

March 4, 1941.

H. W. PRICE

2,234,008

PRESSURE PRODUCING DEVICE

Filed March 17, 1938

4 Sheets-Sheet 1

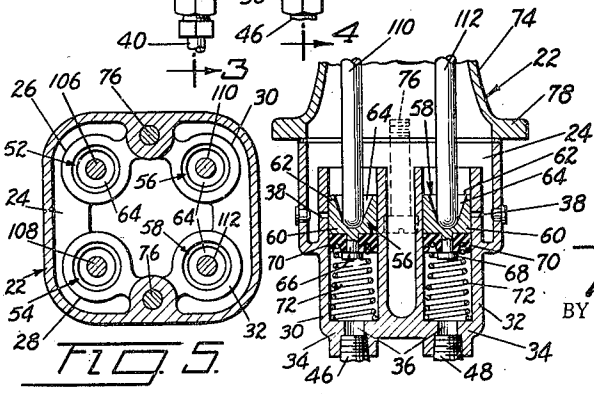
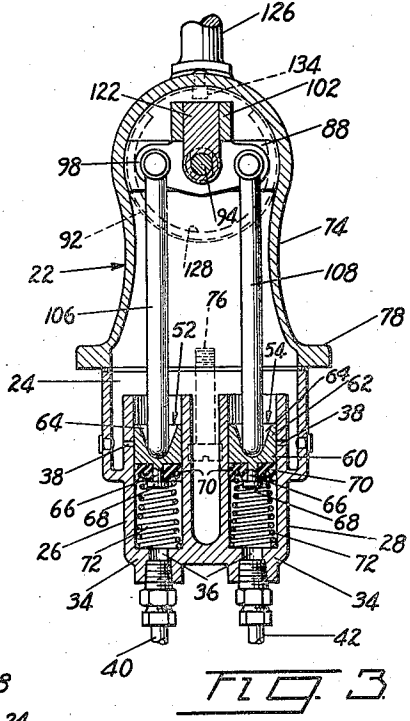
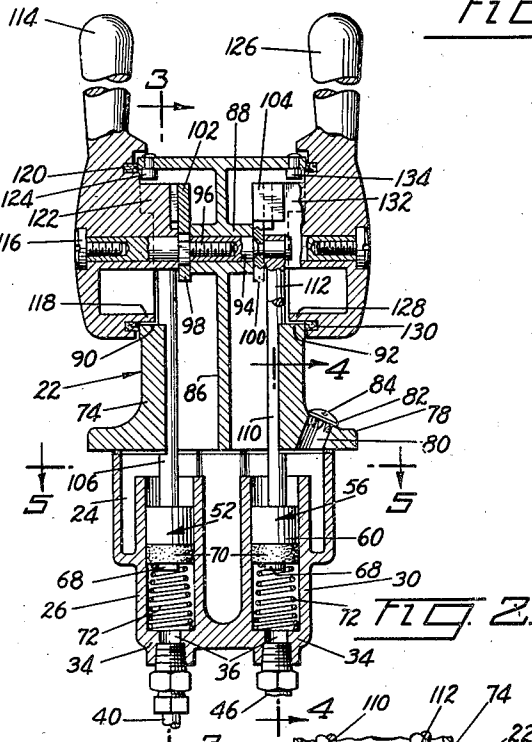
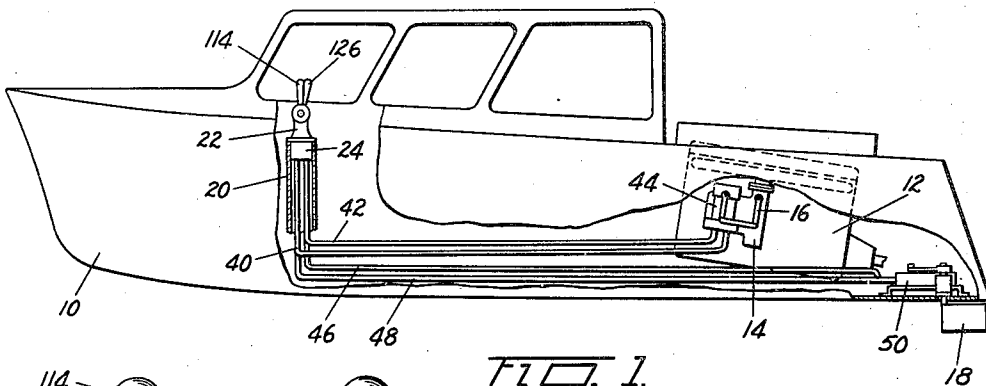


FIG. 4

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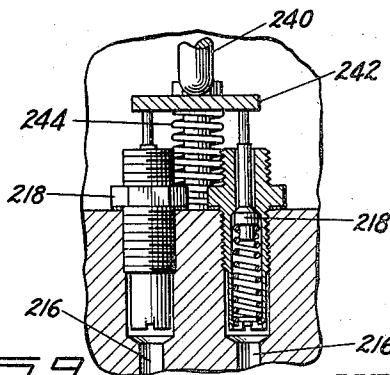
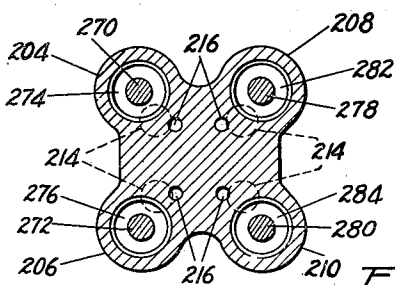
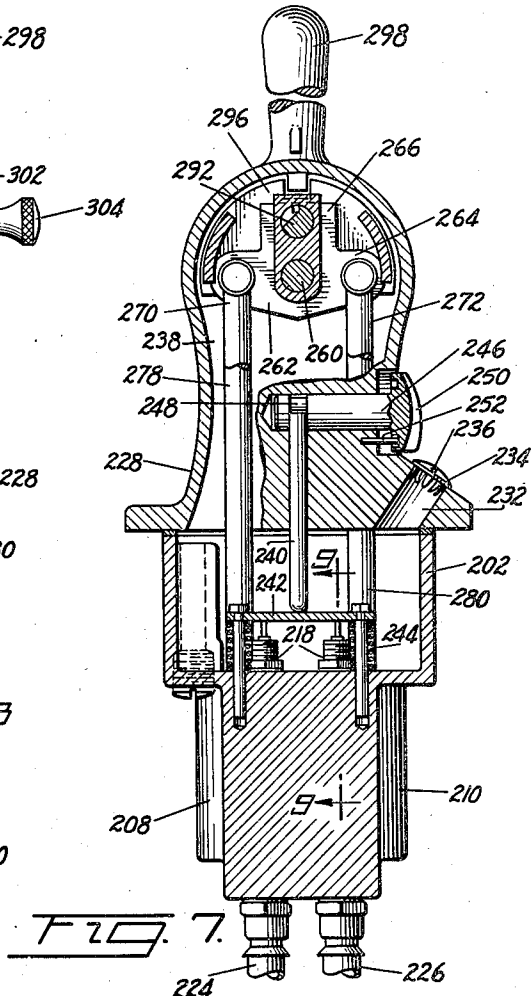
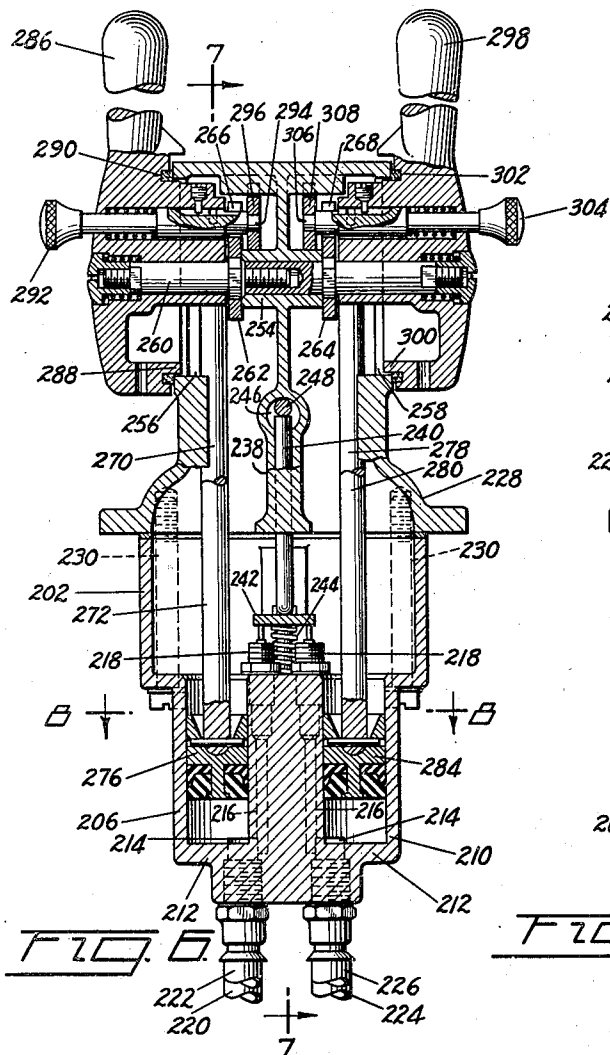
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4 Sheets-Sheet 2



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PRESSURE PRODUCING DEVICE

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4 Sheets-Sheet 3

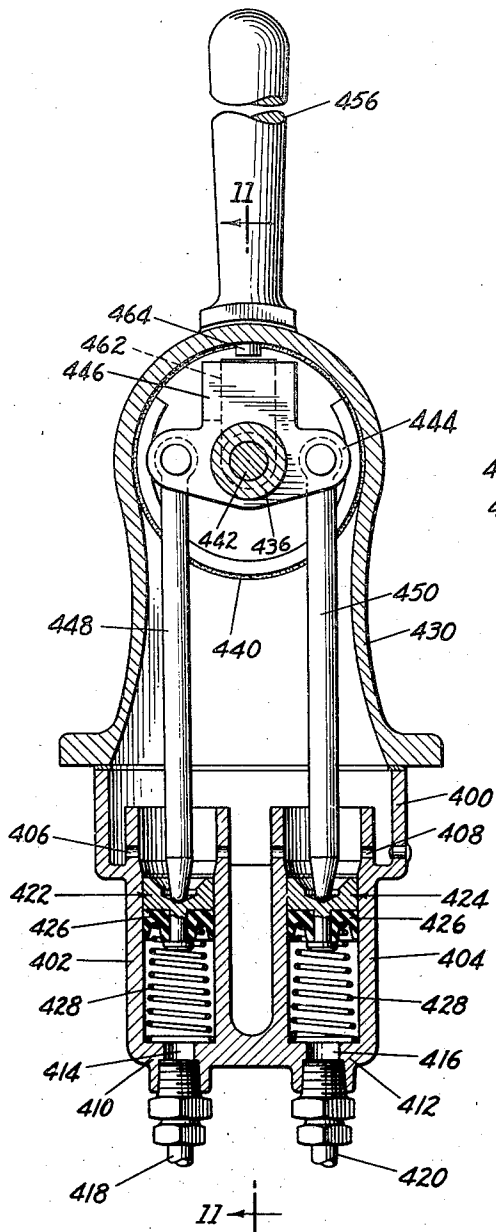


FIG. 10.

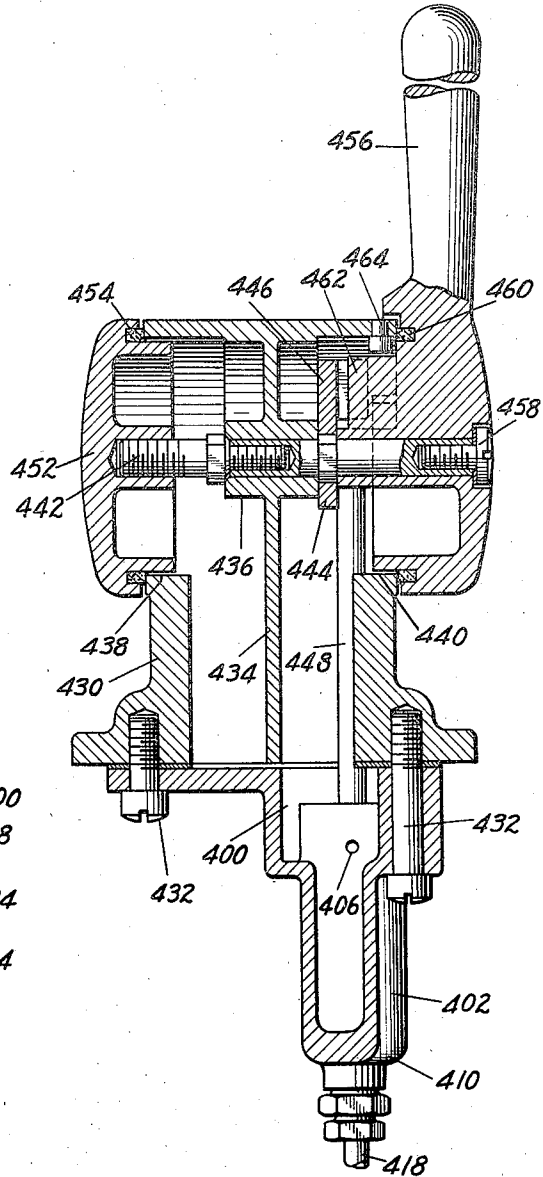


FIG. 11.

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PRESSURE PRODUCING DEVICE

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4 Sheets-Sheet 4

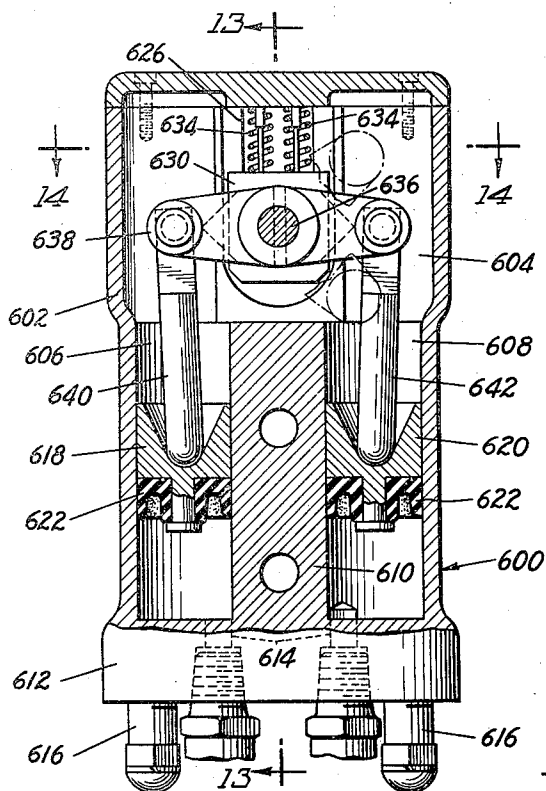


FIG. 12.

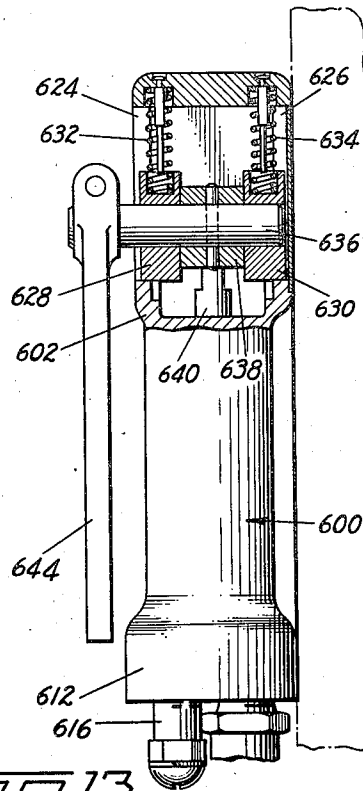


FIG. 13.

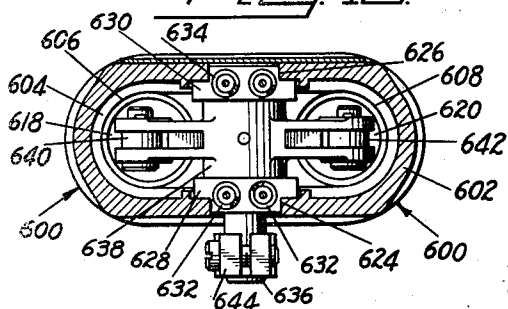


FIG. 14.

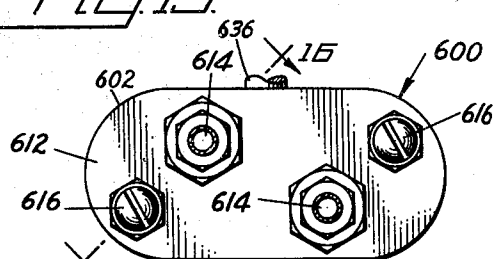


FIG. 15.

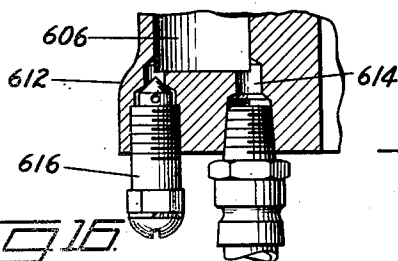


FIG. 16.

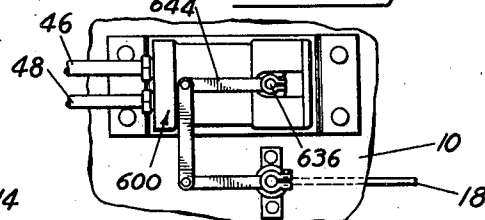


FIG. 17.

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UNITED STATES PATENT OFFICE

2,234,008

PRESSURE PRODUCING DEVICE

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Application March 17, 1938, Serial No. 196,344

2 Claims. (Cl. 60—54.6)

This invention relates to fluid pressure systems. Broadly the invention comprehends a duplex fluid pressure system for actuating remote apparatus.

An object of the invention is to provide a duplex fluid pressure system including a duplex pressure producing device of unique and compact structure.

Another object of the invention is to provide a duplex fluid pressure system including a duplex fluid pressure producing device having means compensating for overcharging the systems.

Another object of the invention is to provide a fluid pressure actuated motor operative to actuate an apparatus and to compensate for variations in the pressure on the fluid so as to stabilize the pressure and thus avoid over-actuation of the apparatus.

Other objects and features of the invention will appear from the following description taken in connection with the drawings forming a part of this specification, and in which—

Fig. 1 is a side elevation of a motor boat equipped with a fluid pressure system embodying the invention;

Fig. 2 is a vertical sectional view of a duplex fluid pressure producing device;

Fig. 3 is a vertical sectional view of the duplex fluid pressure producing device taken substantially on line 3—3, Fig. 2;

Fig. 4 is a fragmentary view, substantially on line 4—4, Fig. 2;

Fig. 5 is a cross-sectional view substantially on line 5—5, Fig. 2;

Fig. 6 is a vertical sectional view illustrating a modified form of the fluid pressure producing device;

Fig. 7 is a vertical sectional view, substantially on line 7—7, Fig. 6;

Fig. 8 is a fragmentary view, substantially on line 8—8, Fig. 6;

Fig. 9 is a cross-sectional view, substantially on line 9—9, Fig. 7;

Fig. 10 is a vertical sectional view of another modification of the fluid pressure producing device;

Fig. 11 is a sectional view substantially on line 11—11, Fig. 10;

Fig. 12 is a vertical sectional view of a fluid pressure actuated motor adaptable for operation by the different fluid pressure producing devices;

Fig. 13 is a vertical sectional view substantially on line 13—13, Fig. 12;

Fig. 14 is a cross-sectional view substantially on line 14—14, Fig. 12;

Fig. 15 is a bottom plan view of the motor;

Fig. 16 is a sectional view substantially on line 16—16, Fig. 15; and

Fig. 17 is a diagrammatical illustration of a preferred connection between the fluid pressure actuated motor and the apparatus to be operated.

Referring to the drawings for more specific details of the invention, 10 represents a motor boat having mounted in its stern an internal combustion engine or power plant 12 equipped with a carburetor 14 provided with a throttle 16. The boat also has mounted in its stern a conventional rudder 18, and mounted in the forward end of the boat is a column 20 supporting a duplex fluid pressure producing device indicated generally at 22.

As shown, the duplex fluid pressure producing device 22 comprises a reservoir 24 fitted in the upper end of the column 20, and arranged in the bottom of the reservoir in spaced parallel relation to one another are four cylinders, 26, 28, 30 and 32. The cylinders are arranged in pairs, one pair oppositely disposed to the other pair. Each cylinder has one end opening directly into the reservoir and its other end closed as by a head 34 provided with a discharge port 36, and each cylinder has a port 38 providing a communication between the cylinder and the reservoir.

The discharge ports of the cylinders 26 and 28 are connected respectively by fluid pressure delivery pipes or conduits 40 and 42 to a fluid pressure actuated motor 44 associated with the carburetor 14, and suitably connected to the throttle 16 thereof. Correspondingly, the discharge ports of the cylinders 30 and 32 are connected respectively by fluid pressure delivery pipes or conduits 46 and 48 to a fluid pressure actuated motor 50 associated with the steering post of the rudder and suitably connected to the steering arm thereof.

The cylinders 26, 28, 30 and 32 have mounted therein corresponding pistons 52, 54, 56 and 58. Each of these pistons includes a head 60 and a skirt 62 providing a recess 64 back of the head. The head has thereon a concentric extension 66, and on the free end of the extension is a flange 68. A sealing cup 70 seated on the head has a lip embracing the extension back of the flange, and a return spring 72 is interposed between the sealing cup and the head of the cylinder.

A housing 74 superimposed on the reservoir and secured thereto as by bolts 76 has at its base a flange 78 overhanging the top of the column so as to support the reservoir in the column, and

arranged in the flange is a filling opening 80 normally closed as by a plug 82 having openings 84 for venting the reservoir to the atmosphere.

The housing has a central web 86 supporting a transverse sleeve 88, and arranged in the wall of the housing concentrically with respect to the sleeve are oppositely disposed openings 90 and 92. The sleeve has mounted therein a two-part shaft 94 threaded together as indicated at 96 so that the overall length of the shaft may be regulated, and rockably mounted on the shaft at the respective ends of the sleeve are walking beams 98 and 100 provided respectively with centrally disposed upwardly extended U-shaped arms 102 and 104. The ends of the walking beam 98 have pivoted thereto thrust pins 106 and 108 received by the recesses in the backs of the pistons 52 and 54, and, correspondingly, the walking beam 100 has pivoted to its ends thrust pins 110 and 112 received by the recesses in the backs of the pistons 56 and 58.

An operating lever 114, rockably mounted on the shaft 94 and suitably secured against displacement as by a screw 116 threaded in the shaft, has an annular part 118 closing the opening 90 and also an annular gland 120 filled with a suitable packing for the exclusion of dust from the casing. The lever 114 has thereon a driver 122 embraced by the arm 102 on the walking beam 98, and a suitable stop 124 for limiting the movement of the lever is mounted in the top of the casing. By rocking the lever 114 the thrust pins 106 and 108 may be advanced or retracted so as to actuate the pistons 52 and 54.

Correspondingly, an operating lever 126 rockably mounted on the shaft 94 and secured against displacement by a screw threaded in the shaft has an annular part 128 closing the opening 92 and an annular gland 130 filled with a suitable packing for the exclusion of dust from the casing. The lever 126 carries a driver 132 embraced by the arm 104 on the walking beam 100, and mounted in the top of the casing is a stop 134 for limiting the movement of the lever. By rocking the lever 126 the thrust pins 110 and 112 may be advanced or retracted so as to actuate the pistons 56 and 58.

In a normal operation, upon rocking the levers 114 and 126, the fluid pressure actuated motors 44 and 50 may be energized so as to operate the throttle of the carburetor 14 and steering arm of the rudder 18. By movement of the lever 114 forward, force is transmitted therefrom through the walking beam 98 and thrust pin 106 to the piston 52 in the cylinder 26, resulting in advancing the piston on its compression stroke. Concomitantly with this operation, the thrust pin 108 is retracted, resulting in release of the piston 54 in the cylinder 28 and the return of the piston 54 under the influence of the return spring 72 and the fluid within the conduit 42 to a position back of the port 38 so as to establish communication between the cylinder 28 and the reservoir. Placing the reservoir in fluid transmitting communication with the conduit 42 permits a portion of the fluid within the conduit and below the piston 54 to flow into the reservoir in the event that the same has been expanded by heat. Furthermore, this connection permits of a so-called bleeding of the system; that is, any trapped air will pass into the reservoir.

As the piston 52 advances on its compression stroke, fluid is displaced from the cylinder 26 through the discharge port 36 and fluid pressure delivery pipe or conduit 40 into the fluid pressure

actuated motor 44, causing energization of the motor, resulting in advancing the throttle 16 of the carburetor 14. During this operation, fluid is returning from the motor, through the fluid pressure delivery pipe or conduit 42 to the cylinder 28, thence through the port 38 to the reservoir.

By rocking the lever 114 backwardly, force is transmitted therefrom through the walking beam 98 and thrust pin 108 to the piston 54, resulting in moving the piston on its compression stroke and concomitantly retracting the thrust pin 106, resulting in release of the piston 52 and the return thereof past the port 38 so as to establish communication between the cylinder 26 and the reservoir. As the piston 54 advances on its compression stroke, fluid is displaced from the cylinder 28 through the discharge port 36 and the fluid pressure delivery pipe or conduit 42 to the fluid pressure actuated motor 44, resulting in energization of the motor, resulting in retarding the throttle of the carburetor, and during this operation fluid is returning from the motor through the fluid pressure delivery pipe or conduit 40 to the cylinder 26, thence to the reservoir by way of the port 38.

Another embodiment of the invention is illustrated in Figs. 6 to 9, both inclusive. In this embodiment of the invention a reservoir 202 has depending from its bottom and opening directly into the reservoir a plurality of cylinders 204, 206, 208 and 210. The outer ends of these cylinders are closed as by a head 212 common to all of the cylinders, and the head has a plurality of openings providing discharge ports 214, one for each cylinder, and each discharge port communicates with a duct 216 opening into the reservoir and controlled as by a spring-pressed valve 218.

The discharge port of the cylinder 204 and the discharge port of the cylinder 206 are connected respectively by fluid pressure delivery pipes or conduits 220 and 222 to fluid pressure actuated motor 44 for actuating the throttle 16 of the carburetor 14. Correspondingly, the discharge ports of the cylinders 208 and 210 are connected respectively by fluid pressure delivery pipes or conduits 224 and 226 to the steering arm of the rudder 18.

A casing 228 imposed on the reservoir 202, and suitably secured thereto as by bolts 230, has a filling opening 232 communicating with the reservoir and normally closed as by a cap 234 provided with openings for venting the reservoir to the atmosphere. The casing has a central web 238 provided with a bore, and mounted in this bore for reciprocation is a thrust pin 240 having its lower end seated on a plate 242 supported by springs 244 above and in engagement with the stems of the valves 218. The upper or other end of the thrust pin 240 is engaged by a key mounted in the wall of the casing. As shown, the key includes a shaft 246 having formed thereon a cam 248 engaging the thrust pin 240 and a knob 250 for turning the key, and mounted in the wall of the casing is a pin 252 for retaining the key in adjusted position. By manipulation of the key, the valves 218 may be opened or closed to relieve pressure in the respective fluid pressure delivery pipes of the system; for oftentimes, during the operation of the controls, the fluid in the system is expanded by heat. Accordingly, the pilot of the boat has but to turn the knob 250 to open one or the other of the valves 218 and permit a portion of the fluid to pass into the

reservoir. In the event the fluid in the system contracts due to cold, it will also be apparent that by opening the valves 218 fluid may flow into the conduits and chambers beneath the pistons. The volume of fluid in the system may thus be maintained constant, and the off positions of the several pistons and connected controls may be maintained at the same setting.

The web 238 supports adjacent the top of the casing a transverse sleeve 254, and arranged in the wall of the casing concentrically to the sleeve and oppositely disposed with respect to one another are openings 256 and 258. A two-part shaft 260 supported in the sleeve 254 has mounted thereon for rotation at the respective ends of the sleeve walking beams 262 and 264 provided respectively with upwardly extended centrally disposed arms 266 and 268. The ends of the walking beam 262 are connected by thrust pins 270 and 272 to pistons 274 and 276 mounted for reciprocation in the cylinders 204 and 206. Correspondingly, the ends of the walking beam 264 are connected by thrust pins 278 and 280 to pistons 282 and 284 mounted for reciprocation in the cylinders 208 and 210.

An operating lever 286 mounted for rotation on the shaft 260 has an annular part 288 fitted in the opening 256 and sealed as by a suitable packing 290. The lever 286 carries a spring-pressed plunger 292 received by an opening in the arm 266 on the walking beam so as to effectively connect the walking beam to the lever, and on the free end of the plunger is a reduced portion 294 adapted to enter an opening in a fixed support 296 so as to lock the lever against movement.

Correspondingly, an operating lever 298 mounted for rotation on the shaft 260 and suitably secured against displacement has an annular part 300 fitted in the opening 258 and sealed as by a suitable packing 302. The lever 298 carries a spring-pressed plunger 304 received by an opening in the arm 268 of the walking beam 264 so as to effectively connect the lever to the walking beam, and the free end of the plunger has a reduced portion 306 adapted to enter an opening in a fixed support 308 so as to lock the lever against movement.

In a normal operation, when it is desired to actuate the carburetor, the plunger 292 carried by the lever 286 is partly retracted so as to unlock the lever. Thereafter the lever 286 may be rocked to actuate the walking beam 262, and upon actuation of the walking beam the pistons 274 and 276 are advanced or retracted according to the direction of movement of the lever. Upon actuation of the pistons, fluid is displaced from the cylinders 204 and 206 through the fluid pressure pipes or conduits to the fluid pressure actuated motor 44 connected to the carburetor so as to energize the motor and concomitantly relieve pressure on the fluid in the motor.

Correspondingly, when it is desired to actuate the rudder, the plunger 304 carried by the lever 298 may be partly retracted so as to unlock the lever, and thereafter the lever may be rocked to actuate the walking beam 264. Actuation of this walking beam results in actuation of the pistons 282 and 284. As the pistons are advanced or retracted, according to the direction of movement of the lever, fluid is discharged from one of the cylinders 208 and 210 through the discharge port and fluid pressure delivery pipes into the motor 50 connected to the rudder, and concomitantly therewith pressure on the fluid in the other cylinder

is released so as to compensate for fluid returning from the motor.

Yet another modification of the invention is illustrated in Figs. 10 and 11. In this modification a reservoir 400 has depending from its bottom and opening directly into the reservoir a pair of parallel cylinders 402 and 404. The cylinders have ports 406 and 408 providing communications between the cylinders and the reservoir, and heads 410 and 412 provided with discharge ports 414 and 416 connected as by fluid pressure delivery pipes or conduits 418 and 420 to a fluid pressure actuated motor corresponding to either motor 44 or 50. The ports 406 and 408 function for the same purpose as the ports 38 in the modification disclosed in Figure 2; that is, they enable trapped air in the system to pass into the reservoir and, if the fluid is expanded by heat, permit a portion of the fluid to pass into the reservoir.

Pistons 422 and 424 are mounted for reciprocation in the cylinders 402 and 404. Each of the pistons includes a head supporting a sealing cup 426 and a skirt having a recess, and positioned in the cylinders between the sealing cups and the heads of the cylinders are return springs 428.

A housing 430 superimposed on the reservoir, and secured thereto as by bolts 432, has therein a web 434 supporting a transverse sleeve 436, and arranged in the wall of the housing concentrically to the sleeve and oppositely disposed with respect to one another are openings 438 and 440.

A two-part shaft 442 supported in the sleeve 436 has rotatably mounted thereon at one end of the sleeve a walking beam 444 having a centrally disposed upwardly extended arm 446, and pivoted to the ends of the walking beam are thrust pins 448 and 450 received by the recesses in the skirts of the pistons 422 and 424.

The opening 438 is closed as by a cap 452 threaded on the shaft 442, and a suitable packing 454 carried by the cap serves to exclude dust from the housing. A lever 456 mounted for rotation on the shaft 442 and suitably secured against displacement as by a screw 458 in the end of the shaft has an annular portion fitted in the opening 440 and provided with a suitable packing 460 for the exclusion of dust from the housing. The lever 456 has thereon a driver 462 interconnected with the arm 446 on the walking beam 444, and mounted in the wall of the housing is a pin 464 for limiting the movement of the lever.

In operation, upon movement of the lever 456, the walking beam is actuated, and force is transmitted therefrom through the thrust pins 448 and 450 to either of the pistons 422 and 424, according to the direction of movement of the lever, and the other piston is released. This results in movement of one of the pistons on its compression stroke and the return of the other piston to its retracted position under the influence of the retractile spring.

As the piston advances on its compression stroke, the fluid in the cylinder forward of the piston is displaced therefrom through its discharge port and one of the fluid pressure delivery pipes to the motor, resulting in energization of the motor, and concomitantly therewith fluid is returning from the motor through the other fluid pressure delivery pipe to the cylinder in which the piston has moved to its retracted position.

A fluid pressure actuated motor 600 corresponding to the motors associated with the carburetor and rudder is illustrated in Figs. 12 to 17, both inclusive. As shown, this motor comprises

a housing or casing 602 having therein a chamber 604 and a pair of corresponding cylinders 606 and 608 arranged in parallel relation to one another and spaced apart by a web 610 disposed longitudinally and centrally of the casing. Each of the cylinders has one of its ends opening into the chamber 604 and its other end closed as by a head 612 having an opening providing a discharge port 614 for the cylinder and another opening normally closed as by a bleeder screw 616.

Pistons 618 and 620 are mounted for reciprocation in the cylinders 606 and 608. Each of these pistons includes a head and a skirt. The head has suitably secured thereon a sealing cup 622, and the skirt has a recess formed therein. The wall of the chamber 604 has oppositely disposed slots 624 and 626, and mounted for reciprocation in these slots are corresponding bearing blocks 628 and 630 yieldingly held against movement by springs 632 and 634 interposed between the blocks and the top of the casing.

A shaft 636 mounted for rotation in the bearing blocks 628 and 630 has keyed thereto between the bearing blocks a walking beam 638, and pivoted to the ends of the walking beam are thrust pins or rods 640 and 642 received in the recesses formed in the skirts of the pistons 618 and 620, and keyed to the shaft 636 outside of the casing is a lever 644 adapted to be connected by suitable linkage to the apparatus it may be desired to actuate.

In a normal operation of this motor, fluid under pressure received by one of the cylinders 606 and 608 results in advancing the piston in the cylinder receiving the fluid, and this movement of the piston transmits force through one of the thrust pins to the walking beam, resulting in actuation thereof, and this actuation of the walking beam transmits force therefrom to the other piston, resulting in advancing the piston on its compression stroke and the consequent displacement of fluid from the other cylinder.

Rocking of the walking beam drives the shaft 636, and this results in moving the lever 644

through an angle, and this movement of the lever 644 may be transmitted by suitable linkage to the apparatus to be actuated. In instances where the pressure on the fluid is excessive for the purpose of effectively actuating the apparatus, and to inhibit overrunning, the bearings of the walking beam are yieldingly supported.

Although this invention has been described in connection with certain specific embodiments, the principles involved are susceptible of numerous other applications that will readily occur to persons skilled in the art. The invention is, therefore, to be limited only by the scope of the appended claims.

Having thus described the various features of the invention, what I claim as new and desire to secure by Letters Patent is—

1. A fluid pressure producing device including a reservoir, four cylinders housed within and secured to said reservoir, a piston in each cylinder, a housing member secured to said reservoir above said cylinders, a web member within said housing member, a sleeve secured to said web member, a two-part shaft rotatably mounted within said sleeve, a walking beam mounted on each shaft, four thrust pins interconnecting the four ends of said walking beams with the four pistons, and means secured to each shaft for rotating the same.

2. A fluid pressure producing device including a reservoir, four cylinders housed within and integrally secured to said reservoir, a piston in each cylinder, a cup-shaped housing member secured to said reservoir above said cylinders, a web member within said housing member dividing said housing into two compartments, a sleeve secured to said web member, a two-part shaft rotatably mounted within said sleeve, a walking beam mounted on each shaft, four thrust pins interconnecting the four ends of said walking beams with the four pistons, and means secured to each shaft for rotating the same.

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