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PRESSURE RESPONSIVE DEVICE

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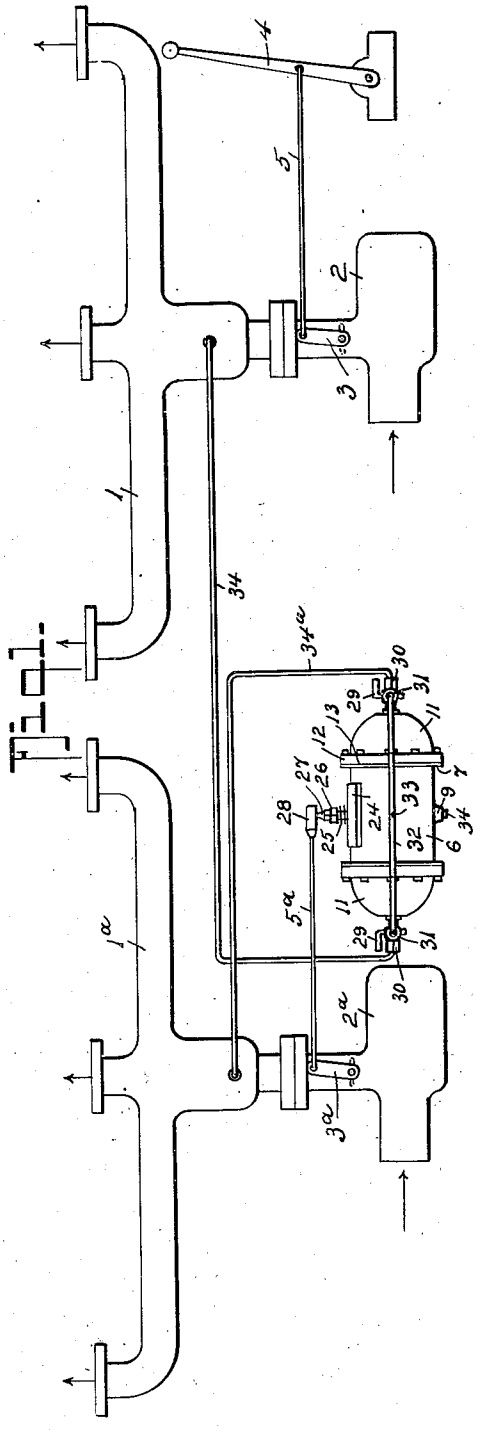


Fig. 1.

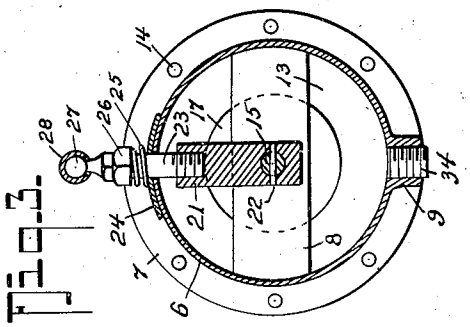


Fig. 3.

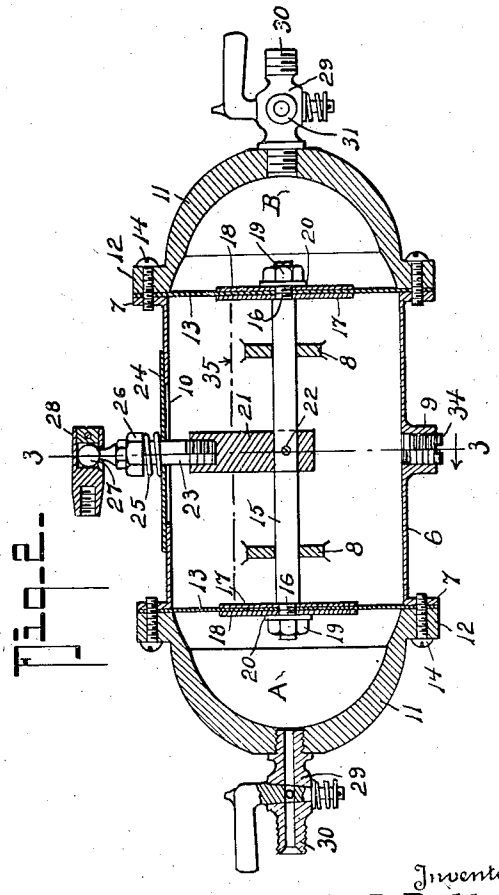


Fig. 2.

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PRESSURE RESPONSIVE DEVICE

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4 Claims. (Cl. 137—156)

The present invention relates to a pressure responsive device which is particularly adapted for use in synchronizing the operation of two or more internal combustion motors which draw their fuel charges by suction.

Primarily the invention has for an object to provide a simple, automatically operable pressure responsive device that may be controlled by the suction of a first or pilot motor for bringing another motor or other motors into step with the pilot motor and keeping the same so during throttle changes in the first or pilot motor.

A further object is to provide a pressure responsive device which, when once properly assembled with the motors, will require no adjustments.

Again it is an object to provide a pressure responsive device which may be used effectively with two or more motors of different sizes; i. e. it is not necessary that the motors which are to be synchronized be of the same size, as the device will synchronize the load output in relation to the capacities of different sized motors.

A further object is to provide a pressure responsive device whose case can be made of steel, iron, aluminum, plastic or other similar materials as there is little or no wear or friction in the operation of the device.

Other objects will in part be obvious and in part be pointed out hereinafter.

To the attainment of the aforesaid objects and ends the invention still further resides in the novel details of construction, combination and arrangement of parts, all of which will be first fully described in the following detailed description, and then be particularly pointed out in the appended claims, reference being had to the accompanying drawing in which:

Fig. 1 is a diagrammatic view illustrating the connections between the pressure responsive device and two motors.

Fig. 2 is a central vertical longitudinal section of the pressure responsive device.

Fig. 3 is a cross-section thereof taken on the line 3—3 of Fig. 2.

In the drawing in which like numerals of reference indicate like parts in all figures, 1 represents the intake manifold of the first or pilot motor, 2 its carburetor and 3 its throttle valve lever. The intake manifold of the second motor is indicated by 1^a, the throttle valve lever by 3^a and the carburetter by 2^a. A manual control lever 4 is connected by a rod 5 with the throttle valve lever 3 of the pilot motor while the throttle valve lever 3^a of the second motor is connected by a rod 5^a to the pressure responsive device by a socket and ball connection 28, 27.

The pressure responsive device comprises a cylinder 6 having end flanges 7, and two cylinder heads 11 whose flanges 12 are secured to the flanges 7 by screws 14. Within the cylinder 6 are two fixed rod supports 8 having bearings for a floating rod 15 whose ends are reduced, as at 16, and threaded to receive the metal discs 17 and 18 and flexible diaphragms 13. The diaphragms are secured to the rod 15 by being tightly clamped between the discs 17 and 18 by nuts 19 and washers 20. The diaphragms 13 are secured between the flanges 7 and 12 and thus provide end chambers A and B cut off from the interior of the cylinder 6.

The cylinder 6 has an oil drain 9 normally closed by a screw plug 34. It also has a longitudinal slot 10 in its upper part through which the cap screw shank 23 passes. The screw shank 23 is threaded into a block 21 that is fitted on the shaft 15 and secured by a pin 22. A shield or slot closing plate 24 is carried loosely by the shank 23 and is held down on the cylinder 6, to whose curvature it conforms, by a light spring 25. The head 26 of the cap screw carries the ball element 27 of the ball and socket joint 27, 28 hereinbefore referred to.

Each cylinder head is bored and tapped to receive a two-way pet cock 29, whose side outlets 31 are joined by a tube 32 having a bleeding port 33 (see Fig. 1). The outlet 30 of cock 29 on the head 11 that is nearest the pilot motor is connected by a tube 34^a to the neck of the intake manifold 1^a while the outlet 30 of the other cock 29 is connected by a tube 34 with the neck of the intake manifold 1 of the pilot motor.

With the parts assembled as indicated in Fig. 1 (the pressure responsive device may be mounted in position in any suitable way) and the pet cocks 29 set to close the outlets 31 and open the outlets 30, the apparatus is ready for service, it being understood that oil is placed in the cylinder 6 to about the level of line 35. The throttles of both motors or engines are set to the "closed" or idling position. The connecting rods are adjusted so that with the throttles closed the block 21 will be centered between the supports 8 (Fig. 2). Now as the operator opens the throttle of the pilot motor the vacuum or suction in chamber A reduces; consequently the greater suction of the second motor draws the diaphragms 13 and connecting shaft 15 from left to right in Fig. 2, thereby pulling rod 5^a and opening the throttle of the second engine until the pressures in chambers A and B are again equalized. As the operator closes the throttle of the pilot motor the reverse action takes place, i. e. the suction in chamber A increases over that in chamber B and the diaphragms 13 and rod 15 are moved from right to left in Fig. 2 until pressures in chambers A and B are again balanced.

When the engines are provided with speed

governors and the manual control is not used the pressure responsive device may be operatively disconnected by closing the pet cocks **29** and thus opening passages to the breather pipe **32**. This shuts off the suction to chambers A and B and permits the rod **15** to be freely moved back and forth, as the governor (not shown) controls the action of the respective throttles in the usual way.

From the above it will be obvious that a series of motors can likewise be synchronized by adding and connecting an additional pressure responsive device for each additional motor used and connecting it with the additional motor and with the pilot motor in the same way as the second motor is connected.

By the use of the present invention no gauges or other instruments are required which demand or require attention.

The invention is especially advantageous when two or more motors are required to carry the load as by its use vacuum balance is automatically synchronized in the respective motors, thus allowing full and complete use of the power of all engines as well as giving a smooth operation of the load carried.

The oil in the cylinder not only acts as a damper of the movements of the shaft to prevent fluttering but it serves to lubricate its bearings and also to keep the diaphragms moist and pliable, when non-metallic discs are used.

The diaphragms **13** are so mounted to the rod **15** and to the case as to effectively seal the chambers A and B from the cylinder **6** and therefore during the operation of the device no unfiltered air will be carried into the motors. The air hole **33** may be omitted and tube **32** made large enough to freely transmit air from one chamber A to the other chamber B and vice versa when the pet cocks **29** are closed and the governor control, instead of the manual control, is being used, and thus at all times keep unfiltered air from being carried into the motors from the pressure responsive device.

From the foregoing description taken in connection with the accompanying drawing it is thought the complete construction, operation and advantages of the present invention will be clear to those skilled in the art.

What we claim is:

1. A pressure responsive device for cooperation with the throttles of two internal combustion engines: said pressure responsive device including a cylinder having flanges at its ends, an upper longitudinal slot and a lower drain closed by a removable plug; a chambered cylinder head for each end of said cylinder and having a flange to register with the flanges of said cylinder; means securing said heads to said cylinder; flexible diaphragms secured so as to divide the cylinder head chambers from the cylinder; a shaft in said cylinder with its ends secured to the respective diaphragms; a block secured to the said shaft; a member secured to said block and projecting through said slot; a ball and socket joint on said member; a pet cock secured to each cylinder head; and a by-pass tube connecting said pet cocks, said pet cocks each having three ports, one in communication with the cylinder-head chamber, a second in communication with the by-pass tube and a third adapted to communicate with a pressure line, said pet cocks being arranged to establish communication between the cylinder-head chamber and either the second or third port.

2. A pressure responsive device for cooperation with the throttles of two internal combustion engines: said pressure responsive device including a cylinder having flanges at its ends, an upper longitudinal slot and a lower drain closed by a removable plug; a chambered cylinder head for each end of said cylinder and having a flange to register with the flanges of said cylinder; means securing said heads to said cylinder; flexible diaphragms secured so as to divide the cylinder head chambers from the cylinder; a shaft in said cylinder with its ends secured to the respective diaphragms; a block secured to the said shaft; a member secured to said block and projecting through said slot; a ball and socket joint on said member; a pet cock secured to each cylinder head; and a by-pass tube connecting said pet cocks, said pet cocks each having three ports, one in communication with the cylinder-head chamber, a second in communication with the by-pass tube and a third adapted to communicate with a pressure line, said pet cocks being arranged to establish communication between the cylinder-head chamber and either the second or third port; bearings in said cylinder for said shaft; and a shield over said slot and carried by said projecting member.

3. A pressure responsive device of the class and for the purposes described: said pressure responsive device including a cylinder having flanges at its ends, an upper longitudinal slot and a lower drain closed by a removable plug: a chambered cylinder head for each end of said cylinder and having a flange to register with the flanges of said cylinder; means securing said heads to said cylinder; flexible diaphragms; said diaphragms being secured so as to divide the cylinder head chambers from the cylinder; a shaft in said cylinder with its ends secured to the respective diaphragms; a block secured to the said shaft; a member secured to said block and projecting through said slot; a ball and socket joint on said member, and a shield adjacent the cylinder, covering said upper longitudinal slot and carried by said projecting member, there being pressure connections to the interiors of the cylinder-heads to enable actuation of the diaphragms.

4. A pressure responsive device of the class and for the purposes described: said pressure responsive device including a cylinder having flanges at its ends, an upper longitudinal slot and a lower drain closed by a removable plug; a chambered cylinder head for each end of said cylinder and having a flange to register with the flanges of said cylinder; means securing said heads to said cylinder; flexible diaphragms; said diaphragms being secured so as to divide the cylinder head chambers from the cylinder; a shaft in said cylinder with its ends secured to the respective diaphragms; a device connected to said shaft and having a portion projecting through said slot; a ball and socket joint on said projecting portion; a shield adjacent the cylinder, covering the upper longitudinal slot and carried by said projecting portion, there being pressure connections to the interiors of the cylinder-heads to enable actuation of the diaphragms; and a suitable lubricant fluid within said cylinder in contact with said diaphragms and immersing said shaft for purposes described.

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