

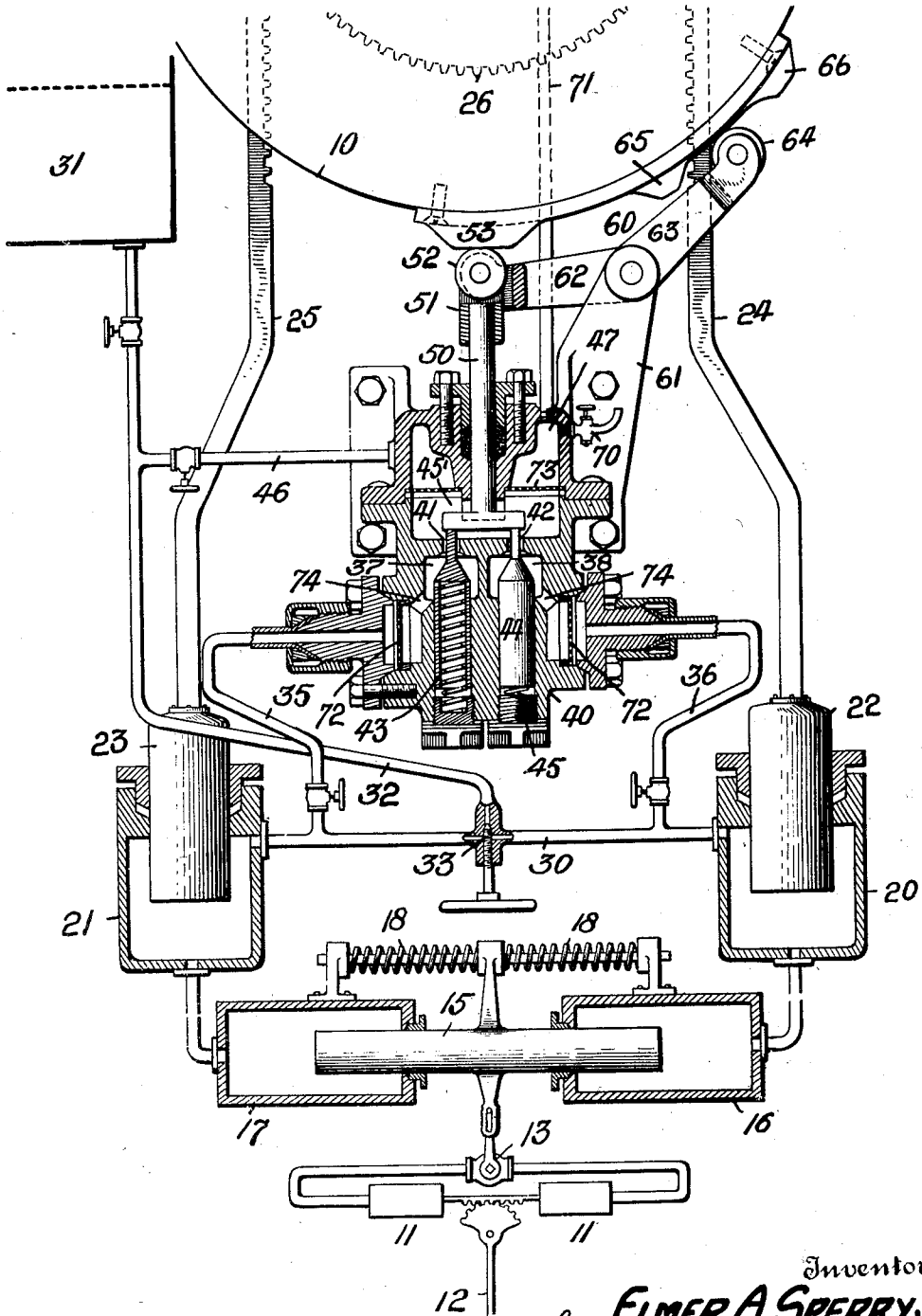
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TELEMOTOR SYSTEM

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UNITED STATES PATENT OFFICE.

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TELEMOTOR SYSTEM.

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This invention relates to telemotor systems of the type employed to operate a ship's rudder from the usual pilot house steering wheel or by an automatic steering device such as the Sperry gyro-pilot. More particularly this invention relates to telemotor systems which employ a substantially incompressible fluid as the transmission medium. It is well known that such systems are subject to errors due to leakage of air therein and to leakage of fluid out of the closed system. The efficiency of the telemotor system depends, of course, upon maintaining the system completely filled with an incompressible fluid, and in maintaining synchronism between the rudder and pilot wheel.

My invention has for one of its objects, the provision of means for segregating any air or other gaseous products which may enter the telemotor system, and the provision of means for getting rid of the air either by hand or automatically.

Another object of this invention is the provision of means for insuring that the entire telemotor system will always be maintained completely filled with incompressible fluid. This means may include the provision of a supply of said fluid, and means for connecting the system with said supply every time the steering wheel or the rudder passes through a predetermined position.

I prefer to accomplish the object set forth in the preceding paragraph preferably by a suitable valve or valves operated by a lever, which in turn is actuated from an operating member, such as the steering wheel. It is another object of my invention to provide means for positively actuating said lever to its effective and ineffective positions to insure positive actuation of the fluid supply controlling valves to open and closed positions.

Further objects and advantages of this invention will become apparent as the description of the invention proceeds.

In the accompanying drawings

The figure is an assembly view, somewhat diagrammatic, and partly sectioned, of a telemotor system embodying my invention.

Referring to the drawings, there is shown a steering wheel 10, adapted to actuate a telemotor system which controls the steering engine 11 for operating the rudder 12 in one

direction or the other. The steering engine may be of the steam or other fluid-pressure controlled type, the pressure being regulated or controlled by a valve 13 adapted to be operated in one direction or the other by an operating member here shown in the form of a piston 15 operating in cylinders 16, 17 containing the fluid of the telemotor system. The piston 15 is normally maintained in centralized position by centralizing springs 18. Obviously, when the fluid in the right hand cylinder 16 is placed under pressure, the piston will be moved toward the left and the fluid will be discharged from the left hand cylinder 17.

The flow of fluid in the said cylinders may be controlled by a second set of cylinders 20—21 connected to said first cylinders 16—17 respectively, the entire connections between the respective sets of cylinders being completely filled with substantially incompressible fluid. In each of said second set of cylinders operates a piston 22—23, the upper ends of which are connected to racks 24—25 geared to opposite sides of a pinion 26, fixed upon the shaft of the steering wheel, so that when said steering wheel is rotated in one direction or the other, the pistons 22—23 in said second set of cylinders are moved in opposite directions, one to compress the fluid therein and cause the operating piston 15 to be moved in a given direction while the other moves outwardly to permit accommodation of the fluid forced out of the other of said first cylinders.

The cylinders 20—21 may be connected to each other by a connection 30, and to a source of fluid supply, such as tank 31, by a connection 32 which may engage connection 30. The supply of fluid to said cylinders by way of connection 30 may be controlled by a needle-valve 33, which not only controls the flow of the fluid from tank 31 to the cylinders, but the flow between the cylinders. In starting, valve 33 is opened to allow both sides of the pressure system to fill with fluid. The interconnection of the two sides of the pressure system through connection 30 insures equalization of volume of fluid in the two sides, since springs 18 maintain piston 15 in centralized position. The valve 33 is then closed to cut off the fluid supply and to

separate the two sides of the pressure system.

It will thus be seen that when the steering wheel is in its zero position, that is, the position corresponding to the neutral position of the rudder, the operating piston 15 will extend to the same degree into said cylinders 16—17 and the pistons 22—23 in the second set of said cylinders will extend into said cylinders to the same degree. If the two sides of the system are completely filled with fluid, then any movement of the steering wheel will be immediately transmitted to the fluid in said cylinders 20—21 and hence to the operating piston 15 and the rudder 12. If, however, air has leaked into the system, then a certain amount of lost motion will be present and a certain error in operation will occur, for the system will not function until the enclosed air has been compressed to the necessary degree.

To relieve any air which has thus leaked into the system and to synchronize the rudder with the steering wheel, I provide the following mechanism:

Both sides of the pressure system are connected by suitable means, such as pipes 35—36 with two valve chambers 37—38 in a casing 40, said valve chambers comprising a set of ports 41—42 with which cooperate valves 43—44, said valves being normally pressed against the valve seats by springs 45 to close said ports. Said ports open into a common fluid chamber 45' connected by piping 46 to the source of fluid supply 31, so that when said valves 43—44 are in open position, both sides of the pressure system are placed in communication with said supply chamber to replenish the supply of fluid therein, while any air in said system passes through the supply chamber into an air dome 47 above said chamber for segregating any air which may have leaked into the system.

Preferably I provide that the valves are opened simultaneously, and preferably each time the steering wheel passes through zero position, that is, the position corresponding to neutral position of the rudder. As the rudder is constantly being swung from one side to the other of its neutral position, the synchronization of the rudder with the steering wheel, the equalization and replenishment of incompressible fluid in the two sides of the pressure system, as well as the segregation of any air from said system, will take place at frequent intervals. For this purpose the valve stems may be provided with a common valve extension 50 which may have a block 51 formed on the upper end in which is mounted a roller 52 adapted to be engaged by a cam 53 fixed on the steering wheel. The cam is so positioned with respect to said wheel that it engages the roller 52 to depress the common

extension 50 and open both valves simultaneously whenever the steering wheel passes through the zero or neutral position. The engagement of the cam with said roller thus places both sides of the pressure system in engagement with said supply chamber so that the same head exists on both ends of piston 15, thus enabling the centralizing springs 18 to restore the piston 15 to central position and synchronize the rudder with the steering wheel. The piston 15 having been returned to central position, both sides of said system are completely filled with fluid, thus equalizing the fluid in the two sides, while any air in said system may pass out into the air dome.

When the steering wheel moves to one side or the other of its central or neutral position, the cam disengages the roller and the springs 45 return the valves to their closed positions and raise the extension 50 to its upper position. In addition to these springs, I provide positive means for closing the valves just as I have provided positive means (cam 53 and extension 50) for opening the valves. Said means may comprise a bell crank 60 pivoted on a bracket 61 which may be attached to, or formed integral with, the casing 40, one arm 62 of said bell crank engaging the block 51 on the upper end of said extension 50, the other arm 63 of said bell crank being provided with a roller 64 adapted to engage one or the other of a pair of cams 65, 66. Said cams are so positioned that they will engage the said roller 64 as soon as said first cam 53 disengages the roller 52 on the upper end of said extension, cam 65 engaging said roller 64 when the steering wheel is rotated in one direction and the other cam 66 engaging said roller when the steering wheel is rotated in the opposite direction. By this means the bell crank is operated positively in a clockwise direction to raise the extension and close the valves.

Since the three cams hereinbefore described bear a definite relation to each other and to the steering wheel to which they are attached, they may be formed as one integral member and suitably attached to the steering wheel in proper relation thereto.

It should be noted that the valves 43—44 are placed above the operating cylinders 20 and 21 and that the reservoir containing the air dome 47 is placed above the valves. This arrangement is important if all the air in the system is to be properly gotten rid of, as otherwise pockets of air will form in the system which will not be discharged when the valves are open.

In order to separate the segregated air within the air dome from the telemotor system, I may provide a stopcock 70 in the upper end of said dome so that said air may be manually discharged. In addition there-

to, or in lieu thereof, I may provide a stand-
pipe 71 running into the upper end of said
air dome and extending upwardly to a point
above the level of the fluid in the supply
5 tank 31 so that the air will rise through
said standpipe and discharge through the
top thereof.

Within the casing 40 I may provide suit-
able screens 72-73 to prevent undue oscil-
10 lations of the fluid therein and also restrict-
ed passages 74 to cause a relatively slow and
steady equalization movement between the
two sides of the pressure system.

In accordance with the provisions of the
15 patent statutes, I have herein described the
principle and operation of my invention,
together with the apparatus which I now
consider to represent the best embodiment
thereof, but I desire to have it understood
20 that the apparatus shown is only illustrative
and that the invention can be carried out
by other means. Also, while it is designed
to use the various features and elements in
the combination and relations described,
25 some of these may be altered and others
omitted without interfering with the more
general results outlined, and the invention
extends to such use.

Having herein described my invention,
30 what I claim and desire to secure by Let-
ters Patent is:

1. In a telemotor system, a pilot wheel,
an operating member, a hydraulic pressure
system for operating said member from the
35 pilot wheel, and means operable when said
pilot wheel is in a predetermined position
for equalizing the liquid throughout the
system and for separating out air.

2. In a telemotor system, an operating
40 member, a pressure system adapted to em-
ploy a substantially incompressible fluid op-
erated by said member, a chamber contain-
ing a supply of said fluid and having an air
dome, and means operable by movement of
45 said member whereby said pressure system
is connected to said chamber for replenish-
ing the supply of fluid in said pressure sys-
tem and permitting discharge of any air
within said pressure system into said air
50 dome.

3. In a telemotor system, an operating
member, a pressure system adapted to em-
ploy a substantially incompressible fluid for
operating said member, including a chamber
55 having an air dome, a valve whereby said
pressure system may be connected to said
chamber to permit discharge of any air
within said pressure system into said air
dome and positive means for opening and
60 closing said valve.

4. In a telemotor system, an operating
member, a pressure system adapted to em-
ploy a substantially incompressible fluid for
operating said member, a chamber having
65 an air dome, means for intermittently con-

necting said pressure system to said cham-
ber to permit discharge of any air within
said pressure system into said air dome, and
means for releasing the air from said air
dome.

5. In a telemotor system, a pressure sys-
tem adapted to be operated by a substan-
tially incompressible fluid, an air dome, op-
erating cylinders, means located at a higher
point in the system than said cylinders for
75 discharging any air within said pressure
system into said air dome, and means for
releasing the air from said air dome.

6. In a telemotor system, an operating
member, a pressure system adapted to em-
80 ploy a substantially incompressible fluid for
operating said member, a chamber contain-
ing a supply of said fluid, means whereby
said pressure system may be connected to
said chamber for replenishing the supply
85 of fluid in said pressure system and per-
mitting discharge of any air within said
pressure system into said chamber, and
means for positively actuating said first
means to effective and ineffective positions.

7. In a telemotor system, an operating
member, a pressure system adapted to em-
ploy a substantially incompressible fluid
for operating said member, a chamber con-
90 taining a supply of said fluid, means where-
by said pressure system may be connected to
said chamber for replenishing the supply of
fluid in said pressure system and permit-
ting discharge of any air within said pres-
95 sure system into said chamber, means for
positively actuating said first means to effec-
tive position, and means for positively ac-
tuating said first means to ineffective po-
sition.

8. In combination, a steering wheel, a
105 telemotor system operated thereby, said sys-
tem including an operating member, a pres-
sure system adapted to employ a substan-
tially incompressible fluid for operating said
member, means for maintaining said pres-
110 sure system filled with said fluid and for
separating out any air from said pressure
system, including a valve located above said
operating member and an air dome above
said valve, and means whereby said steering
115 wheel operates said first means every time
said wheel passes through a predetermined
position.

9. In combination, a steering wheel, a tele-
motor system operated thereby, said system
120 including an operating member, a pressure
system adapted to employ a substantially
incompressible fluid for operating said mem-
ber, a chamber containing a supply of said
fluid and having an air dome, means where-
125 by said pressure system may be connected to
said chamber for replenishing the supply of
said fluid in said pressure system and per-
mitting discharge of any air within said
pressure system into said air dome, and
130

means whereby said steering wheel operates said first means every time said wheel passes through a predetermined position.

10. In combination, a steering wheel, a telemotor system operated thereby, said system including an operating member, a pressure system adapted to employ a substantially incompressible fluid for operating said member, means for maintaining said pressure system filled with said fluid and for separating out any air from said pressure system, means whereby said steering wheel operates said first means to effective position every time said wheel passes through a predetermined position, and means whereby said steering wheel operates said first means to ineffective position when said wheel moves beyond said predetermined position.

11. In combination, a steering wheel, a telemotor system operated thereby, said system including an operating member, a pressure system adapted to employ a substantially incompressible fluid for operating said member, means for maintaining said pressure system filled with said fluid and for separating out any air from said pressure system, including a valve located above said operating member and an air dome above said valve and a cam carried by said steering wheel whereby said first means is operated to effective position every time said wheel passes through a predetermined position.

12. In combination, a steering wheel, a telemotor system operated thereby, said system including an operating member, a pressure system adapted to employ a substantially incompressible fluid for operating said member, means for maintaining said pressure system filled with said fluid and for separating out any air from said pressure system, a cam carried by said steering wheel whereby said first means is operated to effective position every time said wheel passes through a predetermined position, and a second cam carried by said steering wheel for operating said first means to ineffective position when said wheel moves beyond said predetermined position.

13. In combination, a steering wheel, a telemotor system operated thereby, said system including an operating member, a pressure system adapted to employ a substantially incompressible fluid for operating said member, means for maintaining said pressure system filled with said fluid and for separating out any air from said pressure system, a cam carried by said steering wheel whereby said first means is operated to effective position every time said wheel passes through a predetermined position, and a set

of cams carried by said steering wheel for operating said first means to ineffective position when said wheel moves beyond said predetermined position in either direction.

14. In combination, a steering wheel, a telemotor system operated thereby, said system including an operating member, a pressure system adapted to employ a substantially incompressible fluid for operating said member, means for maintaining said pressure system filled with said fluid and for separating out any air from said pressure system, positively-acting means whereby said steering wheel operates said first means to effective position every time said wheel passes through a predetermined position, and positively-acting means whereby said steering wheel operates said first means to ineffective position when said wheel moves beyond said predetermined position.

15. In combination, a steering wheel, a rudder, a telemotor system operated by said wheel for controlling said rudder, means permitting synchronization of said rudder and said wheel, said means including a valve, and means for positively actuating said valve to open and closed positions.

16. In combination, a steering wheel, a rudder, a telemotor system operated by said wheel for controlling said rudder, means permitting synchronization of said rudder and said wheel, said means including a valve, and cam means for positively actuating said valve to open and closed positions.

17. In combination, a steering wheel, a rudder, a telemotor system operated by said wheel for controlling said rudder, said system including an operating member, and means for applying a separate fluid-pressure system to each end of said member, means permitting synchronization of said rudder and said wheel, said means including a valve interconnecting said pressure systems, and means for positively actuating said valve to open and closed positions.

18. In combination, a steering wheel, a rudder, a telemotor system operated by said wheel for controlling said rudder, said system including an operating member, and means for applying a separate fluid-pressure system to each end of said member, means permitting synchronization of said rudder and said wheel, said means including a valve interconnecting said pressure systems, and cam means for positively actuating said valve to open and closed positions.

In testimony whereof I have affixed my signature.

ELMER A. SPERRY, Jr.