Sept. 28, 1943. Q. H. CARLTON 2,330,678

LIQUID PRESSURE REMOTE CONTROL SYSTEM

Filed July 7, 1942 4 Sheets-Sheet 1

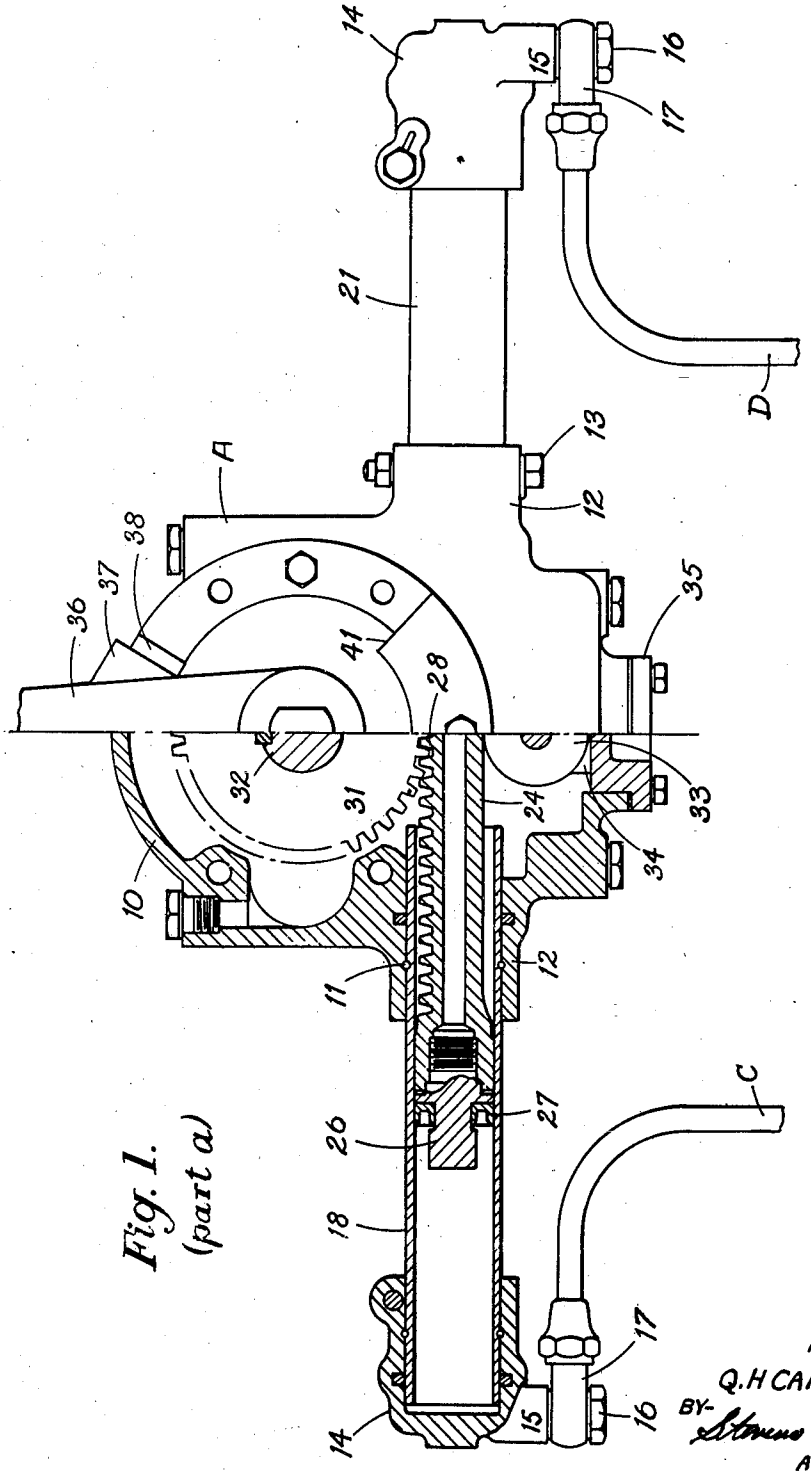


Fig. 1. (part a)

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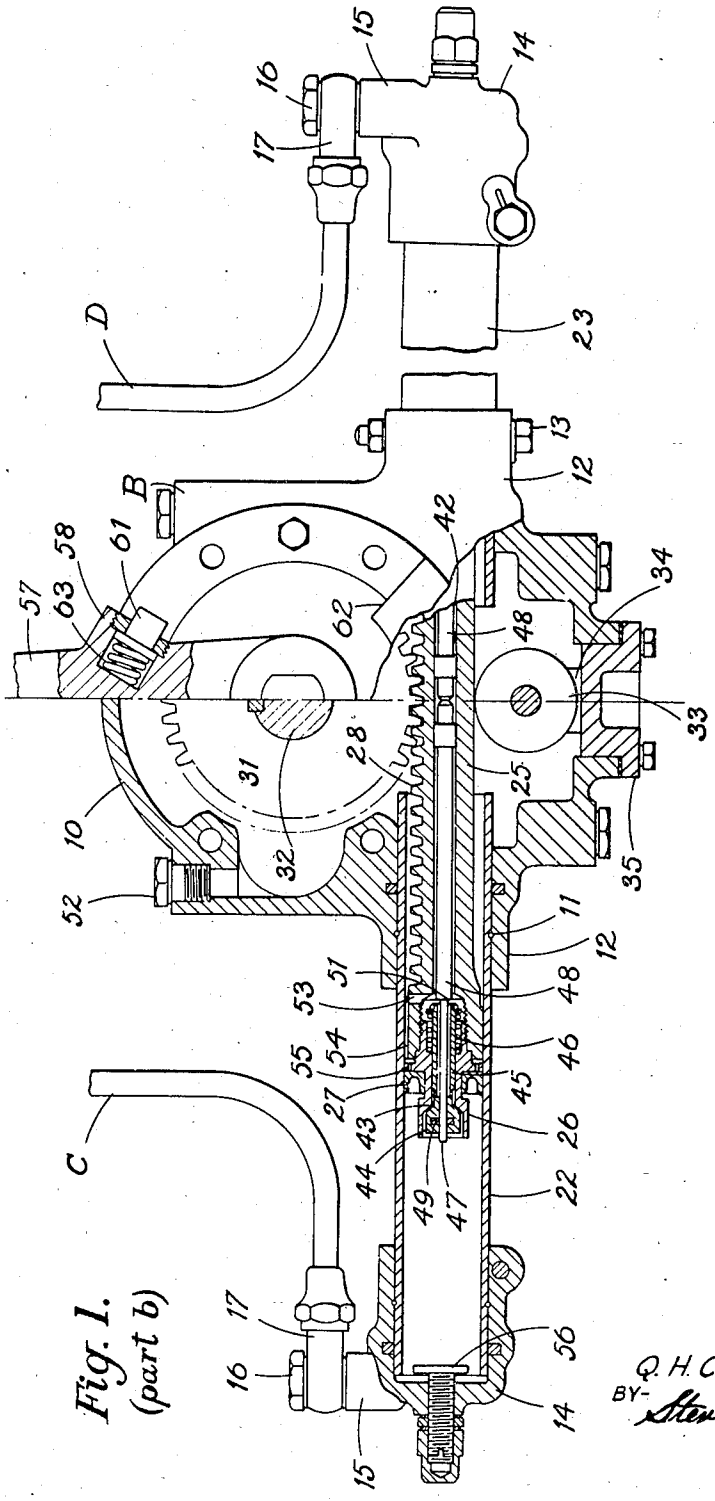


Fig. 1.
(part b)

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LIQUID PRESSURE REMOTE CONTROL SYSTEM

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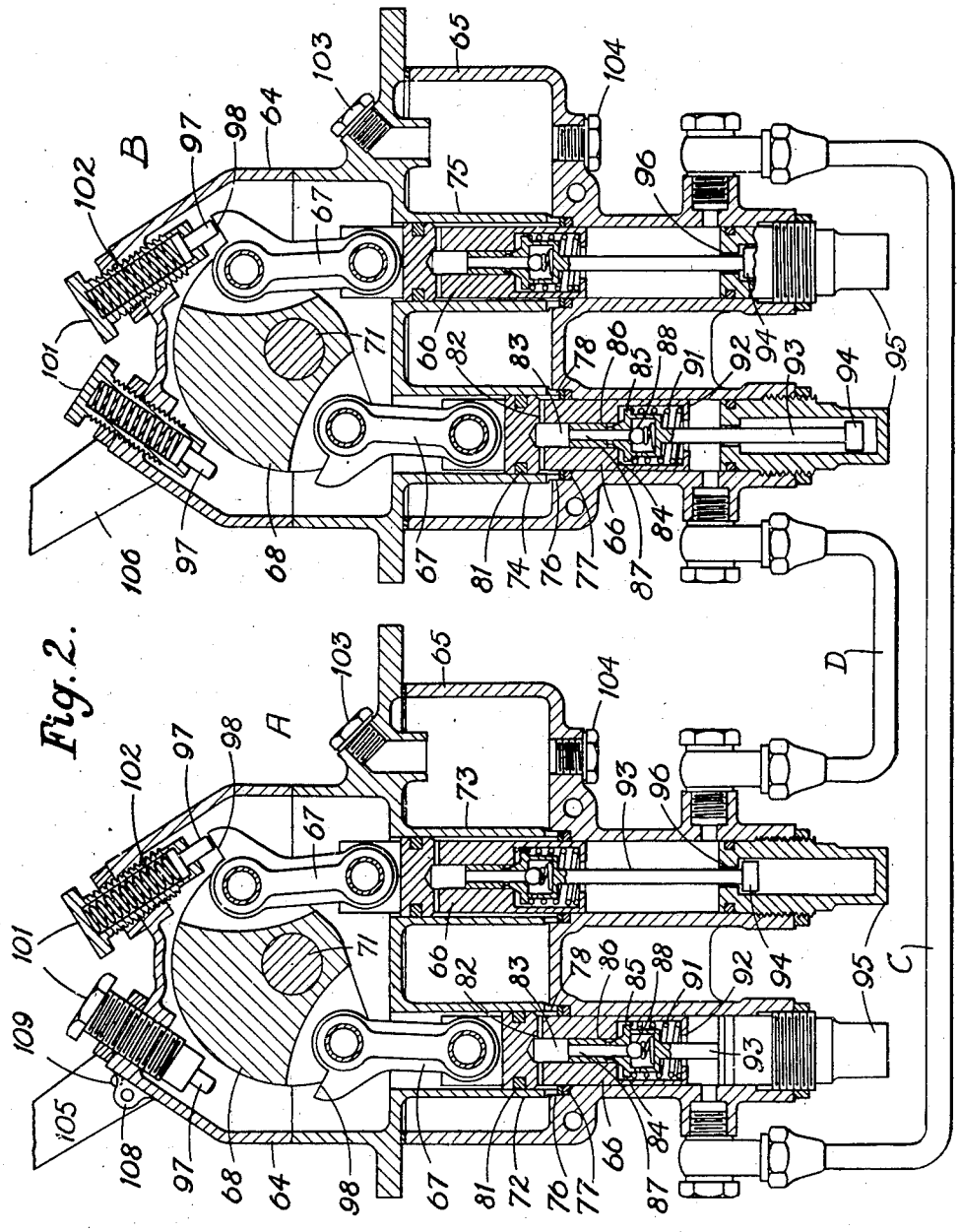


Fig. 2.

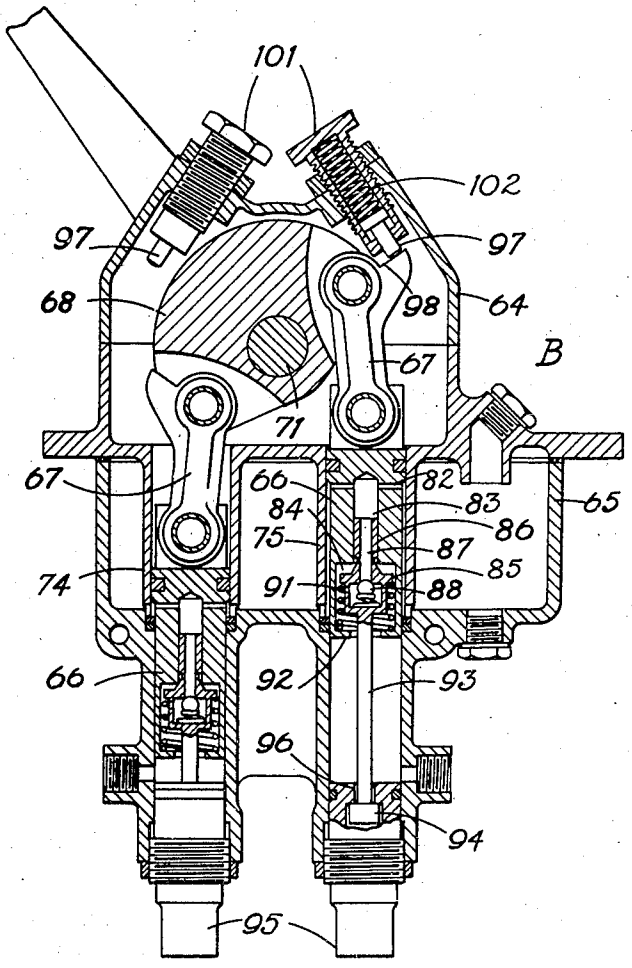
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LIQUID PRESSURE REMOTE CONTROL SYSTEM

Filed July 7, 1942 4 Sheets-Sheet 4

Fig. 3.



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UNITED STATES PATENT OFFICE

2,330,678

LIQUID PRESSURE REMOTE CONTROL SYSTEM

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Application July 7, 1942, Serial No. 450,061
In Great Britain June 17, 1941

12 Claims. (Cl. 60—54.5)

This invention relates to a two-pipeline liquid pressure remote control system of the kind in which a transmitter and a receiver coupled by a pair of pipelines each comprise a pair of cylinder-and-piston units, the pair of pistons in each case being coupled together mechanically to move in opposite senses.

The object of the invention is to provide an improved means for maintaining the correct phase relation between the transmitter and receiver and for returning them to the proper phase relation if they should become out of phase.

According to the invention, stops are provided to limit the movement of the pistons in both the transmitter and the receiver, the receiver pistons being movable against resilient loading beyond their positions defined by the stops, and valves are provided which are adapted to be opened mechanically during such excess movement of the pistons to place the cylinders in communication with a reservoir.

According to one aspect of the invention, valves controlling communication between the receiver cylinders and a reservoir are opened only when the respective pistons reach one end of their strokes, resilient stops being provided to resist movement of the pistons to a position in which the valves are opened and further stops being provided in the transmitter unit which are engaged by the transmitter pistons simultaneously with the engagement of the stops in the receiver unit by the receiver pistons so long as the two units are in phase, the resilience of the receiver stops enabling the pistons in the receiver to be forced beyond their normal stopped position when a receiver piston engages its stop before the corresponding transmitter piston due to loss of phase between the units, thereby opening one of the valves to connect the appropriate receiver cylinder to the reservoir and permit liquid to escape until the transmitter stop is also engaged.

The valves may be mounted in the pistons to control passages extending through the said pistons, and non-return valves may be provided to permit liquid to enter the pipelines from a reservoir. The valves in the pistons may be operated by members projecting axially from the pistons and adapted to engage with abutments in the cylinders. The receiver unit may comprise a pair of coaxial cylinders mounted on opposite sides of a central body, a common piston element carrying the pistons in both cylinders, and means for converting longitudinal movement of the piston element into angular movement of a shaft carried in the body. The central body may constitute a reservoir for liquid.

The valves in the pistons are preferably maintained seated by springs and are connected to rods projecting into the cylinders, the said rods being provided with heads adapted to engage with stops in the cylinders when the pistons are retracted to a predetermined position so that further retraction of the pistons opens the valves. The receiver cylinders may be arranged side by side, the pistons therein being connected by a rocking arm. The transmitter and receiver units may be substantially identical, the transmitter unit being provided with locking means for holding the pistons in a position in which the valve in one of the pistons is open.

The invention is hereinafter described with reference to the accompanying drawings, in which:

Figure 1 shows the transmitter and receiver units of one form of liquid pressure remote control system according to the invention, one half of each unit being shown in section;

Figure 2 is a similar but somewhat diagrammatic illustration of another form of liquid pressure remote control system according to the invention; and

Figure 3 is a view of the receiver unit shown in Figure 2, showing the position of the parts when the valve connecting one of the cylinders to the reservoir is open.

Referring to Figure 1, the liquid pressure remote control system comprises the transmitter unit A and the receiver unit B, the two being connected by pipelines C and D. The transmitter and receiver units are substantially similar in construction, each comprising a generally rectangular box-like central body 10 from which extend in opposite directions two coaxial cylinders secured against longitudinal movement by wires 11 inserted into mating grooves in the cylinders and the bosses 12 in which they are mounted, the ends of the wires being attached to bolts 13 to lock them in place. Heads 14 are similarly attached to the cylinders, and are formed with suitable bosses 15 to receive the bolts 16 of banjo connections 17 for the pipelines C and D. The cylinders of the transmitter unit, indicated by references 18 and 21 on the drawing, are connected respectively by the pipes C and D to the cylinders 22 and 23 of the receiver. The piston elements of the transmitter and receiver, indicated respectively by the references 24 and 25 are double ended, each having a head 26 provided with a sealing cup 27 in each of the two cylinders

of the unit in which it is mounted. Each piston element is formed with rack teeth 28 between its two heads, these teeth meshing with a pinion 31 on a shaft 32 journalled in the body 10. The piston elements are supported against bending by rollers 33 mounted in lugs 34 carried by cover members 35 closing openings in the lower parts of the bodies of the transmitter and receiver units.

Referring now particularly to the transmitter, the piston heads 26 are solid, and flow of liquid past them is prevented by the cups 27. The shaft 32 carries a hand-lever 36 on opposite sides of which are formed two bosses such as that shown at 37 to received rigid stop members 38 cooperating with abutments 41 on the body 10 to limit the movement of the hand-lever 36, and thus limit the movement of the element 24.

In the receiver unit B, the piston heads 26 are formed with axially-extending holes, and the piston unit itself is bored through to form a passage 42. A valve seat 43 is formed in each piston head, on which seats the head 44 of a valve member 45 urged on to the seat by a spring 46. The valve member 45 is hollow, and through it extends the reduced end 47 of a rod 48 lying in the passage 42 in the piston element and abutting at the centre of the latter against a similar rod 48 associated with the valve at the other end of the piston element. A seal 49 provides a fluid-tight joint between the valve member 45 and the reduced portion 47 of the rod. The reduced portions 47 of the rod 48 terminate just inwards of the ends of the valve members 45, the arrangement being such that when both valves are seated there is a very small clearance between the inner end of each valve member and the shoulder 51 formed by the change in diameter of the corresponding valve rod. The interior of the body 10 of the receiver unit forms a reservoir for liquid, being provided with a filler cap 52. A passage 53 connects the inner side of the valve 45 to this reservoir, and a channel 54 formed on the surface of the piston, leads to apertures 55 in the piston head behind the cup 27. The cup 27 is sufficiently flexible to collapse in the event of the pressure in the cylinder falling below that in the reservoir, and so allow liquid to flow into the cylinder. In the head of each of the receiver cylinders 22 and 23 is mounted an adjustable abutment 56 with which the end of one of the rods 48 is adapted to engage when the piston reaches a suitable position in the cylinder. The shaft 32 carrying the pinion 31 in the receiver unit has mounted on it externally of the body an arm 57 by which the receiver is connected to the member to be operated, and on opposite sides of the arm 57 are formed two hollow bosses 58 in each of which is mounted a spring-loaded stop 61 adapted to engage with an abutment 62 on the body. The springs 63 of the stops 61 are of considerable strength, so that an appreciable effort is required to compress them.

The stops 61 and abutments 62 are so positioned that the angular movement of the arm 57 available without compressing the stop springs 63 is equal to the total angular movement of the transmitter hand-lever 36, and the abutments 56 in the receiver cylinders 22 and 23 are so positioned that, so long as this angular movement is not exceeded, they do not come into contact with the rods 48. A greater movement of the receiver arm 57, however, which is permitted by the springs 63, immediately allows the rod 48 at one end of the piston to engage the corresponding abutment 56, thus moving the rods 48 relatively to the piston element and engaging the shoulder on the other rod 48 with the end of the valve member 45 at the remote end of the piston element to open the valve.

This form of remote control system operates in the following manner. So long as the transmitter and receiver units remain in phase, the stops 38 and 61 on the transmitter and receiver units respectively will engage their abutments simultaneously if the control is moved to an extreme position. The rods 48 in the receiver piston do not, therefore, engage with the abutments 56, and the valves 45 remain closed. The circuit thus remains closed, except that, should contraction of liquid in the pipelines occur, liquid can flow thereinto past the cups 27 on the receiver pistons. Should the units become out of phase, due to leakage or unequal expansion or contraction of the liquid on the two sides, the stop 61 on the receiver unit will, when the control is moved to one extreme position, engage its abutment 62 before the corresponding stop 38 on the transmitter unit engages its abutment 41. If the operater then exerts an increased pressure on the hand-lever 36, the spring 63 of the stop 61 will be compressed, and the piston element 25 of the receiver unit will be moved further along the cylinder, with the result that one of the rods 48 engages with an abutment 56, and one of the valves 45 is opened to allow the excess liquid to escape from the pipeline. Taking a specific example, it may be assumed that there is an excess of liquid in the right-hand side of the system, that is cylinders 21 and 23 and pipeline D, and too little liquid in the left-hand side. If the hand-lever 36 is moved in a counter-clockwise direction, it is evident that stop 61 will engage abutment 62 before the stop on the left-hand side of lever 36 corresponding to stop 38 engages its abutment corresponding to 41. An increased pressure exerted on the lever 36 will compress the spring 63, and allow the piston element 25 to move slightly further to the left, the rod 48 at the left-hand side of the drawing engaging the stop 56, and causing the shoulder of the right-hand rod 48 to be brought up against the end of the corresponding valve member 45, to open that valve, allowing the liquid to escape from the right hand side of the system into the reservoir, and thus permitting movement of the piston unit 24 to the right until the stop corresponding to 38 engages its abutment when the valve recloses. In the meantime, liquid has been drawn into the left-hand side of the system past the cup 27 in the cylinder 22 to fill the space created in that side of the system by the movement of the piston unit 24. The pressure in the right-hand side of the system is now at some relatively high figure dependent on the spring 63, and the pressure on the left-hand side is substantially atmospheric, but the release of the hand-lever 36 allows this pressure to be transmitted through the transmitter piston to the left-hand side of the system, leaving both sides at a pressure somewhat above atmospheric pressure. The clearance between the shoulders on the rods 48 and the valve members 45, and the additional movement necessary to bring the rods 48 into contact with the abutments 56 after the stops 61 have engage the abutments 62 are both extremely small, for example of the order of one-thousandth of an inch, and, therefore, the move-

ment of the piston element after the stop 61 is engaged, and before the valve begins to open is almost infinitesimal. The recovery of the spring 63 when the hand-lever is released must of course move the receiver piston element the amount of this additional movement, and the transmitter piston element will be correspondingly moved, thus throwing the control very slightly out of phase. With a pitch circle diameter of four inches for the pinion 31, and a total lost movement before the valve begins to open of two-thousandths of an inch, the control would be out of phase by an angle of the order of one-twentieth of a degree, which is negligible.

In the hydraulic remote control system shown in Figures 2 and 3, the transmitter and receiver units A and B are again connected by pipelines C and D, and are identical in form. Each unit comprises a body 64 from which project two cylinders surrounded for a part of their length by a reservoir 65. In each cylinder is mounted a piston 66, and the pistons in each unit are connected by pivoted links 67 to a rocking arm 68 secured to a shaft 71 passing through the body 64. The cylinders of the transmitter unit are numbered respectively 72 and 73, and the cylinders of the receiver unit are numbered 74 and 75 respectively, the cylinders 72 and 75 being connected one to the other by the pipeline C, whilst the cylinders 73 and 74 are similarly connected by the pipeline D. Each of the cylinders 72 to 75 has its upper portion formed integral with the body 64, and its lower portion, which is of slightly smaller diameter, is integral with the reservoir 65. The lower end of the upper part of each cylinder fits into an enlargement 76 of the upper end of the lower part, and serves to retain in the said enlargement a sealing ring 77 forming a seal for the piston. The lower end of the upper part of the cylinder is slotted as at 78 to admit liquid from the reservoir to the part of the cylinder above the seal 77. Another seal 81 mounted in a groove at the upper end of the piston, which is enlarged to fit in the upper part of the cylinder, whilst the lower part is a sliding fit in the lower part of the cylinder. There is thus provided an annular space around the piston which is in constant communication with the reservoir 65 by way of the slots 78, and this space is connected by diametral passages 82 in the piston to a longitudinal passage 83 therein leading into a cavity 84 in the lower end of the piston. In the cavity 84 is a valve member 85 adapted to seat in the mouth of the passage 83, the valve member 85 being guided by a stem 86 sliding in the passage 83, and having radial ports in the stem 86 just above its seating face to connect with a longitudinal passage 87 through the stem. The passage 87 is closed at its lower end by a spring-loaded non-return valve 88. The valve member 85 is urged on to its seat by a spring 91 taking its abutment on an annular wall 92 partially closing the cavity 84, and from the valve member extends a stem 93 terminating in a head 94. The head 94 lies in the bore of a hollow adjustable closure plug 95 at the lower end of the cylinder, the upper end of the plug 95 having a restricted opening 96 through which the head 94 cannot pass. It will be seen that when the piston rises to a position in which the head 94 is stopped by the restricted opening 96 the valve member 85 will be pulled off its seat. Figure 3 shows the receiver unit B with the valve 85 of the piston 66 opened. The movement of the pistons of both the transmitter and receiver units is limited by stops 97 mounted in the bodies 64 of the respective units, the stops cooperating with abutments or lugs 98 formed on the links 67. The stops comprise plungers slidable in adjustable tubular housing 101 screwed into the body 64, and are loaded by strong springs 102. The stops are set so that, when the control is in phase, one stop in the transmitter unit and one stop in the receiver unit are engaged simultaneously, and such engagement takes place before the heads 94 on the stems 93 of the corresponding pistons are stopped by the restricted openings 96, the clearance at the said heads 94 when the stops 97 engage being of the order of one-thousandth of an inch.

The reservoirs 65 on the transmitter and receiver units are provided with filler plugs 103 and drain plugs 104. On the shaft 71 of the transmitter unit A is mounted a hand-lever 105, and on the shaft 71 of the receiver unit B is mounted an arm 106 for coupling the control to the member which it is to operate. Means, such as a pin passing through holes in a pair of lugs 108 and through a corresponding hole 109 in the hand-lever 105, are provided for holding the lever 105 in a position in which the valve 85 of the piston in the cylinder 73 is held open, for a purpose to be described below.

As in the control shown in Figure 1, the system remains closed so long as it is not operated beyond the range limited by the spring-loaded stops 97, except that liquid can enter from the two reservoirs 65 through the valves 88 to make up for any loss. Whilst the system remains in phase the stops 97 in the transmitter and receiver are engaged simultaneously at either end of the stroke. In the event of loss of phase taking place, the receiver stop 97 at one end of the stroke will come into engagement before the corresponding transmitter stop, and continued pressure on the transmitter hand-lever 105 then causes compression of the spring 102 of the receiver stop, bringing the head 94 on the stem 93 of the appropriate valve 85 up against the end of the restriction 96, and opening the valve 85, to allow the transmitter movement to be continued until the transmitter stop 97 also comes into engagement with its abutment. Figure 3 shows the receiver unit B with the valve 85 of the piston in the cylinder 75 open, the stop 97 on the right-hand side of the unit being forced back against its spring 102 to allow opening of the valve. The clearance at the head 94 has been exaggerated in Figures 2 and 3, with the result that the stop 97 has required to move an appreciable distance to open the valve, but in practice the clearance would be of the order of one-thousandth of an inch, and the movement of the stop would be correspondingly small. As in the previous case, the return of the stop to its normal position when the hand-lever 105 was released would involve such a small movement as to be negligible.

If the control is left unused for any considerable length of time, the variations of temperature to which it is subjected are liable eventually to build up an excessive pressure in the system, which is unable to escape, and may, therefore, do some damage. To avoid this, provision is made for leaving the system in a condition in which the pipelines are open to the reservoirs or are able to be so opened automatically in the event of a rise of pressure. For example, the hand-lever 105 in Figure 2 may be moved over until the stop 97 on the right of the transmitter is forced back against its spring and the valve 85 of the piston

in the cylinder 73 opened, the hand-lever being held in this position by a pin passed through the lugs 108 and the hole 109 in the hand-lever. The excess movement beyond the normal stop-engaging position also forces back the stop 97 on the right-hand side of the receiver, and opens the valve 85 of the piston in the cylinder 75. Liquid escapes from the pipeline C, until the valve 85 just closes, but the head 94 remains in contact with the end of the restriction 95, and any subsequent increase in pressure in the pipeline C will re-open the valve, and such pressure will be relieved. Thus, no pressure can be built up in either side of the system.

It has hitherto been usual, in liquid pressure remote control systems of the kind herein described, to arrange for the opening of valves connecting the system to the reservoir whenever the pistons reached the ends of their strokes. With that arrangement the working pressure in the control is lost each time an end of the stroke is reached, and a small movement is required to close the valves before pressure can be built up, with the result that the receiver unit tends always to lag slightly behind the transmitter, and accurate phasing of the transmitter and receiver cannot be obtained. With the present invention, movement of the control within its normal range takes place without any opening of the valves, so that the working pressure is never released, and re-phasing is effected by movement beyond the normal range, the valves opening against a resilient resistance which reacts on the liquid and maintains it under pressure even when the excess liquid has escaped.

It may be found possible, in controls according to this invention, to omit the spring-loaded stops illustrated in the drawings, and to provide solid stops attached directly to the body of the transmitter or receiver unit, sufficient movement of the stops for the purposes required being permitted by the resilience of the stops themselves or the parts to which they are attached. The stops for the receiver unit may be provided on the member which it operates instead of on the receiver itself.

It will be understood that the arrangement shown in Figure 1 may be provided with valves in the transmitter pistons, and spring-loaded stops 61 on the transmitter, so that the system may be opened for breathing as described with reference to Figures 2 and 3. Similarly, the valves and spring-loaded stops may be omitted from the transmitter in the arrangement shown in Figures 2 and 3.

What I claim is:

1. A two-pipe-line liquid pressure remote control system comprising a transmitter unit and a receiver unit, a pair of cylinders in each unit, pistons in the cylinders, coupling means between the pistons of each unit to produce simultaneous movement of said pistons in opposite senses, two pipe-lines each connecting one cylinder of the transmitter unit to one cylinder of the receiver unit, stops limiting the movement of the pistons in both the transmitter and the receiver units, resilient means supporting the stops for the receiver pistons, a reservoir, a passage through each receiver piston providing a connection between the cylinder in which said piston is mounted and the reservoir, a valve in said passage adapted to at times connect the cylinder to the reservoir, and means other than said stops to open either of said valves when the piston in the cylinder which that valve connects to the reservoir is moved beyond the position defined by its stop.

2. A two-pipe-line liquid pressure remote control system comprising a transmitter unit and a receiver unit, a pair of cylinders in each unit, pistons in the cylinders, coupling means between the pistons of each unit to produce simultaneous movement of said pistons in opposite senses, two pipe-lines each connecting one cylinder of the transmitter unit to one cylinder of the receiver unit, stops limiting the movement of the pistons in both the transmitter and the receiver units, resilient means supporting the stops for the receiver pistons, a reservoir, a passage through each receiver piston providing a connection between the cylinder in which said piston is mounted and the reservoir, a valve in said passage adapted to at times connect the cylinder to the reservoir, and means other than said stops to open either of said valves when the piston in the cylinder which that valve connects to the reservoir is moved beyond the position defined by its stop.

3. A two-pipe-line liquid pressure remote control system comprising a transmitter unit and a receiver unit, a pair of cylinders in each unit, pistons in the cylinders, coupling means between the pistons of each unit to produce simultaneous movement of said pistons in opposite senses, two pipe-lines each connecting one cylinder of the transmitter unit to one cylinder of the receiver unit, stops limiting the movement of the pistons in both the transmitter and the receiver units, resilient means supporting the stops for the receiver pistons, a reservoir, mechanically actuated valves each adapted to at times connect one of the cylinders of the receiver unit to the reservoir, means other than said stops for actuating either of said valves when the piston in the cylinder which that valve connects to the reservoir is moved beyond the position defined by its stop, and non-return valves also controlling communication between said receiver cylinders and said reservoir and permitting flow of liquid only from said reservoir to said receiver cylinders.

4. A two-pipe-line liquid pressure remote control system comprising a transmitter unit and a receiver unit, a pair of cylinders in each unit, pistons in the cylinders, coupling means between the pistons of each unit to produce simultaneous movement of said pistons in opposite senses, two pipe-lines each connecting one cylinder of the transmitter unit to one cylinder of the receiver unit, stops limiting the movement of the pistons in both the transmitter and the receiver units, resilient means supporting the stops for the receiver pistons, a reservoir, a passage through each receiver piston providing a connection between the cylinder in which said piston is mounted and the reservoir, a valve in said passage adapted to at times connect the cylinder to the reservoir, operating means for said valves, and abutments in said receiver cylinders other than said stops adapted to engage the operating means of a valve when the piston in the cylinder which that valve connects to the reservoir is moved beyond the position defined by its stop, to open the said valve.

5. A two-pipe-line liquid pressure remote control system comprising a transmitter unit and a receiver unit, a pair of cylinders in each unit, pistons in the cylinders, coupling means between the pistons of each unit to produce simultaneous movement of said pistons in opposite senses, two pipe-lines each connecting one cylinder of the transmitter unit to one cylinder of the receiver unit.

a reservoir, a receiver unit comprising a pair of co-axial cylinders, a central body on opposite sides of which said cylinders are mounted, a common piston element constituting the pistons in both cylinders, a shaft rotationally mounted in said body, means for converting longitudinal movement of said piston element into rotational movement of said shaft, stops limiting the normal travel of said piston element in both directions, resilient means for supporting said stops, valves adapted to at times connect each of said co-axial cylinders to the reservoir, and means other than said stops to open one of said valves when the piston element is moved beyond either extreme position defined by the stops, and a transmitter unit provided with stops to permit a travel of the pistons therein corresponding exactly to the normal travel of the receiver pistons defined by the resilient stops.

6. In a two-pipe-line liquid pressure remote control system comprising a transmitter unit and a receiver unit, a pair of cylinders in each unit, pistons in the cylinders, coupling means between the pistons of each unit to produce simultaneous movement of said pistons in opposite senses, two pipe-lines each connecting one cylinder of the transmitter unit to one cylinder of the receiver unit, a receiver unit comprising a pair of co-axial cylinders, a central body on opposite sides of which said cylinders are mounted, said body forming a reservoir, a common piston element constituting the pistons in both cylinders, stops limiting the normal travel of said piston element in both directions, resilient means for supporting said stops, valves adapted to at times connect each of said co-axial cylinders to the reservoir, and means other than said stops to open one of said valves when the piston element is moved beyond either extreme position defined by the stops, and a transmitter unit provided with stops to permit a travel of the pistons therein corresponding exactly to the normal travel of the receiver pistons defined by the resilient stops.

7. A two-pipe-line liquid pressure remote control system comprising a transmitter unit and a receiver unit, a pair of cylinders in each unit, pistons in the cylinders, coupling means between the pistons of each unit to produce simultaneous movement of said pistons in opposite senses, two pipe-lines each connecting one cylinder of the transmitter unit to one cylinder of the receiver unit, stops limiting the movement of the pistons in both the transmitter and the receiver units, and resilient means supporting the stops for the receiver pistons, said receiver unit comprising a pair of co-axial cylinders, a central body on opposite sides of which said cylinders are mounted, said body forming a reservoir, a common piston element constituting the pistons in both cylinders, passages in said piston element connecting each of said cylinders to said reservoir, a valve seat in each said passage co-axial with said piston, a valve element co-operating with each said seat, rod means extending slidably through said piston element and having reduced end portions extending through said valve elements to project beyond the ends of said piston element, abutments on said rod means to engage said valve elements, and abutment means in said cylinder adapted to be engaged by said rod means when the piston element is moved beyond either extreme position defined by the stops to stress the resilient supporting means therefor, whereby said valve elements are lifted from their seats.

8. A two-pipe-line liquid pressure remote control system comprising a transmitter unit and a receiver unit, a pair of cylinders in each unit, pistons in the cylinders, coupling means between the pistons of each unit to produce simultaneous movement of said pistons in opposite senses, two pipe-lines each connecting one cylinder of the transmitter unit to one cylinder of the receiver unit, stops limiting the movement of the pistons in both the transmitter and the receiver units, resilient means supporting the stops for the receiver pistons, a reservoir, a passage through each receiver piston providing a connection between the cylinder in which said piston is mounted and the reservoir, a valve in said passage adapted to at times connect the cylinder to the reservoir, resilient means tending to seat said valves, rods associated with said valves and projecting into the cylinders, and abutment means in said cylinders to engage said rods when the pistons are moved beyond the positions defined by their stops, to produce opening of the valves.

9. A two-pipe-line liquid pressure remote control system comprising a transmitter unit and a receiver unit, a pair of cylinders in each unit, pistons in the cylinders, coupling means between the pistons of each unit to produce simultaneous movement of said pistons in opposite senses, two pipe-lines each connecting one cylinder of the transmitter unit to one cylinder of the receiver unit, stops limiting the movement of the pistons in both the transmitter and the receiver units, resilient means supporting the stops for the receiver pistons and a reservoir, said receiver unit comprising a pair of cylinders disposed side-by-side, a body to which said cylinders are attached, pistons in said cylinders, a rocking arm, rigid links coupling said pistons to the opposite ends of said rocking arm, a valve adapted to at times connect each of said cylinders to the reservoir, and means other than said stops to open one of said valves when a piston is moved beyond its extreme position defined by the stop.

10. In a two-pipe-line liquid pressure remote control system comprising a transmitter unit and a receiver unit each comprising a pair of cylinders, pistons in the cylinders, coupling means between the pistons of each unit to produce simultaneous movement of said pistons in opposite senses, and two pipe-lines each connecting one cylinder of the transmitter unit to one cylinder of the receiver unit; the provision of a receiver unit comprising a body to which the receiver cylinders are attached in side-by-side relation, a rocking arm, rigid links connecting the receiver pistons to opposite ends of the said rocking arm, an abutment on each said rigid link, resilient stops in said body adapted one to engage each of said abutments and define a normal travel of said pistons beyond which they can be moved only by compressing said stops, a reservoir, valves adapted to at times connect each of said receiver cylinders to said reservoir, and means for opening one of said valves when the piston in the receiver cylinder which it connects to the reservoir is moved beyond its normal travel to compress one of the resilient stops, the transmitter unit being provided with stops to permit a travel of the pistons therein corresponding exactly to the normal travel of the receiver pistons defined by the resilient stops.

11. In a two-pipe-line liquid pressure remote control system comprising a transmitter unit and a receiver unit each comprising a pair of cylinders, pistons in the cylinders, coupling means between the pistons of each unit to produce simultaneous movement of said pistons in opposite

senses, and two pipe-lines each connecting one cylinder of the transmitter unit to one cylinder of the receiver unit; the provision of a receiver unit comprising a body to which the receiver cylinders are attached in side-by-side relation, a rocking arm, rigid links connecting the receiver pistons to opposite sides of the said rocking arm, an abutment on each said rigid link, resilient stops in said body comprising plungers, resilient loading means for said plungers, and adjustable tubular housings in which said plungers and loading means are mounted, said stops being adapted one to engage each of said abutments and define a normal travel of said pistons beyond which they can be moved only by compressing said stops, a reservoir, valves adapted to at times connect each of said receiver cylinders to said reservoir, and means for opening one of said valves when the piston in the receiver cylinder which it connects to the reservoir is moved beyond its normal travel to compress one of the resilient stops, the transmitter unit being provided with stops to permit a travel of the pistons therein corresponding exactly to the normal travel of the receiver pistons defined by the resilient stops.

12. In a two-pipe-line liquid pressure remote control system comprising a transmitter unit and a receiver unit each comprising a pair of cylinders, pistons in said cylinders, coupling means between the pistons of each unit to produce simultaneous movement of said pistons in opposite senses, and two pipe-lines each connecting one cylinder of the transmitter unit to one cylinder of the receiver unit; the provision in the transmitter and receiver units of stops limiting the travel of the pistons therein so that, when the units are in phase, the corresponding stops in the transmitter and receiver units are engaged simultaneously, resilient means supporting the said stops, a reservoir in each unit, a valve adapted to at times connect each of said cylinders to a reservoir, means other than said stops to open the valve associated with each cylinder when the piston in the said cylinder is moved beyond the position defined by its stop to stress the resilient supporting means for said stop, and locking means on the transmitter unit for holding a piston thereof in a position in which the corresponding valve is open.

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