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J. L. L. A. A. MOULET
CENTRALIZED REMOTE CONTROL SYSTEMS
FOR PIPING NETWORKS
Filed Sept. 25, 1941

Serial No.
412,280

3 Sheets-Sheet 1

Fig. 1

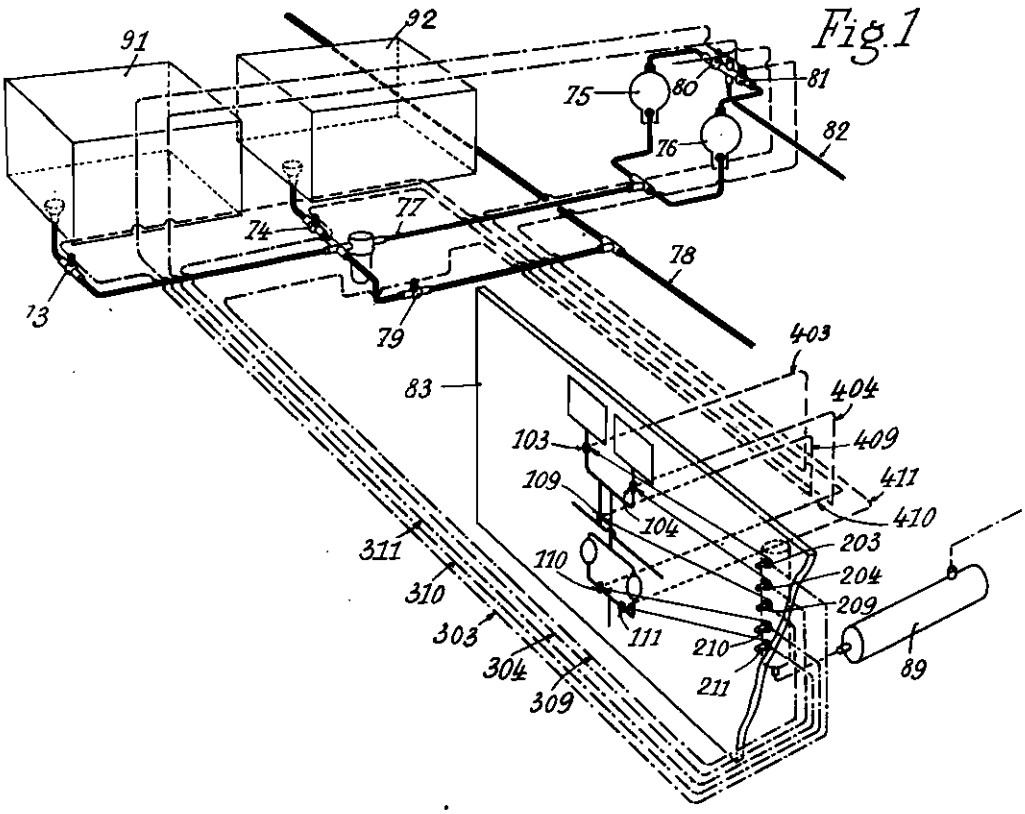

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Fig. 2

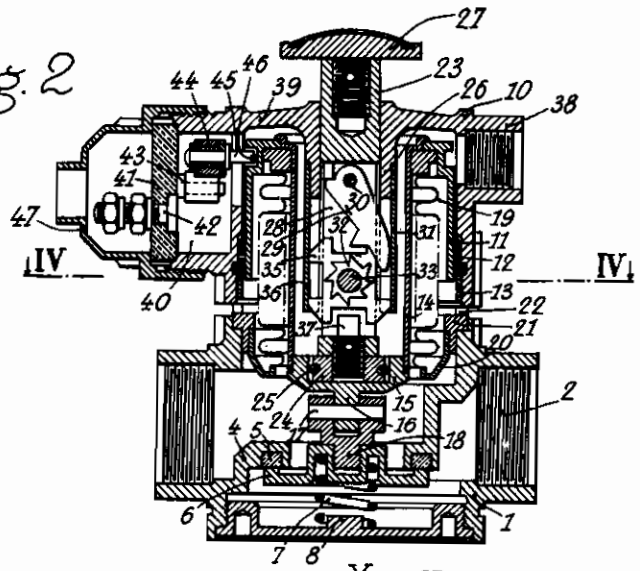

Fig. 3

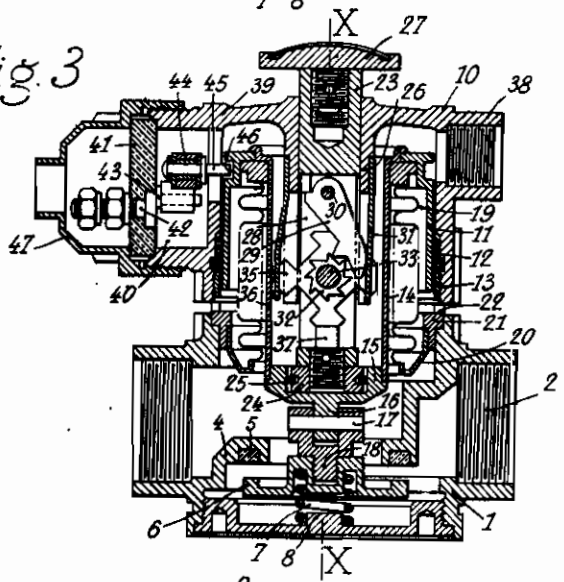

Fig. 4

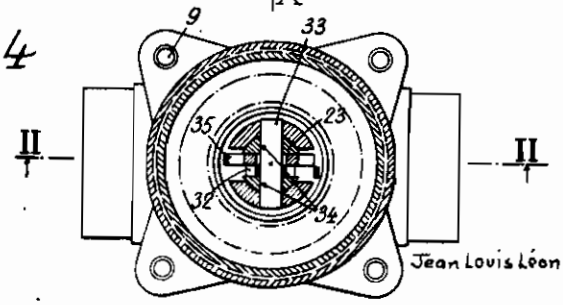

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Fig. 5

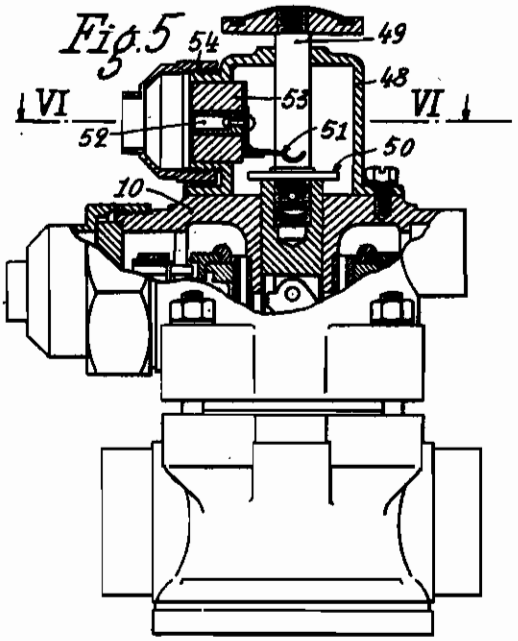


Fig. 6

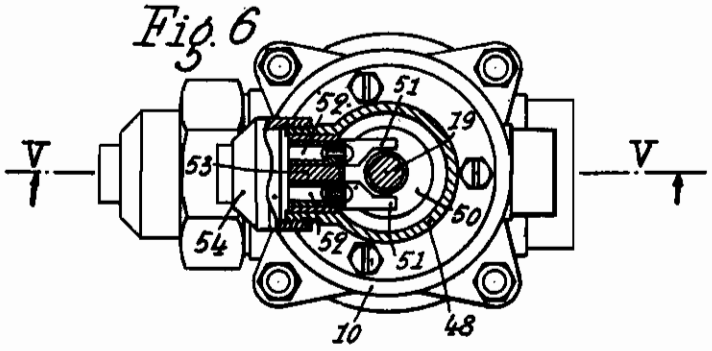


Fig. 7

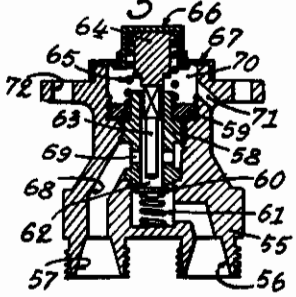
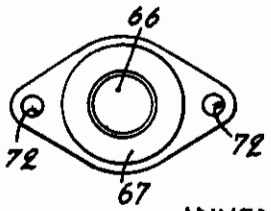


Fig. 8



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ALIEN PROPERTY CUSTODIAN

CENTRALIZED REMOTE CONTROL SYSTEMS FOR PIPING NETWORKS

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Application filed September 25, 1941

The present invention relates to remote control systems for piping networks controlled from a central operating panel, more particularly intended for the distribution of fluids such as the fuel or lubricating oil on airplanes.

The constant increase in the dimensions and power of aircraft has for result, among others, an increase of the extent and complexity of the piping networks connecting the tanks to the engines. The valves controlling said network are often numerous; furthermore their direct control is frequently impossible or difficult, this necessitating the use of remote control devices. Now, mechanical remote controls of a certain extent are costly and difficult to establish; they are frequently stiff to manipulate and doubtful in operation, requiring constant maintenance. Moreover, owing to their weight and to their cumbersomeness, they must have a minimum of length, and this condition prevents the centralizing of control or its appropriate grouping, so that errors and accidents are possible.

The present invention concerns a remote control system of the pneumatic type, for valve devices or other elements of a fluid distribution network, which remedies these drawbacks.

This system comprises, according to one feature of the invention, in combination with a plurality of valves or other members to be actuated, which are pneumatically controlled, a source of compressed air or other fluid under pressure, pilot valves, preferably of the push-button type, in communication with said source of compressed air and with said pneumatically operated control valve devices, lamps or other signalling means capable of being actuated by the positions of said pneumatically operated control valve devices and a control or supervision panel on which are grouped according to any suitable diagram the pilot valves and the lamps or other signalling means corresponding to the various apparatus to be actuated.

According to an important feature of the invention the control valve device or said system, provided for any liquid or gaseous fluid, and capable of being controlled from a distance by means of impulsions of compressed air or gas or other fluid, is characterized, in particular, by the fact that it is arranged in such a manner that the control is effected by means of a single pilot pipe enabling of alternately and positively obtaining the opening and closing operations.

Another feature consists in the fact that said pneumatically operated control valve device is capable of being actuated in the desired direction by means of a direct hand control, independent of the compressed air control and which can eventually be used as emergency control.

According to a further feature, the valve device comprises electric contacts, indicating on a panel by suitable means (lamps or movable signals), the kind of operation effected, when said operation is effectively accomplished.

In the accompanying drawings, given by way of example:

Fig. 1 shows the diagrammatic arrangement of a distributing network according to the invention.

Figs. 2 and 3 illustrate in vertical section an embodiment of the remote controlled valve device.

Fig. 4 is a plan view thereof.

Figs. 5 and 6 refer to a modification.

Figs. 7 and 8 illustrate the hand control.

In Fig. 1, reference **91** and **92** designate fuel tanks respectively provided with stop valves **73** and **74** and capable of communicating either with the feeding pumps **75** and **76**, through the piping **77**, or with other tanks or other distributing members through the intercommunicating pipe **78** which can be stopped by the valve device **79**. Two valve devices **80** and **81** respectively control the output of the pumps **75** and **76** through the piping **82**. It will be assumed that the remote control valve devices **73**, **74**, **79**, **80** and **91** are pneumatically controlled; their more detailed description is given hereinafter.

On a control and supervision panel **83** is reproduced the general diagram of the piping networks in which the valve devices and other members to be controlled are represented by lamps **103**, **104**, **108**, **110**, **111** respectively corresponding to the valve devices **73**, **74**, **79**, **80** and **91**.

A compressed air container **89** or other source of fluid under pressure is connected to pilot valves preferably of the push-button type **203**, **204**, **209**, **210**, **211** arranged on the panel **83** and said pilot valves are connected by distinct pilot tubes **303**, **304**, **309**, **310**, **311**, to each of the pneumatic valve devices or corresponding remote control apparatus **73**, **74**, **79**, **80**, **81** respectively. The lamps **103**, **104**, **109**, **110**, **111** are moreover connected by electric signalling circuits **403**, **404**, **409**, **410**, **411**, to contacts provided on the pneumatic valve devices, as will be shown later on.

Each of the remote control pneumatic valve devices is designed as illustrated in Figs. 2 to 6. As shown in Fig. 2, it comprises a body **1** carrying the inlet opening **2** and the outlet opening **3** for the fluid to be controlled. These two open-

ings are separated by a partition 4 in which is housed a member 5 forming a seat for a movable valve element and preferably consisting of a ring of plastic material. On the valve seat bears a movable valve element 6 subjected to the action of the spring 7 which tends to close the valve by taking a bearing on the plug 8, which closes the lower part of the body 1 of the valve device.

On this valve body 1 is mounted by means of four studs 9, shown in Fig. 4, the cover 10 of the valve device, in which is housed the mechanism pneumatically controlling the movable valve elcment. This mechanism comprises a hollow piston 11 freely sliding in the cover 10. A fluid-tight leather washer 12 is clamped about said piston by a ring 13 screwed in the cover.

On the piston 11 is secured at the upper part, a coaxial tubular member 14 terminated by a bottom 15 comprising a rod 16 on which is mounted by means of the spindle 17 a member 18 of spherical shape and carrying the movable valve element 6.

At its upper part, the piston 11 is moreover connected in a fluid-tight manner to the end of an elastic bellows 19 the other end of which is tightly connected to a cup 20 secured to a socket 21 centered in the body 1 of the valve device and held in position by clamping the studs assembling the cover and the valve body. Said socket 21 serves as abutment for the piston 11 and limits its downward displacement. It comprises a ring 22 in which are provided openings allowing atmospheric pressure to reach the outside of the bellows 19.

The member 15 is connected on the one hand, to the movable valve element 6 and on the other hand to a plunger 23, for instance through the medium of the tapered base 24 and the pins 25. The plunger 23 slides vertically in a cylindrical guiding socket 26 provided in the cover 10 of the valve device, and terminates at the upper part by a hand operating knob 27. On a portion of its height from the base 24, the plunger contains a transverse slot 28.

In this slot is mounted a pawl 29 pivoted on a pin 30 and pushed by a spring 31. When the plunger 23 moves downwardly, the pawl engages one of the teeth of a ratchet wheel 32 which is journalled on a fixed spindle 33 fixed in the guiding socket 26 of the cover 10 and which passes in two longitudinal stud-holes 34 (see Fig. 4) provided in the plunger 23. The ratchet wheel 32 carries in its rotation a cam element 35 loosely mounted on the spindle 33, and maintained in its successive angular positions by the spring 36. According to said suecessive positions, the cam element presents either a noteh, or a projection opposite the member 37 fixed on the base 24 and forms an abutment at different levels for said member 37.

The cover 10 moreover comprises an opening 38 through whieh is admitted the operating fluid under pressure used for the control. It eomprises on the other hand, in a boss 39, an opening 40 obturated by a partition made of insulating material 41. Said partition is traversed by a terminal 42, forming a eontact-piece embedded in the insulating partition, and by another terminal 43 forming the pivot for a rocking contact element 44. Said element carries an insulated pin 45 engaged in a circular groove 46 of the piston 11, so as to follow the vertical displacements of the piston; a cover 47 containing the passage of a wire, closes the boss 39.

Figs. 5 and 6 show in a partial longitudinal section and in a sectional plan view, a modification consisting in mounting at the upper part of the cover 10 of the valve device, a casing 48, the hand operating knob 27 being replaced by a knob 49 comprising a contact base 50 arranged opposite two springs 51. Said springs are secured by two contact-pieces 52 in a partition made of insulating material 53 secured in the boss of the casing 48. The boss is closed by a cover 54.

The push-button type pilot valve illustrated in Figs. 7 and 8 is composed of a body 55 carrying an opening 56 connected by a piping to the source of compressed air or gas, and an opening 57 connected likewise to the opening 38 of the valve device shown in Fig. 1.

In said body 55 is mounted a member 58 secured by the nut 59 and forming a valve seat 60 held on its seat by a spring 61. The member 58 comprises a central bore 62 through which passes, with an important clearance a rod 63, the base 44 of which, pushed back by the spring 65, is housed in the push-button 66. The push-button 68 is retained against the action of the spring 65 by a cup 67 secured on the body 55. The opening 57 connected to the piping of the valve device communicates through channels 68, 69, 62, with the chamber 70, which is in communication with the atmosphere through holes 71. The body 55 carries two attaching lugs for securing the knob on a panel.

The operation is as follows:

It will be assumed that the valve device 73 of Fig. 1 is under consideration and that it is controlled by the pilot valve 203. This pilot valve being in the position shown in Fig. 7, the valve element 60 rests on its seat, the piping 503 connecting the pilot valve to the control valve device is in communication with the atmosphere through the channels 68, 69, the chamber 70 and the holes 71. The control valve device 73 is in the position shown in Fig. 2, its movable valve element 6 being closed.

If the pilot valve 203 is acted upon in such a manner that the rod 63 spaces away the movable element 60 from its seat, the base 64 presses on the member 58 cutting off the communication of the channel 62 and of the chamber 70 with the atmosphere, and the pressure of the compressed air or gas coming from the container 88 is transmitted by the channels 69, 68, the joint 57 and the connecting piping 303 up to the opening 38 of the control valve device 73. This pressure acts within the cover 10 and causes the piston 11 to descend against the action of the spring 7, until it abuts on the ring 21. The movable valve element 6 connected to the piston 11 by the tubular member 14 also descends on and moves away from its seat 5. The valve device opens.

The pawl 29, connected to the piston 11 by its pin 30 secured in the slot 28 of the rod 23, participates in said downward movement and reaches, after a certain stroke, one of the teeth of the ratchet wheel 32 to which it imparts an indexing movement, equal at the end of the stroke, to the angular sector corresponding to said tooth. It results therefrom that the cam element 35, attached to the ratchet wheel 32, which was before in the position shown in Fig. 1 and one of the notches of which received the bearing surface 37 of the piston, assumes the position shown in Fig. 3, and one of its projections is now opposite said bearing surface 37.

When the pilot valve 203 is no longer pressed upon, the movable valve element 60 returns on

its seat and thus cuts off the arrival of compressed air or gas; the base **64** moves away from its seat on the member **56**, and the pilot tube **303** is again in communication with the atmosphere, the pressure diminishes in the chamber of cover **10**, and by the action of the spring **7**, the movable valve element **6** acts on the plunger **23** and the piston **11**, but the bearing surface **37** is stopped by the projection of the cam element **35**, thus preventing the movable valve element **6** from returning on the seat **5**. The valve device therefore remains open.

The upward stroke of piston **11** being thus stopped, the element **44** controlled by the pin **45** actuated by the piston **11** through the groove **46** remains in contact with the contact-piece **42** maintaining the electric circuit closed and consequently feeding the signalling line **403**, which produces the lighting of the corresponding signalling lamp **103** on the control panel **83**.

If, by means of the control knob **203**, another impulse of fluid under pressure is transmitted through the opening **36** in the chamber of cover **10**, said pressure acts in the manner above described, but the rotation which it imparts to the ratchet wheel **32** through the medium of the pawl **29**, has for result to cause the cam element **35** to pass from the position illustrated in Fig. 3, (in which one of its projections is opposite the bearing surface **37**) to the position shown in Fig. 2 (in which one of its notches receives the bearing surface **37**).

Upon expansion of the fluid, when the pilot valve is no longer acted upon, said bearing surface **37** pushed back by the spring **7**, effects a full upward stroke and enters one of the notches of the cam element **35** thus allowing the movable valve element **6** to be applied on its seat, which corresponds to the closed position of the valve device.

The upward stroke of piston **11** being thus accomplished the contact element **44** controlled by the pin **43** disengages from the contact-piece **42** thus opening the electric circuit of line **404** and extinguishing the signalling lamp **103** on the panel **83**.

It will be noted, on the other hand, that if the knob **27** of Fig. 2 is acted upon by any means, for instance by hand, the same relative movements as those resulting from the action of the compressed air on piston **11** are produced by the pawl **29** and the ratchet wheel **32**. Moreover, signalling takes place identically. Thus an emergency means is therefore available for the operation of the valve device, in case of accidental failure of the pneumatic control.

The operation of the apparatus illustrated in Figs. 5 and 6 and in which the valve device is provided with a device for grounding two electric circuits, is as follows:

The respective positions of the base **50** and of the contact springs **51**, are such that the springs are in contact with the base when the valve device is closed, and separated from said base when the valve device is open. Therefore, if said springs, through the medium of the contact-piece **52** and of a conducting wire are, for instance connected to the earth contact of an ignition circuit of an airplane engine, said circuit will be grounded when the valve device is closed.

If, for instance, the considered valve device controls the delivery of oil to an airplane engine, the latter cannot be started if the valve device is not open, this avoiding any possibility of false operation, liable to cause a serious accident.

It is obvious that the invention is not limited to the embodiments as illustrated or described, which have been chosen only by way of example. The indicating panel may carry any diagram according to requirements, for instance it can indicate the normal or conventional order of the exhaust of various tanks, or any other arrangements capable of avoiding errors of operation. Said panel may comprise any signalling system. In particular, the luminous points supplied by the lamps can be replaced by movable signals or by luminous zones illustrating all the region of the diagram which is put in action or out of action.

On the panel, each push-button pilot valve can be connected by an arrow to the corresponding lamp, as illustrated in Fig. 1. It can also be placed directly on the diagram at the place corresponding to the pneumatic valve device to be actuated. Instead of push-button pilot valves, use can be made of any other operating member. The pneumatic devices can have flow controlling members of any type.

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