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R. L. LEVY
MEANS FOR COMPENSATING FOR LIQUID VOLUME VARIATIONS
IN HYDRAULIC REMOTE CONTROL SYSTEMS

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2 Sheets-Sheet 1

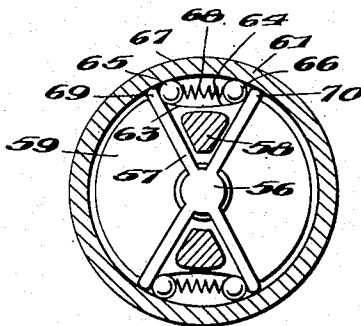
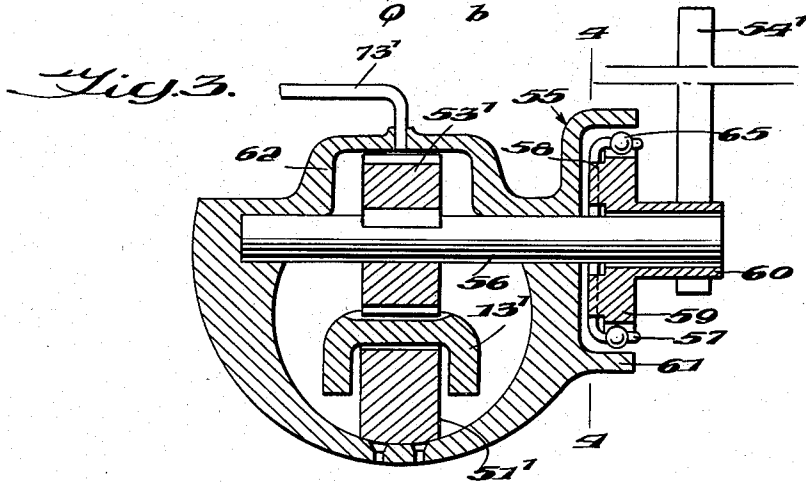
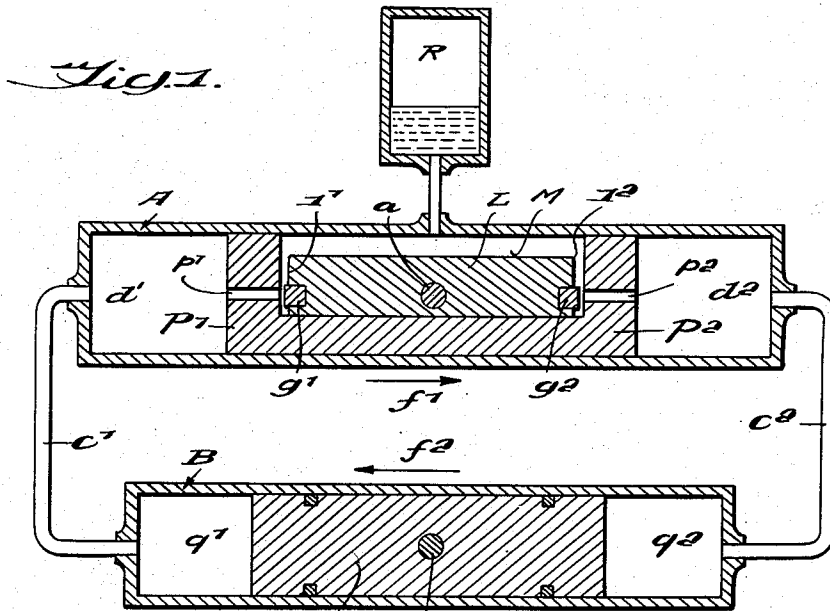


Fig. 4.

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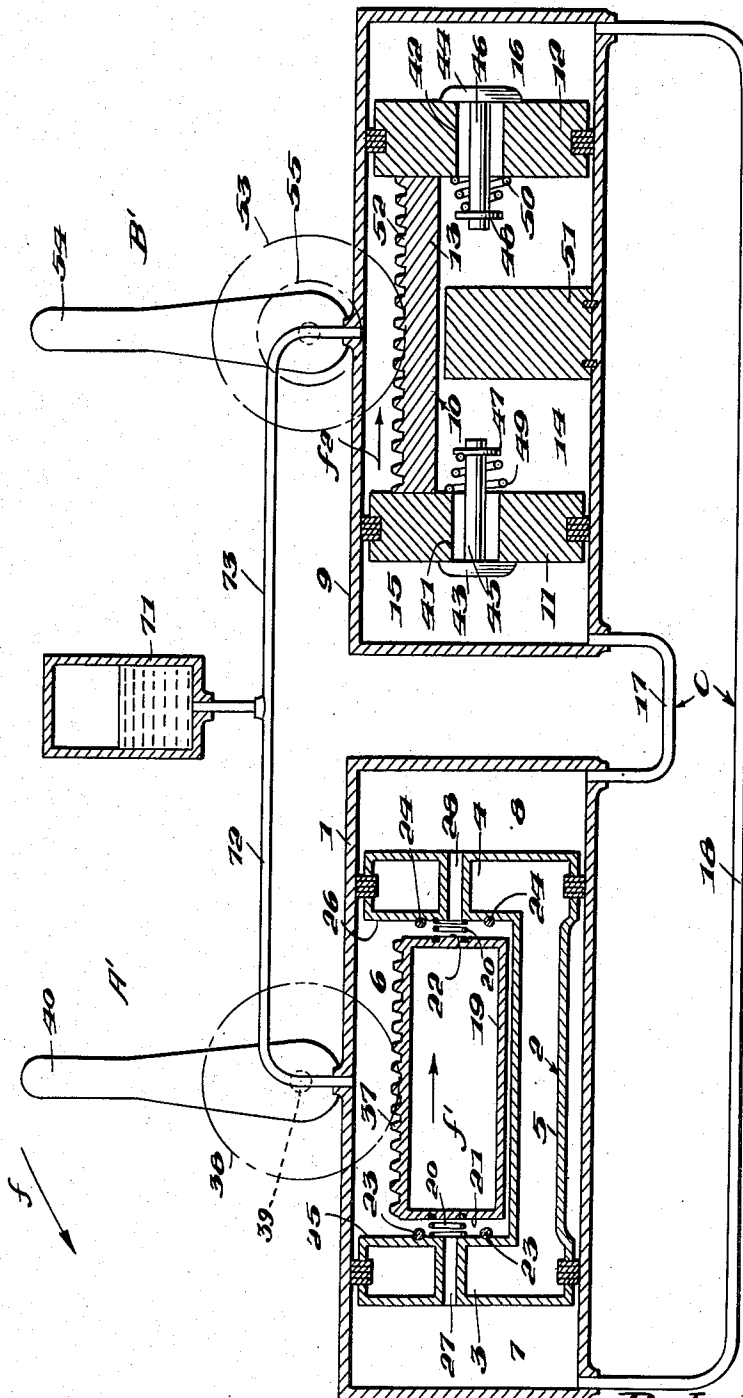
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2 Sheets-Sheet 2

Fig. 2.



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MEANS FOR COMPENSATING FOR LIQUID
VOLUME VARIATIONS IN HYDRAULIC RE-
MOTE CONTROL SYSTEMS

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The present invention relates to hydraulic re-
mote control systems.

More particularly this invention relates to hy-
draulic remote control systems of the type in
which a transmitting station imparts, through
a double hydraulic circuit, movement to a driven
member at a receiving station.

Hydraulic remote control systems are known
which incorporate means that compensate for
leakage and also systems are known which pro-
vide means for maintaining synchronism between
the movement of the driving and driven mem-
bers.

Accordingly, the present invention has for an
object to provide a hydraulic remote control sys-
tem of the type including a transmitting and a
receiving station and a double hydraulic circuit
between the stations with means for compensat-
ing for variations in the liquid volume in the cir-
cuits.

Specifically the remote control system of the
present invention provides means which permit
the expansion and contraction of the liquid in
the fluid circuit to occur at all positions of the
respective driving or driven members in the sys-
tem so that the component structural parts of the
control system are in the proper operating con-
ditions regardless of any temperature changes
that may affect the liquid. This is particularly
true as regards an increase in temperature since
such an increase has an effect of causing a com-
pression in the channels or ducts of the system
and thereby necessitating an increased compo-
nent of the driving force that may be out of pro-
portion to the resistance established by the driven
member.

Still more specifically, this present invention
provides a hydraulic remote control system
which, while incorporating means allowing for
free expansion and contraction of the liquid vol-
ume in the system, also provides a system which
is capable of transmitting powerful driving im-
pulses and still maintain synchronism between
the driving and the driven member at the re-
spective transmitting and receiving stations.

In order to accomplish the foregoing objects,
it is a still more specific object of this invention
to provide in conjunction with the remote con-
trol system a container or tank for liquid with
conduit means providing communication between
the respective stations and this container so that
the entire hydraulic circuit can communicate
with the container. The system is provided with
valve means associated with the transmitting
station which close communication between the

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container and one of the hydraulic circuits prior
to the initiation of a power transmitting move-
ment or stroke and during the duration of such
stroke.

Structurally the present invention has for an
object to provide at a power transmitting station
a cylinder, a double headed piston within the
cylinder and between the heads of the power
transmitter piston, power transmitting means
which is operably connected for movement re-
sponsive to the movement of the driving mem-
ber. The heads of the power transmitter piston
are provided with ports and the power transmit-
ting member constitutes a valve body and has
means normally maintaining the same in spaced
relation to both of the ports so that except dur-
ing the power transmitting period there will be
communication between the heads of the power
transmitter piston and the space beyond the
heads. In this connection the power transmitter
piston has less axial extent than the axial ex-
tent of the cylinder at the transmitting station.
This space between the heads of the power trans-
mitter piston is in communication with the liquid
tank.

It is a further specific object to provide in a
remote control system of the type incorporating
a transmitting and a receiving station each in-
cluding a piston and cylinder arrangement in
which the respective cylinders have a greater ax-
ial extent than the pistons within the same and
the pistons are more than half the length of the
cylinders and in which each piston is a double
headed piston provided with ports through the
heads thereof, a fluid volume compensating
means which includes a tank for containing liquid
and conduit means externally of the cylinders
and communicating with the same medially
thereof so as to provide constant communication
between the tank and the space between the
heads of the pistons, a double hydraulic circuit
including conduits connecting the respective op-
posite ends of the cylinders and valve means as-
sociated with the ports in the heads of each
piston including valve means associated with the
transmitter piston opening toward the space be-
tween the heads of the piston and valve means
associated with the ports of the receiver piston
opening away from the space between the heads
of this receiver piston.

Consistent with the aforementioned object, the
invention has for an object to provide in con-
junction with the receiving station, the double
headed receiver piston of less axial extent than
the receiver cylinder, ports through the heads of

the receiver piston and valve means including stems extending through the ports and terminating within the space between the heads of the receiver piston so that the valves in the respective heads open away from one another and thus toward the space beyond the heads of the receiver piston.

Still more specifically, it is an object to provide in cooperation with the valve stems immediately aforementioned a stationary abutment within the receiver cylinder that is contacted by either valve stem depending on the direction of movement imparted to the receiver piston to open the valve, the stem of which has contacted the abutment to permit fluid to flow from the space beyond the head of the piston, the valve stem of which has contacted the abutment, to the reservoir and vice versa so as to insure synchronism between the position of the driven member with respect to that of the driving member at the completion of the power transmitting stroke.

Further and more specific objects will be apparent from the accompanying drawings, in which:

Figure 1 diagrammatically illustrates one form of hydraulic remote control system incorporating a movable power transmitting member that functions as a valve body associated between the heads of the power transmitter piston,

Figure 2 illustrates diagrammatically and in longitudinal section an embodiment of the invention,

Figure 3 is a transverse cross-sectional view taken medially through a power receiver piston and cylinder arrangement and illustrating the preferred shape of the means that operably connect the receiver piston with the driven member, and

Figure 4 is a sectional view taken on lines 4—4 of Figure 3 and illustrates a one-way drive connection for the driven member.

In the drawings, in Figure 1 the reference character A denotes the power transmitting station and B denotes the receiving station, each of these stations being constituted by a cylinder within which is respectively movable a transmitter piston and a receiver piston. The opposite ends of the transmitter cylinder and receiver cylinder are connected by conduit means externally of the cylinders, C¹ and C², and which conduit means constitute a double hydraulic circuit or connection between the stations. The power transmitter piston is a double headed piston and includes opposite heads P¹ and P². It is to be noted that both the power transmitter and receiver pistons are respectively of less axial extent than the axial extent of their associated cylinders but that each are approximately more than half the length of the cylinders. The space between the heads of the power transmitter piston is denoted by reference character M and a liquid containing tank R is in communication through suitable duct or channels with this space M substantially medially of the length of the cylinder at the transmitting station A. Disposed between the heads P¹ and P² of the power transmitter piston is a power transmitting member L which is of less axial extent than the distance between the heads P¹ and P² so that it constitutes a slider mounted with a limited play within the space or chamber M. A driving member *a* is operably connected to the power transmitting member L. At the receiving station B is a receiver piston Q to which is operably connected a driven member *b*

and which receiver piston Q moves responsive to the impulses transmitted by the movement of the piston at the transmitting station.

The heads P¹ and P² of the power transmitter piston are provided with ports or ducts p¹, p² respectively providing communication between space or chamber M and the chambers d¹ and d² beyond the heads of the transmitter piston. These ducts or ports p¹ and p² open into the space M respectively opposite the end faces l¹ and l² of the power transmitting member L. This power transmitting member L constitutes a double valve body and within the faces l¹ and l² are mounted packing plugs g¹ and g² which cooperate, depending on the movement of the body L with the ports p¹ and p², to close the same.

This arrangement operates as follows: If the valve body or power transmitting member L is moved to the direction of arrow f¹ responsive to movement of the driving member *a*, the packing plug g² in the face l² of the body L bears against the end of the port p² to close the same. As power transmitting movement continues the double valve body L drives the power transmitter piston to the right as shown in the drawings so that liquid passes from chamber d² through conduit C² into chamber q² at the receiving station to initiate movement in the direction of the arrow f², to the left, as viewed in the drawing, in the receiver piston Q and thus a corresponding movement is imparted to the driven member *b*, the liquid in chamber q¹ at the receiving station passing through channel C¹ into chamber d¹.

Any expansion or contraction of the liquid in the system is compensated for substantially instantaneously due to the transfer of liquid between the reservoir or tank R and the particular hydraulic circuit either C¹ or C² through the ports p¹ or p², provided that the openings of the ports are uncovered due to the position of the body L within the space between the heads of the transmitter piston.

It is thus clear that an expansion in either circuit C¹ or C² will permit fluid to flow back through port p¹ or p² respectively, into the space M and thus to the reservoir.

In Figure 2, the transmitting and receiving stations are denoted respectively at A', B'. At the transmitting station is a cylinder 1 within which is mounted a transmitter piston 2. The piston 2 is a double headed piston having spaced opposite heads 3 and 4 interconnected by a rod portion 5. The axial extent of the double headed piston 2 is, as indicated, less than the axial extent of cylinder 1 but more than half of the axial extent thereof. The heads 3 and 4 delimit between them a central chamber or space 6. Beyond the heads are additional chambers 7 and 8, the fluid chamber 7 being comprised between the outer face of the head 3 and the adjacent cylinder wall and the chamber 8 being comprised between the outer face of the head 4 and the inner space of the adjacent wall.

The receiving station B' is also constituted by a cylinder 9 within which is movable a receiver piston including spaced heads 11 and 12 interconnected by a rod portion 13. The receiver piston 10 including its heads has an axial extent less than that of the cylinder 9 but more than half the length of the cylinder 9. The space between the heads 11 and 12 constitutes a chamber 14, while between the outer face of head 11 and the adjacent cylinder end wall is a chamber 15 and between the outer face of piston head 12

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and the adjacent cylinder end wall is a chamber 16.

A double hydraulic circuit is included in this system including the conduit 17, externally of the cylinders and interconnecting chambers 8 and 15, and another conduit 18 also externally of the cylinders and interconnecting chambers 7 and 16. The conduits 17 and 18 constitute a double hydraulic circuit denoted generally at C.

Within the space or chamber 6 between the heads 3 and 4 of the power transmitting piston is mounted a slidable power transmitting member 19. This member 19 constitutes a double valve body and has operative end faces 21 and 22 which can be made of plastic or rubber and which, as shown, are maintained in spaced relation with respect to the adjacent faces 25 and 26 of the piston heads by spring means 20. In other words, the power transmitting member 19 has less axial extent than the space between the piston head faces 25, 26 and the spring means at the opposite ends of the power transmitting member 19, that are mounted respectively between faces 21 and 25 and 22 and 26, tend to maintain the power transmitting member 19 centrally of the space 6. The heads 3 and 4 are bored through to provide ports or ducts 27 and 28. Packing rings 23 and 24 surround the ports or ducts 27 and 28 respectively and cooperate with the end faces 21 and 22 upon movement of the power transmitting member 19 to right or left depending on the direction of movement imparted thereto.

On the upper face of the power transmitting member 19 is a toothed rack 37 that cooperates with a cog wheel denoted diagrammatically at 38 constituting a rack and pinion arrangement. The cog wheel 38 is locked on the shaft 39 upon which is mounted the lever 40 that constitutes the driving member. It is thus clear that movement of lever 40, through the interposition of cog wheel 38 and rack 37 moves power transmitting member 19 accordingly.

At the receiving station, the piston heads 11 and 12 are likewise drilled through to provide ports or ducts 41 and 42 respectively. These ports are respectively controlled by flap valves 43 and 44, the stems 45 and 46 of which extend through the ports 41 and 42 and terminate in the space 14 between the heads 11, 12 of the piston 10. These stems are respectively provided with washers 47 and 48 and are surrounded by springs 49 and 50 interposed between the washers and the adjacent piston head faces which normally bias the valves 43 and 44 to closed position. A stationary abutment 51 is mounted within the space 14 substantially medially of and symmetrical with respect to the mean transverse plane of cylinder 9 so that it is in the path of movement of the valve stems 45 and 46. The rod or member 13 that interconnects the piston heads 11, 12 is U-shaped in cross-section so that the opposite legs of the U pass down on opposite sides of the stationary abutment 51 as indicated with reference to the arrangement of Figure 3. The upper surface of the member 13 is provided with teeth 52 with which cooperate the teeth of a cog wheel 53 so that movement of the receiver piston imparts movement to the wheel 53 and thence through a one-way or non-reversible coupling denoted diagrammatically at 55 of the type as described with reference to Figures 3 and 4, to the lever 54 constituting the driven member. This coupling is such that the movement of the receiver piston moves the driven member 54, but the reverse movement, that is movement of the

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driven member, does not react back on the receiver piston.

Figures 3 and 4 illustrate a portion of the receiving unit of slightly modified form and on a different scale than the illustration in Figure 2 with particular reference to the coupling or non-reversible drive transmitting means between the driven member and the receiver piston. In Figure 3 the cog wheel 53' is locked on a shaft 56. This shaft passes transversely through the receiver cylinder 62 and a conduit, a portion of which 73' provides communication with the space between the heads of the receiver piston, and a tank or reservoir for liquid similar to the tank 71 of Figure 2. A stationary abutment 51' is mounted medially of the bottom of receiver cylinder 62 and cooperates with the heads of the receiver pistons in this cylinder. The power receiving member within the receiver cylinder 62, that is the rod 13' that extends between the heads of the receiver piston, is U-shaped in section as shown and provided with teeth on its upper surface for cooperation with teeth on the wheel 53'. It thus follows that movement of the receiver piston imparts movement to the wheel 53' and thus to shaft 56. On shaft 56 are a plurality of fingers 57, four as illustrated in Figure 4. These fingers engage with clearance, projections 58, two of which are shown, that are mounted on a disk 59. This disk 59 has a tubular extension 60 and is journaled for free rotation about shaft 56. The disk 59 is mounted within an annular crown 61 that forms part of the casing of receiver cylinder 62. This crown 61 is therefore fixed. Inclined planes 63 and 64 are provided on opposite faces of the disk 59 and ball members 65 and 66 are mounted on these inclined planes, spaced apart by spring means 68 disposed between two out-turned ends 69 and 70 of fingers 57. These balls 65 and 66 are normally pushed into the angles of the internal periphery 67 of the annular crown and the respective inclined planes 63 and 64. The driven member 54' is locked for rotation with the tubular extension 60.

It is therefore clear that, while shaft 56 is capable of driving responsive to its rotation, in one or the other direction, the disk 59 and thus driven member 54', the first phase of motion of shaft 56 interrupts the wedging action of the balls, but a reverse rotation, that is starting from driven member 54', is not possible since the balls are wedged.

In both forms of this invention the receiver and transmitter cylinders communicate with the storage container or reservoir. In Figure 2 the reservoir 71 is connected via pipes 72 and 73 at points medially of the length of cylinders 1 and 9 so that there is always fluid communication between the central chambers 6 and 14 and the reservoir 71.

In the operation of the invention, with reference to Figure 2, if lever 40 is turned to the left in the direction of arrow *f*, the slidable power transmitting member 19 is displaced to the right in the direction of arrow *f*¹ and during the first phase of this motion the operative face 22 of member 19 is applied against packing ring 24, if this face was not already against this ring due to the conditions of the liquid, and thus duct or port 28 is closed. As movement of lever 40 is continued, the transmitting member 19 drives piston 2 to the right in cylinder 1. The portion of the liquid in chamber 8 is forced by the head 4 of transmitter piston through conduit 17 into

chamber 15 at the receiving station B'. The entry of liquid under pressure within chamber 15 causes the displacement of the receiver piston in the direction of the arrow f^2 . The liquid from chamber 16 is forced by receiver piston head 12 through pipe 18 and back into chamber 7 at the transmitting station, since the volumetric capacity of chamber 7 has increased due to the movement of transmitter piston. Since the cross-sectional area of cylinders 1 and 9 is the same and the means that operably connect the power transmitting member 19 with the lever 40 and the rod member 13 with the lever 54 being essentially similar the movement of driving member or lever 40 is duplicated by the driven member 54.

If there is an expansion or contraction of the liquid due to variations of temperature, it is substantially immediately compensated for by a transfer of liquid between the reservoir 71 and the proper chamber in the respective cylinders. If, when this expansion or contraction occurs, the power transmitting member 19 is spaced from the piston heads 3 and 4, the outlets of ports 27 and 28 are open and liquid transfer occurs freely through chamber 6. If one of the end faces 21 or 22 of power transmitting member 19 is applied against the adjacent face of a piston head, such as face 21 being applied against face 25, pressure of the liquid in chamber 7 increasing by expansion moves power transmitting member 19 away, that is to its position centrally of chamber 6, so as to open port 27.

A contraction of the liquid in the system can cause the opening of valves 43 and 44 at the receiving station B against the action of springs 49 and 50 and the required resupply of liquid passes from tank 71 into the affected hydraulic circuit 17 or 18 and the associated chambers 3 and 11 or 1 and 16, respectively.

Since the springs 20 assign a definite position to the driving member or lever 40 as regards the position of the power transmitting member 2, as soon as this driving lever is released by the operator, the synchronism between the position of the driven member 54 and the position to which the driving member or lever 40 can be displaced is insured in an accurate manner. In the event the displacement of the driven member 54 establishes only a slight resistance, power transmission is effected without any substantial clearance existing between faces 21 and 22 and 25 and 26 since the face 21 is slightly pressed against the packing rings 23 and 24 and the distances between faces 25 and 26 of piston heads 3 and 4 and faces 21 and 22 of the transmitting member 19 remain substantially constant.

If there is any leakage in the system it is compensated for by delivery of liquid from the container 71 and thence through either circuit or conduits 17 or 18 and through the ports through piston heads 11 and 12.

Furthermore, if for any reason the position of driving member or lever 40 and driven member 54 are no longer in synchronism, a resynchronization is effected by a to and fro movement of the driving lever 40. If, for example, upon rotation of the driving lever 40 in the direction of the arrow f , the driven member 54 is moving out of phase or is leading the movement of the driving member, the receiver piston 10 reaches the end of its stroke before the transmitter piston 2 has reached the end of its stroke. Thus, when the receiver piston 10 reaches the end of its stroke, valve stem 45 contacts abutment 51 and valve 43

is open so that for the remaining period of motion of transmitter piston 2, the liquid expelled from chamber 8 passes through port 41 into the space between piston heads 11 and 12 and thence through conduit 73 into the tank 71. When the transmitter piston 2 has reached the end of its stroke, the two pistons are again in synchronism. Preferably the conduits 72 and 73 communicate with the top of chambers 6 and 14 so as to automatically provide for any substantial increase in pressure.

The essence of the present invention consists in a system for compensating for liquid volume variations in combination with means providing for resynchronization of the receiver with the transmitter. As set forth, the invention is characterized by the fact that the transmitting and receiving stations are each provided with a valve system and that the valves in each system open in opposite directions, in other words the communication between chamber 8 and chamber 6 is normally open while the communication between chamber 15 and chamber 14 is normally closed. Thus any expansion of fluid occurring in line 11 is absorbed by passage through conduit 28 into chamber 6 and returned to the tank and as soon as contraction occurs liquid flows past valve 43 from the chamber 14. Additionally, the valves 43 and 44 which open toward the chambers 15 and 16 cooperate with the fixed abutment 51 so if for any reason the position of the element 40 and of the lever 54 are out of phase, resynchronization is obtained by back and forth movement of the element 40. If, for instance, the receiver piston 10 has for any reason reached the end of its stroke before the power transmitter piston 2 has reached the end of its stroke, stem 45 contacts the abutment, opens valve 43 so that during the remainder of the stroke of the unit 40 2 the liquid flows from chamber 8 past valve 43 and back to the tank.

What I claim is:

1. In a hydraulic remote control system of the type including a transmitting station and a receiving station, movable drive means at the transmitting station for initiating a power stroke in opposite directions, driven means at the receiving station movable in response to the movements of the drive means, each station including a double ended cylinder respectively constituting a transmitter cylinder and a receiver cylinder, a double headed piston movable in each cylinder and respectively constituting a transmitter piston and a receiver piston, each piston having an axial extent more than half the axial extent of its associated cylinder and less than the total axial extent thereof, conduit means externally of the cylinders and respectively providing communication between the opposite ends of the cylinders, and means operably connecting the driven means with the receiver piston, the improvement comprising a fluid volume compensating tank, conduit means connecting the tank in communication with each cylinder at a point lying medially of the length of each cylinder so that the tank is always in fluid communication with the cylinder at the space between the heads of the pistons therein, a movable power transmitting member disposed between the heads of the transmitter piston, means operably connecting the drive means with the power transmitting member so that movement of the drive means moves the power transmitting member and thus the transmitter piston to force fluid into the receiver cylinder to initiate movement of the re-

ceiver piston and thus the driven member, ports through each head of each piston and providing communication between the opposite ends of each cylinder and the space between the heads of each piston and valve means at the heads of each piston controlling communication through the ports.

2. In a hydraulic remote control system of the type including a transmitting station and a receiving station, movable drive means at the transmitting station for initiating a power stroke in opposite directions, driven means at the receiving station movable in response to the movements of the drive means, at each station a double ended cylinder respectively constituting a transmitter cylinder and a receiver cylinder, a double headed piston movable in each cylinder and respectively constituting a transmitter piston and a receiver piston, each piston having an axial extent more than half the axial extent of its associated cylinder but less than the total axial extent thereof, conduit means externally of the cylinders and providing communication between the respective opposite ends of the cylinders, and means operably connecting the driven means with the receiver piston, the improvement comprising a fluid volume compensating tank, additional conduit means extending between the tank and the cylinders and in communication with each cylinder at a point lying medially of the length thereof so as to always provide communication between the tank and the space between the heads of the piston at each station, a movable power transmitting member disposed between the heads of the transmitter pistons, ports through each head of each piston providing communication between the opposite ends of each cylinder and the space between the heads of each piston, valve means at the heads of each piston for controlling communication through said ports, said movable power transmitting member constituting the valve means at the transmitting station, means normally spacing said transmitting member from both heads of the transmitter piston, means operably connecting the drive means with the power transmitting member so that movement of the drive means moves the power transmitting member and thus the transmitter piston to force fluid into the receiver cylinder to initiate movement of the receiver piston and thus the driven means, and said transmitting member being operably in a power transmitting stroke to move to a position closing one of the ports in the head of the transmitter piston before imparting power transmitting movement to said transmitter piston, and said transmitting member maintaining the said port closed during the duration of power transmitting movement.

3. In a hydraulic remote control system of the type defined in and by claim 2, and in which the means for normally maintaining the transmitting member spaced from both heads of said transmitter piston constitute spring means.

4. In a hydraulic remote control system of the type defined in and by claim 2, in which the means for normally maintaining the transmitting member spaced from both heads of said transmitter piston constitute spring means, and the valve means at the heads of the receiver piston constitute normally closed valves carried by the receiver piston and including valve heads cooperable with the respective heads of the receiver piston at the faces thereof adjacent the ends of the receiver cylinder, valve stems pro-

jecting through the ports in the heads of the receiver piston and terminating in the space between the heads of the receiver piston, and spring means for normally holding said last mentioned valves closed.

5. In a hydraulic remote control system of the type defined in and by claim 2, in which the means for normally maintaining the transmitting member spaced from both heads of said transmitter piston constitute spring means, the valve means at the heads of the receiver piston constituting normally closed valves carried by the receiver piston and including valve heads cooperable with the respective heads of the receiver piston at the faces thereof adjacent the ends of the receiving cylinder, valve stems projecting through the ports in the heads of the receiver piston and terminating in the space between the heads of the receiver piston, spring means for normally holding said last mentioned valves closed, and a fixed abutment disposed substantially centrally of and within the receiver cylinder and in alignment with the path of movement of the valve stems carried by the receiver piston whereby depending on the direction of movement of said receiver piston one of said valve stems contacts said abutment to open communication through the port controlled by the valve, the stem of which has contacted the abutment so as to provide communication between the space between the heads of the receiver piston and the space beyond the head carrying the contacting valve stem so as to provide for synchronization of the movement of the receiver piston with respect to the movement of the transmitter piston and also to permit resynchronization of the receiver piston.

6. In a hydraulic remote control system of the type including a transmitter, a driving means for initiating movement in opposite directions thereof, a receiver, a driven means responsive to the movements thereof, said transmitter including a double ended transmitter cylinder, a double headed transmitter piston movable in said cylinder, having an axial extent less than the axial extent of the transmitter cylinder but more than half the axial extent thereof and the heads of said transmitter piston being spaced from one another, said receiver including a double ended receiver cylinder, a double headed receiver piston movable in said receiver cylinder and also having an axial extent less than the axial extent of the receiver cylinder but more than half the axial extent of the receiver cylinder, the heads of said receiver piston being spaced from one another, means operably connecting the receiver piston to the driven means, a double hydraulic circuit between the cylinders including conduit means connected between and respectively providing communication between opposite ends of the cylinders, each head of each piston having a port therethrough through which fluid can flow in the cylinders between the space beyond the heads of each piston and the space between the heads of each piston, a fluid volume compensating tank, conduit means externally of the cylinders connected to the tank and in communication with each cylinder at a point substantially medially of the length thereof so as to provide constant fluid communication between the tank and the space between the heads of each piston, a movable power transmitting member between the heads of the transmitter piston, means operably connecting said driving means with said movable power trans-

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mitting member so that movement of the driving means imparts movement to the power transmitting member and thence to said transmitter piston, said power transmitting member having an axial extent less than the distance between the heads of the transmitter piston, means normally maintaining the transmitting member spaced from the ports in the heads of the transmitter piston so that upon movement of the driving means in a power transmitting stroke in either direction said power transmitting member moves to first close fluid communication between the space between the head of the transmitter piston and the adjacent end of the transmitter cylinder toward which the power transmitting movement is directed and thence to move said transmitter piston so as to force fluid to flow into the end of the receiver cylinder that is in fluid communication with the said adjacent end of the transmitter cylinder to impart movement to the receiver piston and thus to the driven means in correspondence with the movement of the driving means, and normally closed valves controlling fluid flow through the ports in the heads of the receiver piston and movable to open position in response to contraction of fluid volume in the hydraulic circuits between and including the cylinders so as to permit fluid to flow from the tank to the space between the heads of the receiver piston, through the ports in the heads of the receiver piston and into the circuits.

7. In a hydraulic remote control system of the type defined in and by claim 6, in which the means for normally maintaining the transmitting member spaced from both heads of said transmitter piston constitute spring means, the valve means at the heads of the receiver piston constituting normally closed valves carried by the receiver piston and including valve heads

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cooperable with the respective heads of the receiver piston at the faces thereof adjacent the ends of the receiving cylinder, valve stems projecting through the ports in the heads of the receiver piston, spring means for normally holding said last mentioned valves closed, and a fixed abutment disposed substantially centrally of and within the receiver cylinder and in alignment with the path of movement of the valve stems carried by the receiver piston whereby depending on the direction of movement of said receiver piston one of said valve stems contacts said abutment to open communication through the port controlled by the valve, the stem of which has contacted the abutment so as to provide communication between the space between the heads of the receiver piston and the space beyond the head carrying the contacting valve stem so as to provide for synchronization of the movement of the receiver piston with respect to the movement of the transmitter piston and also to permit resynchronization of the receiver piston.

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