaphragm closing said chamber and adapted to be actuated by pressure from an engine intake manifold, means for varying the pressure extent by said diaphragm mounted in the chamber on said unit, means connecting said valve and said diaphragm whereby movements of the latter will control the position of said valve in the manifold, and means including a duct constantly open leading from said manifold above said valve leading to the far side of said chamber for controlling the pressure on the diaphragm by admitting air to the chamber.

2. In combination, an intake manifold, a control unit of the class described comprising a casing, a diaphragm secured thereto and forming therewith a chamber, a spring in said chamber engaging said diaphragm, means mounted on said casing for adjusting said spring, connections between said diaphragm and a throttle valve located in said manifold, engine load control means including a constantly open duct connected to said chamber and to said manifold above said throttle valve, and adjustable means connected to said duct for admitting fluid to said chamber during the normal operation of the device.

3. In combination with an engine throttle valve, means exposed to and adapted to be operated by the resultant of two pressures derived from two different sources for affecting the operation of said valve, said means comprising a diaphragm, the source of one of said pressures being a constantly open duct opening into the intake manifold between said valve and engine, the other of said pressures being derived from the atmosphere, said diaphragm closing a chamber with which said duct communicates, means controllable at will for regulating the flexing of said diaphragm by said atmospheric pressure, a manually adjustable vent on said duct, and manually operable means for said throttle valve whereby the same may be adjusted independently of said first means.

4. In combination with an engine having a throttle valve, a hand lever connected thereto adapted to move the throttle, means exposed to

and adapted to be operated by the resultant of two pressures derived from two different sources and moving said throttle valve, one of said pressures being constantly communicated from the intake manifold of an engine between said engine and the throttle valve thereof, said means including a movable diaphragm having one side in communication with a chamber connected to one of said pressures, and means including a bleed valve adapted to admit atmospheric pressure to said chamber operable at all times during the normal operation of the device.

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