Feb. 22, 1955 J. L. PETERSON 2,702,508

HYDRAULIC CONTROL SYSTEM FOR ADJUSTABLE HOSPITAL BEDS

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FIG. 1.

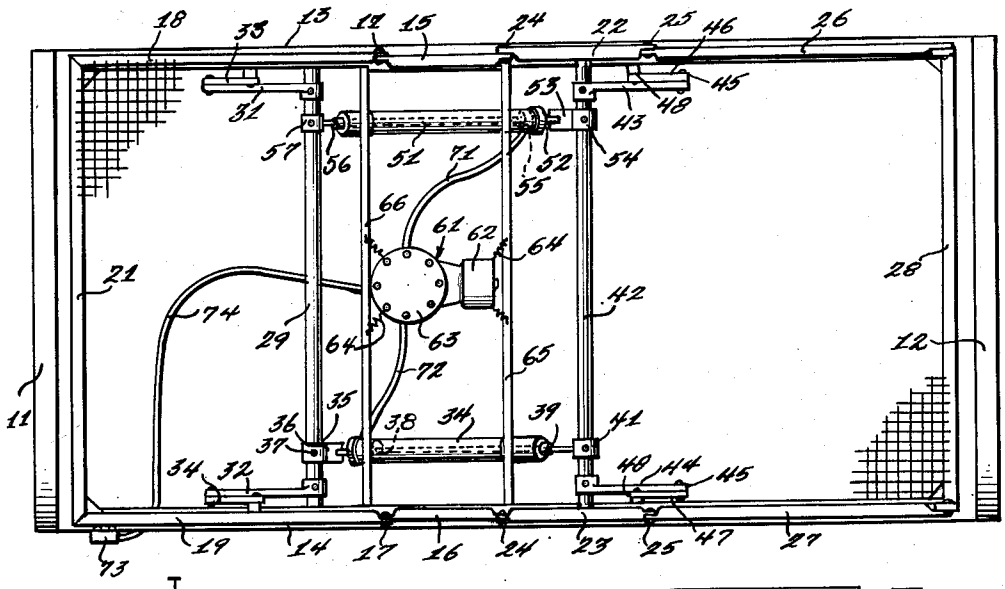


FIG. 2.

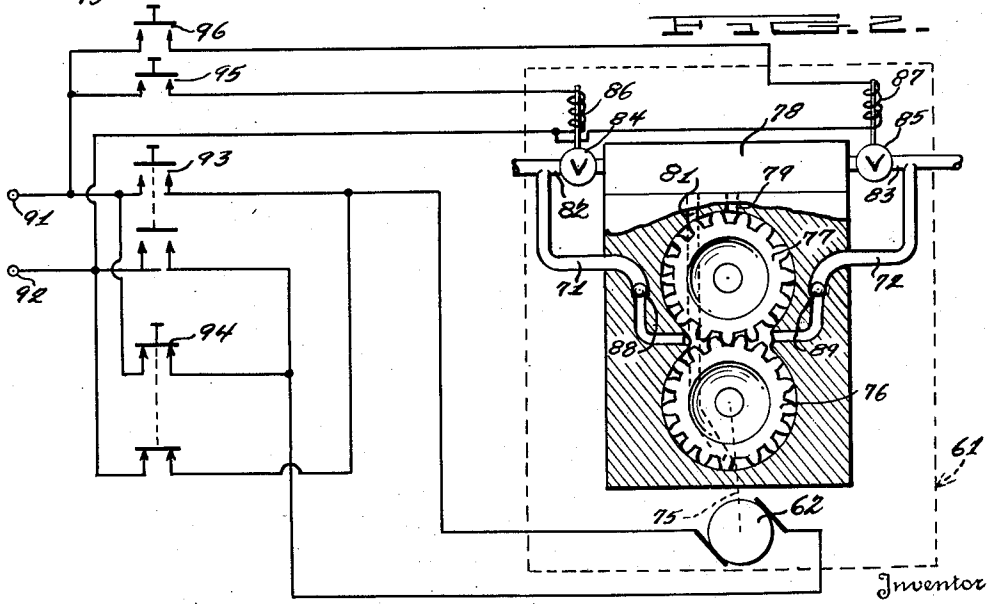
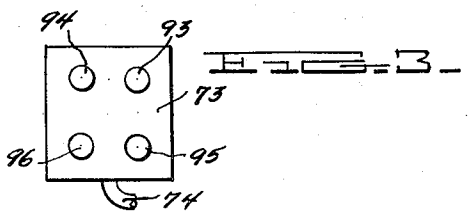


FIG. 3.



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HYDRAULIC CONTROL SYSTEM FOR ADJUSTABLE HOSPITAL BEDS

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1 Claim. (Cl. 103—3)

This invention relates to hydraulically operated hospital beds and particularly concerns an improved control system whereby the patient may easily and safely operate the bed to any desired position.

In hospital beds of the type to which this invention relates, the bed spring is adjustable in two ways. First, the head of the bed spring may be raised upwardly so the whole head end portion of the bed is raised to lift the upper part of the patient's body above a horizontal position. Second, a portion of the bed spring below the patient's knees is raised upwardly by turning the center portion of the bed spring about a pivot in the frame, and permitting the foot end of the bed spring to slide horizontally along the frame. In my earlier Patent No. 2,263,784, there is shown an arrangement in which a hydraulic pump supplies hydraulic fluid pressure to two separate hydraulic cylinders for individually operating the bed spring in its two above-described movements.

In the control of these hydraulic cylinders, it is necessary, first, that all controls be conveniently accessible to a patient in the bed and, secondly, that the movements of the bed be effected only when the patient desires them. It is essential that, when the patient releases the control, the movement of the bed be arrested. It is important that the controls be positive and that there be no danger of the bed continuing to move when not so desired by the patient.

It is, therefore, a major object of this invention to provide an improved control system for a hydraulically operated hospital bed wherein the controls are centered at a position convenient for operation by the patient and in which the patient has positive control over the operation.

More specifically, it is an object of this invention to provide an electrical control box containing switches for electrically controlling upward and downward movements of the head end of the bed spring, and upward and downward movements of the knee portion of the bed spring.

In accordance with these objects, important features of this invention reside in the connection of the two hydraulic cylinders of the bed to opposite sides of a gear type electrically driven pump. The selection of the cylinder to be operated, that is the end of the bed to be raised, is determined by the direction in which the motor is driven. The patient in the bed may select either of two switches in the control box to start the motor running in one direction or the other. Lowering movements of the bed are controlled by solenoid operated valves in the hydraulic conduits connecting the hydraulic cylinders to a sump or reservoir. Two switches in the control box may be operated to selectively operate either of these solenoid valves whereby either the head or the knee portion of the bed spring may be lowered.

Other objects and advantages of the invention will become apparent from the following specification taken in connection with the accompanying drawing wherein

Figure 1 is a top plan view of a hospital bed embodying the invention in its preferred form;

Fig. 2 is a schematic diagram of the hydraulic system with the electrical controls therefor; and

Fig. 3 is an enlarged plan view of the electrical control box shown in Fig. 1.

In accordance with the preferred form of the invention, movements of the two portions of the bed spring are controlled by a pair of independent hydraulic cylinders and the pistons therein. These cylinders are respectively connected by hydraulic couplings to opposite sides of an electrically driven gear type hydraulic pump. With

this arrangement, the supply of hydraulic fluid to one cylinder or the other is determined by the direction of rotation of the gear pump which, in turn, is determined by the direction in which the electric motor is driven. A pair of switches in a control box conveniently accessible to a patient in the bed are connected in an electrical circuit to start the motor in one direction or the other dependent upon whether the patient wishes to raise the head or the foot portion of the bed spring. A branch coupling is connected between each of the hydraulic couplings and a sump. Solenoid operated valves in these branch couplings respectively control the exhaust of fluid pressure from the two cylinders. A second pair of switches in the control box are electrically connected to operate either of these two valves, depending upon whether the patient wishes to lower his head or his knees. Check valves are inserted in the hydraulic couplings between the branch couplings and the gear pump to prevent undesired exhaust of fluid pressure from the hydraulic cylinders.

For a detailed description of the invention reference may be had to the accompanying drawings. In Fig. 1 a hospital bed is illustrated having a bedstead with head and foot portions **11** and **12**, connected by side frame members **13** and **14**. A bed spring on the bedstead has stationary side frame members **15** and **16** and a central portion of the bed is pivotally connected at **17**, **17**, to a head frame having side members **18** and **19** connected by a transverse head member **21**. The bed spring frame has intermediate portions **22** and **23**, pivotally connected at **24**, **24**, to the other ends of side frame members **13** and **14**, and also pivotally connected at **25**, **25**, to side frame members **26** and **27** of a foot frame having a transverse foot member **28**.

To raise the head frame of the bed spring, a rotatable shaft **29** journaled in a bracket (not shown), below the bedstead, has a pair of lever arms **31** and **32**, fixed thereto, and pivotally connected to links **33** and **34** which are, in turn, pivoted to a mid-portion of the side members **18** and **19** of the head frame. The shaft **29** may be turned by a hydraulic cylinder **34** to raise or lower the head frame. The hydraulic cylinder **34** has its closed end pivoted at **35**, to a lever **36**, fixed by a collar **37**, to the shaft **29**. A piston **38** has its piston rod **39** secured to a collar **41** rotatable on another shaft **42** similar to the shaft **29**.

It will be apparent, that the application of hydraulic fluid to the cylinder **34** will move the piston **38**, and the piston rod **39**, to cause movement of the lever **36**, which will turn the shaft **29**, with its links **31** and **32**, and raise the head frame of the bed spring.

The shaft **42** has lever arms **43** and **44** fixed thereto and pivoted at **45**, **45**, to links **46** and **47** which are, in turn, pivoted at **48**, **48**, to the intermediate side frame members **22** and **23**. To turn the shaft **42**, a hydraulic cylinder **51** has its closed end pivoted at **52**, to a lever arm **53**, secured by a collar **54**, to the shaft **42**. A piston **55** has its piston rod **56** secured to a collar **57** rotatable on the shaft **29**. Thus, application of fluid pressure to the cylinder **51** will cause turning movements of the lever arm **53** and the shaft **42** to raise the intermediate frame members **22** and **23** and thereby lift the knee portion of the bed, the foot of the bed sliding horizontally along the bedstead away from the foot **12** of the bedstead.

A motor pump unit **61** consisting of an electric motor **62** and a hydraulic gear pump **63** is suspended by springs **64**, **64**, from crosspieces **65** and **66** of the bed frame. The gear pump **63** is connected by hydraulic couplings **71** and **72** to hydraulic cylinders **51** and **34**, respectively.

Control of the movements of the bed spring is effected by electric switches in a control box **73** which may be connected through an electric cable **74** to the motor pump unit **61**.

For a better understanding of the control of the motor pump unit, reference may be had to Fig. 2, which shows, diagrammatically, the hydraulic and electrical circuits. The reversable electric motor **62** drives through a shaft **75** to rotate the gears **76** and **77** of the gear pump. The gear pump includes a sump or reservoir **78**, which is connected by conduits **79** and **81**, to the gears **77** and **76**, respectively.

Hydraulic oil, supplied from the sump **78** to the gears

of the pump, is fed under pressure from opposite sides of the gear pump through conduits 71 and 72 to the hydraulic cylinders 51 and 34, respectively. Connected between these hydraulic couplings 71 and 72 and the sump 78 are a pair of branch couplings 82 and 83, in which are inserted control valves 84 and 85, respectively, operated by solenoids 86 and 87. A ball check valve 88 is positioned in the hydraulic coupling 71, between the branch coupling 82 and the gear pump, to prevent flow of hydraulic oil to the pump. A similar ball check valve 89 is arranged in the hydraulic coupling 72, between the branch coupling 83 and the pump.

Electric power for operating the motor 62 and the solenoids 86 and 87 may be supplied from any suitable source, as represented by terminals 91 and 92. The supply of electric power to the motor 62 is controlled by either of two push button switches 93 or 94. Both of these switches are normally biased to open positions. Closure of the switch 93 connects the motor 62 in one way to the source of power and depression of the switch 94 reverses these connections to cause the opposite direction of rotation of the motor.

If the patient wishes his head raised, he depresses push button 93 which causes the motor to be driven in a direction to turn the gears of the gear pump so fluid pressure is supplied to conduit 72. Ball check valve 88 prevents the flow of fluid pressure from the conduit 71. This fluid pressure from conduit 72 acts on piston 38 to raise the head frame. When his head is high enough, the patient releases the push button and the head frame remains in the selected position.

If the patient wishes his knees raised, he pushes the push button 94, which causes a reverse direction of rotation of the motor, so hydraulic oil is supplied under pressure through conduit 71, to the hydraulic cylinder 51. Movement of the piston in that hydraulic cylinder turns the shaft 42 and raises the knee portion of the bed spring to raise the knees of the patient.

The solenoid 86 may be connected to the source of electric power by push button 95 and the solenoid 87 may be similarly connected by a push button 96. Both of these push buttons are normally biased to open position. If the patient desires to lower his head, he depresses push button 96, which energizes solenoi 87, to open the valve 83 and permit the exhaust of oil from the hydraulic cylinder 34, through a portion of hydraulic coupling 72 and the branch coupling 83, to the sump 78. Upon release of the push button 96, downward movement of the head of the bed spring will be arrested, so the patient's head will be held in any desired position. To lower the knee portion of the bed spring, the patient depresses push button 95, which actuates solenoid 86 to open valve 84, and permits the exhaust of hydraulic oil from the cylinder 51 through the branch conduit 82 to the sump 78.

As illustrated in Fig. 3, the four push buttons are conveniently arranged in the control box 73, which is placed adjacent the head end of the bed, where it is readily accessible to the patient. Movements of the head and/or knee portion of the bed spring are effected only during that interval which the patient depresses one of the push

buttons of the control box. Immediately upon release of the push button, the electrical circuits are opened and all movements of the bed spring cease. With this arrangement, the movements are positively controlled by the patient, so the bed is entirely safe and there is no danger of continued operation after the patent releases the push button. It is unnecessary for the patient to take any positive action to prevent further movement of the bed spring.

Furthermore, this simplified control of the hydraulic system may be more economically manufactured and less likely to require service or will require service at less frequent intervals. It is not necessary to have precise adjustments of the controls because the only controls are ordinary electric push button switches which are well developed and available on the market.

What is claimed is:

A motor pump unit comprising a gear pump including a pair of meshed gears, pump housing means providing a chamber closely confining said gears, sump means, first liquid conduit means connecting said sump means to said chamber at a point adjacent the periphery of one of said gears remote from the zone of meshing of said gears, second liquid conduit means connecting said sump means to said chamber at a point adjacent the periphery of the other of said gears remote from the zone of meshing of said gears, first pressure outlet conduit means extending from said chamber from a point at one side of the zone of meshing of said gears, first by-pass conduit means including a valve connecting said first pressure outlet conduit means to said sump means, second pressure outlet conduit means extending from said chamber from a point at the other side of the zone of meshing of said gears, second by-pass conduit means including a valve connecting said second pressure outlet conduit means to said sump means, a check valve in each of said pressure outlet conduit means between said chamber and the point of connection of the associated by-pass conduit therewith, a motor, means drivingly connecting said motor to said gears, means for reversing the direction of drive of said pump gears, and means for selectively operating the valves in said by-pass conduit means.

References Cited in the file of this patent

UNITED STATES PATENTS

1,595,381	Christensen	Aug. 10, 1926
1,687,523	Staude	Oct. 16, 1928
1,948,951	Walker	Feb. 27, 1934
2,047,898	Staude	July 14, 1936
2,065,912	Staude	Dec. 29, 1936
2,168,649	Johnson	Aug. 8, 1939
2,193,497	Spire	Mar. 12, 1940
2,263,784	Peterson	Nov. 25, 1941
2,311,864	Parsons	Feb. 23, 1943
2,389,164	Payne	Nov. 20, 1945

FOREIGN PATENTS

126,594	Great Britain	May 15, 1919
253,397	Germany	Nov. 1912