July 22, 1952 A. A. DANIELSEN ET AL 2,603,796

HOSPITAL BATHTUB

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Fig. 1.

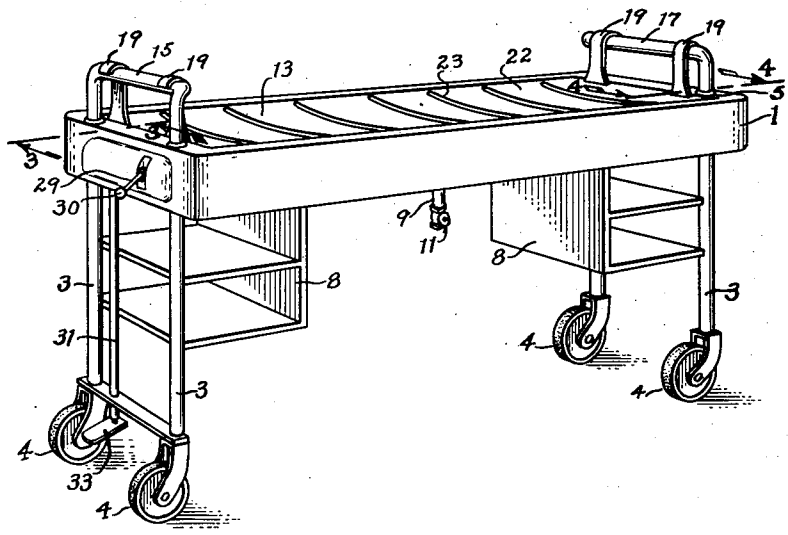
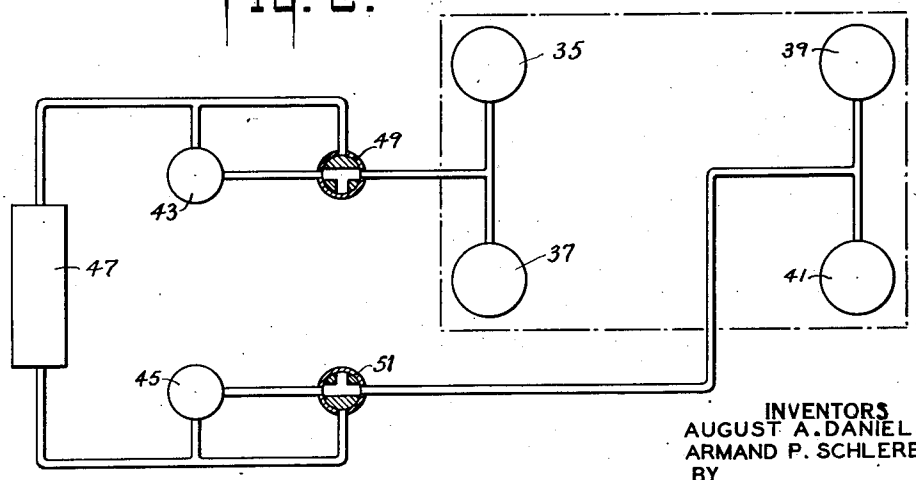


Fig. 2.



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HOSPITAL BATHTUB

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Fig. 3.

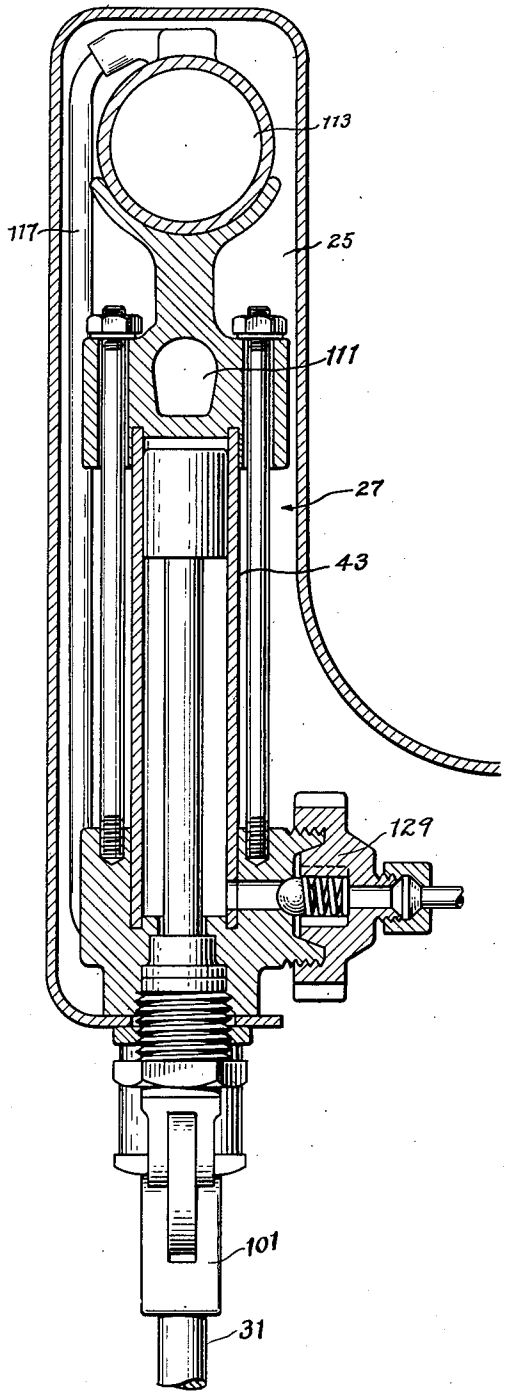
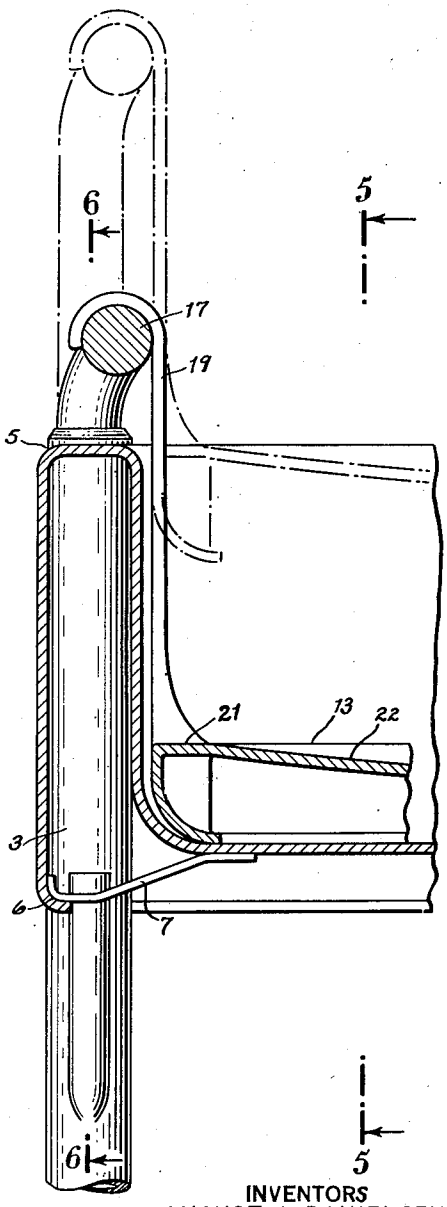


Fig. 4.



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HOSPITAL BATHTUB

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Fig. 5.

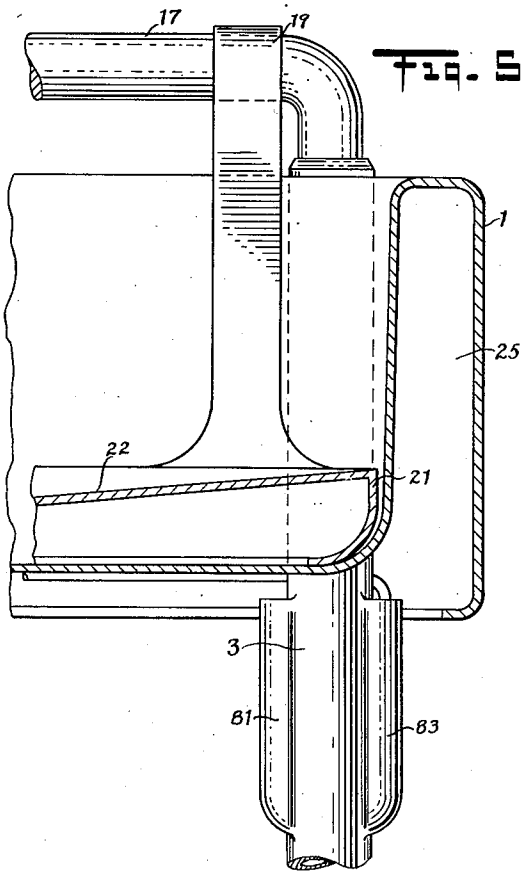


Fig. 6.

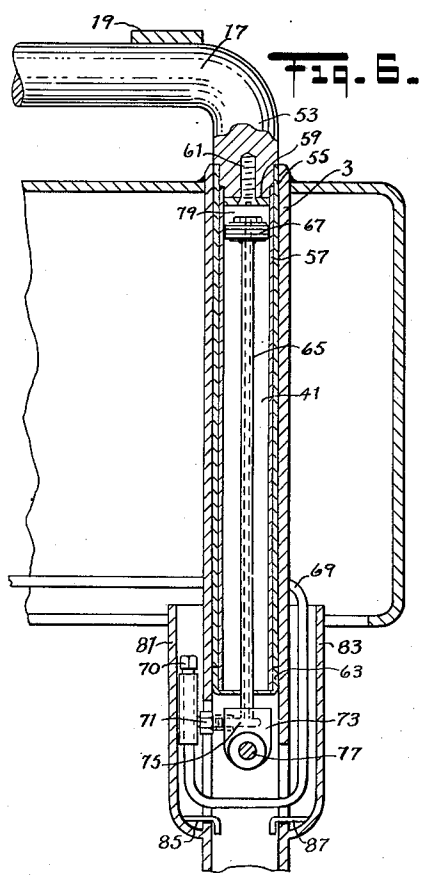
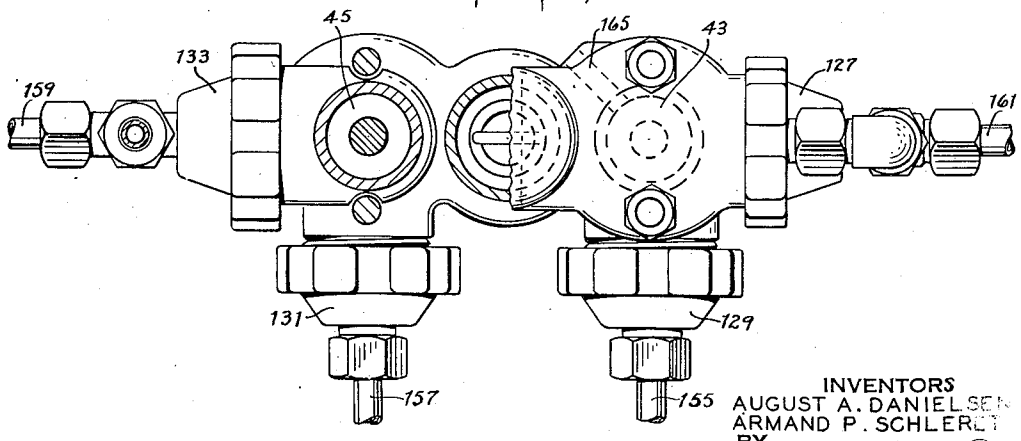


Fig. 7.



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HOSPITAL BATHTUB

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Fig. 8.

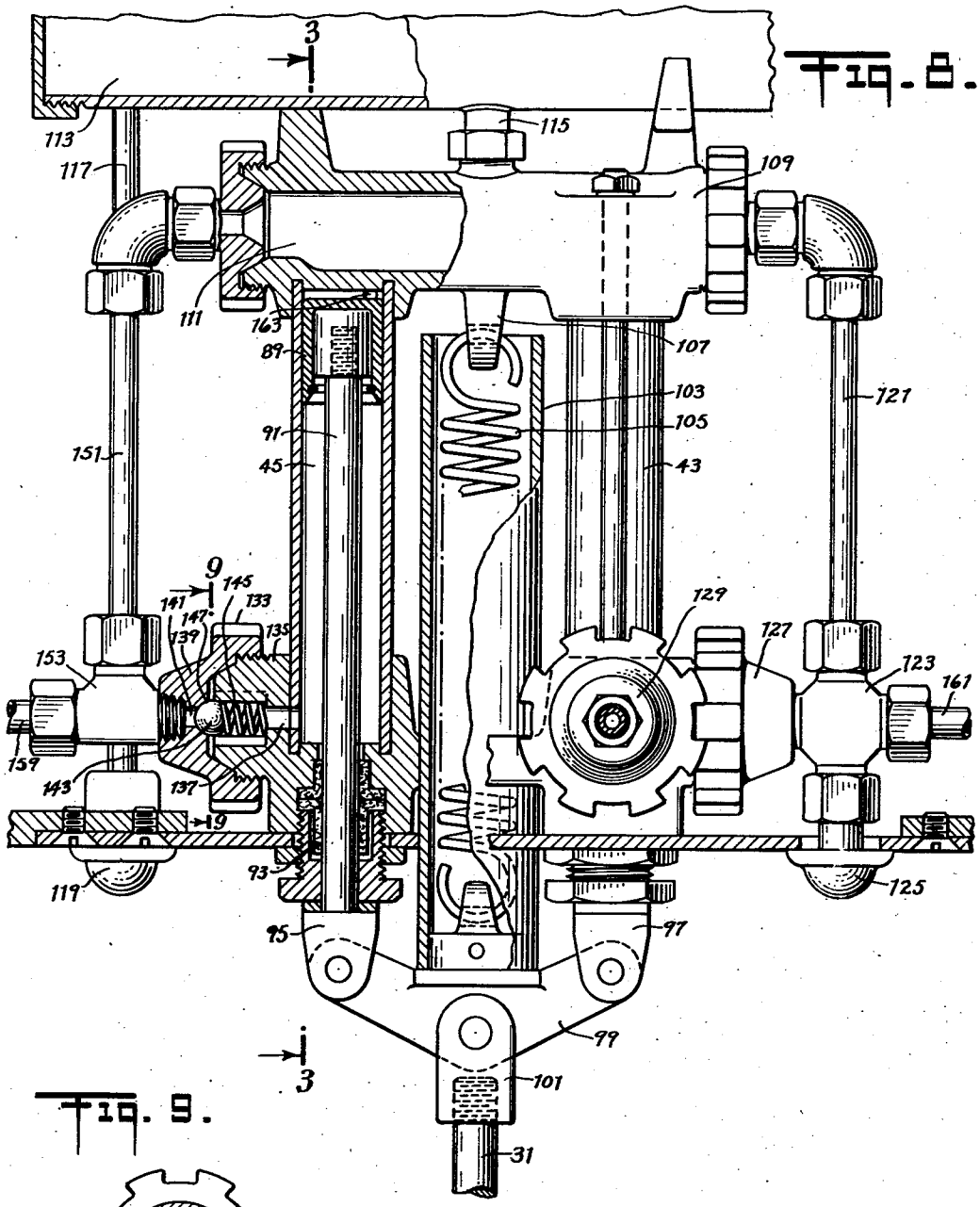
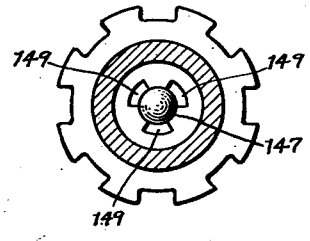


Fig. 9.



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HOSPITAL BATHTUB

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Fig. 10.

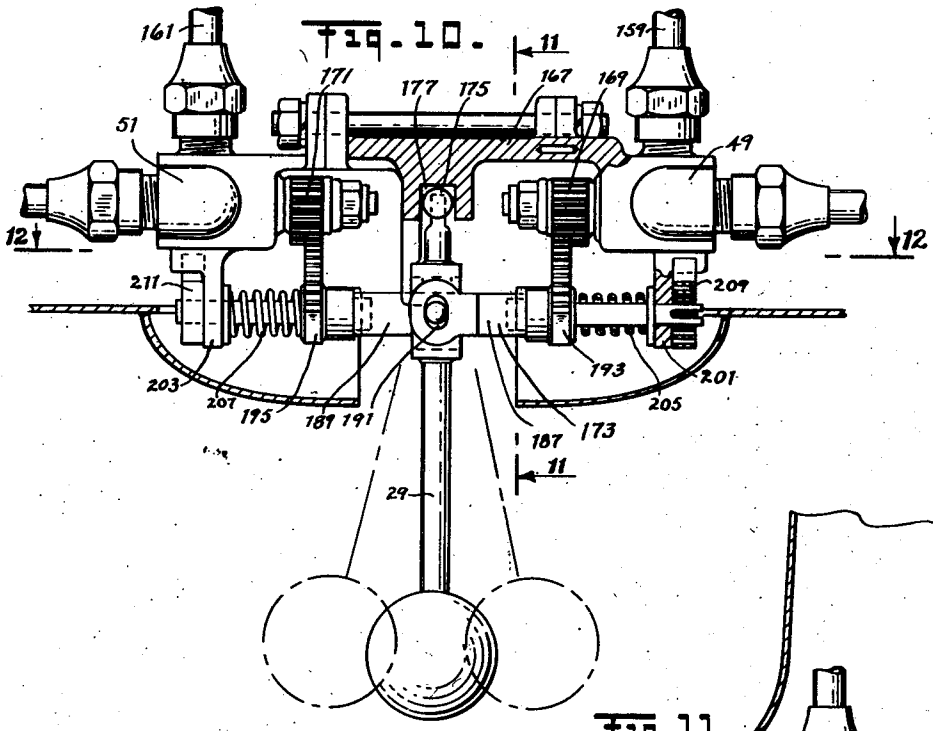


Fig. 11.

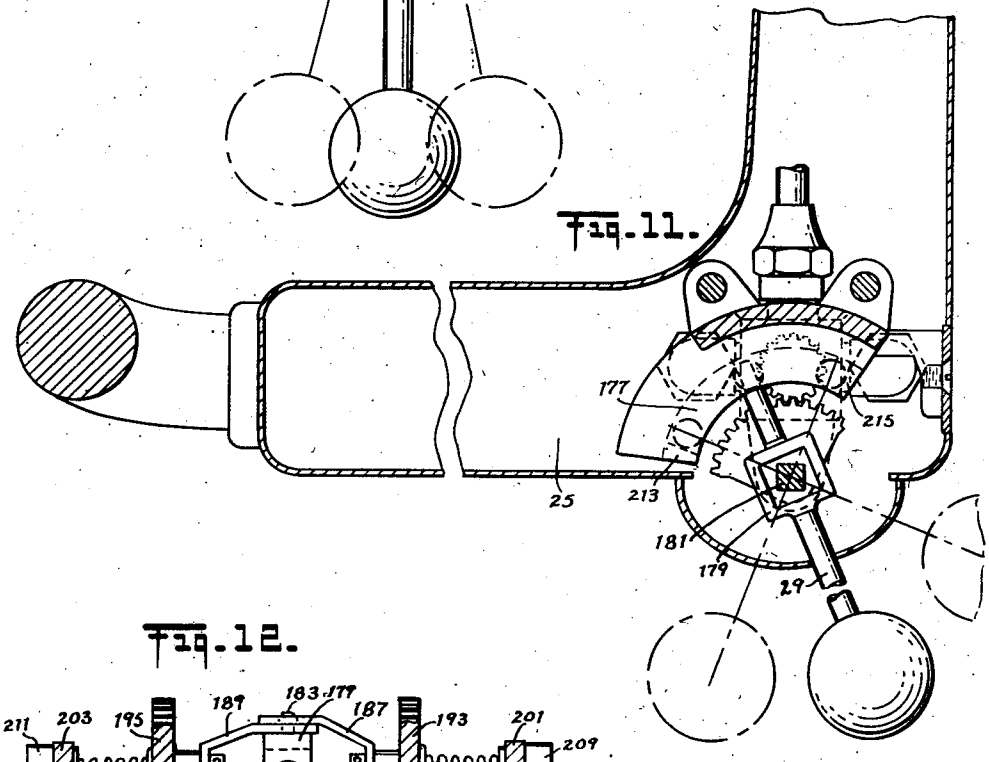
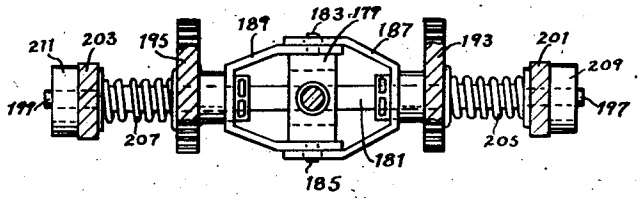


Fig. 12.



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HOSPITAL BATHTUB

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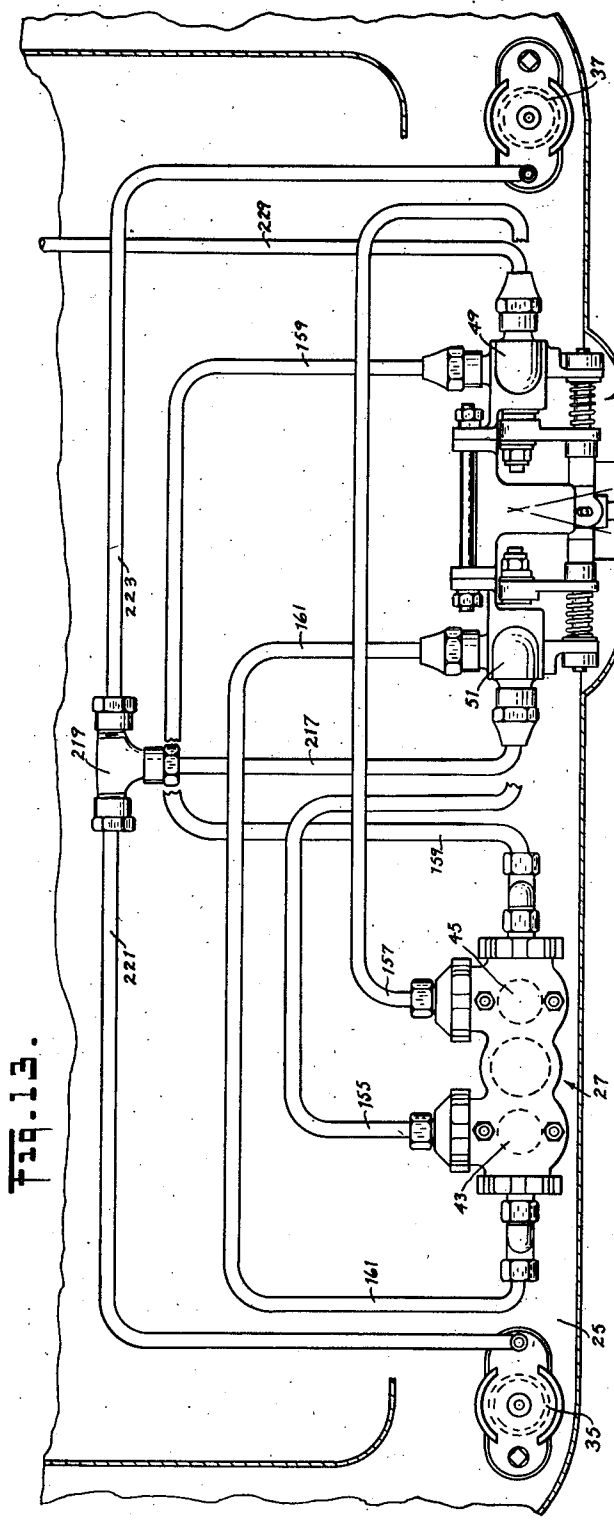


Fig. 13.

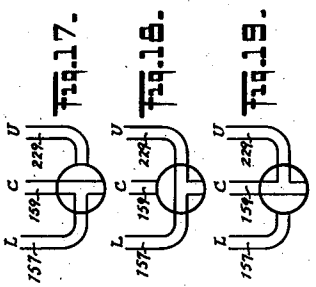


Fig. 17.

Fig. 18.

Fig. 19.

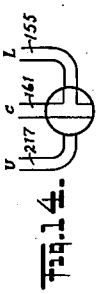


Fig. 14.

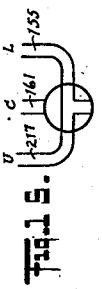


Fig. 15.

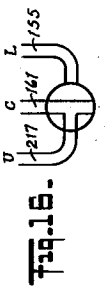


Fig. 16.

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UNITED STATES PATENT OFFICE

2,603,796

HOSPITAL BATHTUB

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Application September 27, 1946, Serial No. 699,848

5 Claims. (Cl. 4—173)

1

This invention relates to body-supporting and lifting apparatus and more particularly to a bathtub having a vertically movable body-supporting member. The bathtub of the present invention is particularly well adapted to be used in bathing a hospital patient who must be bathed in a horizontal position.

In caring for hospital patients it frequently happens that a patient either because of weakness or because of the nature of his injuries or illness cannot be bathed in a conventional bathtub because of the fact that it is necessary or desirable that the patient be bathed in a prone or supine position. On the other hand bathing the patient in bed is unsatisfactory in many respects. In order to bathe such a patient effectively and without danger of injury to the patient a bathtub is required that differs materially in its construction from conventional bathtubs. Such a tub should provide means for supporting the body of the patient in a substantially horizontal position and the body-supporting means should be vertically movable and easily positionable to various levels. For example, in transferring the patient from his bed to the bathtub it is desirable that the body-supporting member be positioned substantially at the level of the bed so that the patient may be transferred from the bed to the tub with a minimum of movement and discomfort. It is further desirable that the body-supporting means be vertically positionable within the tub so that the patient's body may be substantially completely immersed in the bathing liquid or partly immersed in the liquid or positioned above the liquid as desired. Selective vertical positioning of the body-supporting member permits effective washing, rinsing and drying of the patient.

It is accordingly an object of the present invention to provide a bathtub that can be used in bathing an invalid or hospital patient with a maximum of convenience and a minimum of discomfort to the patient. It is another object of the invention to provide a bathtub including a vertically movable body-supporting member that is easily positionable to desired different levels. It is a further object of the invention to provide a bathtub having a body-supporting member that is selectively tiltable to permit bathing of selected portions of the patient's body while maintaining other portions of his body at points relatively remote from the bathing liquid. It is still another object of the invention to provide a bathtub of this type that is portable, i. e., that may be used to transfer a patient from his bed to a bathroom in cases where such a transfer is desirable. It is another object of the invention to provide a bathtub of this type having controls that are conveniently located for operation by an attendant and easily operable. It is also an object of the invention to provide improved hydraulic apparatus for selectively positioning a body-supporting member. Other objects of the invention will be in part obvious and in part pointed out hereinafter.

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The many objects and advantages of the present invention will be best understood by reference to the accompanying drawings which illustrate a bathtub incorporating a preferred embodiment of the present invention and wherein

Fig. 1 is a perspective view of the tub as a whole;

Fig. 2 is a diagram illustrating the hydraulic system used in positioning the body-supporting tray of the tub;

Fig. 3 is a vertical section taken on the line 3—3 of Fig. 1 and showing the hydraulic pump;

Fig. 4 is a vertical section taken on the line 4—4 of Fig. 1 and showing the position of the tray within the tub;

Fig. 5 is a vertical section taken on the line 5—5 of Fig. 4 and showing from a different direction the position of the tray within the tub;

Fig. 6 is a vertical section taken on the line 6—6 of Fig. 4 and showing certain details of the tray lifting mechanism;

Fig. 7 is a top plan view of the hydraulic pump with the auxiliary reservoir removed;

Fig. 8 is an elevation partly in section of the hydraulic pump;

Fig. 9 is a detail view on one of the check valves in the hydraulic pump;

Fig. 10 is a top plan view partly in section of the control mechanism for the hydraulic system:

Fig. 11 is a section taken on the line 11—11 of Fig. 10 showing further details of the control mechanism;

Fig. 12 is a vertical section taken on the line 12—12 of Fig. 10 and showing other details of the control mechanism;

Fig. 13 is a semi-diagrammatic top plan view of the hydraulic pump and control mechanism showing the manner in which the hydraulic pump, control mechanism and tray-positioning cylinders are interconnected; and

Figs. 14 through 19 are diagrams illustrating the manner in which the control valves are positioned for different positions of the main control lever.

Referring to the drawings, and more particularly to Fig. 1, the bathtub there shown comprises a relatively shallow rectangular tub 1 supported on the tubular legs 3 which are in turn mounted on the casters 4 that permit the tub to be moved about as desired. The tub may be made of any suitable material such as sheet metal and, as shown in Fig. 4, is formed with hollow walls. The tub-supporting legs 3 pass through the hollow walls of the tub 1 near the corners of the tub and are fixed to the tub at the points 5 and 6 at the top and bottom of the tub respectively in any suitable manner such as by brazing, welding or soldering. Braces such as the brace 7 are provided to lend rigidity to the tub structure.

Referring again to Fig. 1, beneath the tub 1 there are shelves 8 whereon towels, pans and other miscellaneous bath equipment may be conveniently kept. At the center of the bottom of the tub there is a drain pipe 9 provided with a manually operated valve 11 to permit drainage of the bathing liquid from the tub. Within the tub 1 there is a body-supporting tray 13 to each end of which is affixed a pair of hooks 19 by means of which the tray is supported at its ends on the U-shaped bars 15 and 17 at the head end and foot end of the tub respectively. (It may be noted that the terms "head end" and "foot end" do not bear any necessary relation to the position of the patient on the tray 13 but merely provide a convenient way of distinguishing the two ends of the tub.) Since the hooks 19 merely rest on the U-shaped bars 15 and 17 without being fixed thereto, the tray 13 is readily removable for washing and sterilization. The lower ends of the bars 15 and 17 extend into the hollow legs 3 and are connected therein with hydraulically operated mechanism, described in detail hereafter, by means of which the bars 15 and 17 may be raised and lowered to raise and lower tray 13.

The construction of the tray is shown in Figs. 1, 4 and 5 of the drawings. It may comprise a rectangular metal frame 21 and a slightly dished sheet metal body-supporting surface 22 provided with the transverse stiffening ribs 23. As shown in Fig. 4 the frame 21 is spaced somewhat from the inner wall of the tub to permit flow of the bathing liquid between the tray and tub as the tray is raised and lowered. If desired the tray may be provided with suitable drainage holes and may be covered with a material such as rubber or plastic having a relatively low heat conductivity. Manifestly the body-supporting portion of the tray 13 may be of any reticulated or foraminous construction that will permit effective washing and rinsing of the patient. For example, it may comprise a network of transverse and longitudinal rubber or plastic strips.

It is desirable that the tray 13 be vertically positionable with respect to the tub 1 and hydraulically operated means are provided for positioning the tray. Referring to Figs. 3 and 13 it has been pointed out that the tub 1 is so formed that its sides and ends are hollow and thus the walls of the tub define an enclosure or chamber 25 at the head end of the tub. Within the chamber 25 there is mounted a hydraulic pump, generally indicated by the numeral 27, and a control mechanism, generally indicated by the numeral 28, having a control lever 29 that extends through the wall of the tub 1 and is provided at its outer end with a knob 30. To operate the hydraulic pump 27 there is a vertically reciprocable connecting rod or pump actuating shaft 31 which (see Fig. 1) extends downwardly from the pump and is provided at its lower end with a foot pedal 33. Actuating shaft 31 is spring urged in an upward direction and the pump is operated by periodically depressing and releasing the foot pedal 33.

The position and movement of the tray 13 with respect to the tub 1 is controlled by manual operation of the control lever 29 which actuates the control mechanism 28, described in detail hereafter to change the connections in the hydraulic system to permit raising and lowering of the tray 13 as desired. The control lever 29 is movable in both a vertical and horizontal direction and in each direction has three operative positions. The lever is spring-biased in an upward direction and also toward its central position so that when it is not being manipulated it normally tends to come to rest in its upper central position. When the lever is in this upper central position the tray is held stationary; when the lever is depressed to its lowest central position the elements of the hydraulic system are so interconnected as to cause the tray to move downwardly; and when the control lever is depressed only half way to its lowest position the elements of the hydraulic system are so connected as to permit upward movement of the tray.

The head end and foot end of the tray 13 may be positioned independently of one another to effect tilting of the tray at a desired angle. This independent positioning of the two ends of the tray is effected by moving the lever 29 in a horizontal direction. Thus if the control lever is moved to the right and then depressed to its lowest right-hand position, the connections within the hydraulic system are such that the head end of the tray is lowered and the foot end remains stationary. If the control lever is positioned in its lowest left-hand position the hydraulic connections are such that the foot end of the tray is lowered and the head end remains stationary. When the lever is positioned in its right central position the head end of the tray may be raised and when the lever is positioned in its left central position the foot end of the tray may be raised. It may be noted that the control lever has a total of nine positions, six of which produce movement of the tray. When the lever is in its topmost position the tray remains stationary whether the lever is in its upper left-hand, upper central or upper right-hand position. It will be understood that operation of the hydraulic pump by the foot pedal 33 is required only in those cases where it is desired to raise one or both ends of the tray. When the control lever is in one of its tray lowering positions the connections of the hydraulic system are such that the weight of the tray either with or without a patient thereon is sufficient to cause the tray to move downwardly.

The manner in which the principal elements of the hydraulic system are interconnected is schematically shown in Fig. 2 of the drawings. Referring to Fig. 2 the numerals 35 and 37 designate hydraulic positioning cylinders in the legs 3 at the head end of the tub and the numerals 39 and 41 designate the hydraulic positioning cylinders within the legs 3 at the foot end of the tub. Hydraulic fluid to operate the positioning cylinders 35, 37, 39 and 41 is supplied from a duplex hydraulic pump, the cylinders of which are diagrammatically represented in Fig. 2 and

designated by the numerals 43 and 45. The hydraulic pump also includes a reservoir 47, and a pair of three-way valves 49 and 51 are provided for changing the connections between the different elements of the hydraulic system. In Fig. 2 valves 49 and 51 are so positioned that all four positioning cylinders 35, 37, 39 and 41 are connected to one or the other of the pumping cylinders 43 and 45 of the hydraulic pump and hence the two valves 49 and 51 are in their tray lifting position and operation of the foot pedal 33 will raise both ends of the tray 13 simultaneously. When valve 49 is rotated 90° counterclockwise and valve 51 is rotated 90° clockwise all of the positioning cylinders 35, 37, 39 and 41 are connected to the reservoir 47 and the tray will move downwardly. When valve 49 is rotated 90° clockwise and valve 51 is rotated 90° counterclockwise the positioning cylinders are disconnected from the rest of the hydraulic system and the tray will remain stationary. It is further evident that the desired independent positioning of the head end and foot end of the tray may be effected by suitable independent movement of the valves 49 and 51.

From the foregoing description it is apparent that the tub of the present invention provides an unusually flexible and adaptable apparatus for positioning the body-supporting tray 13 and the controls are conveniently located for operation by an attendant. The detailed structure that permits these operations to be carried out will now be described.

Positioning cylinders

The tray-positioning cylinders located within the legs 3 may be similar in construction and hence only one need be described. The construction of the tray-positioning cylinders is best shown in Fig. 6 of the drawings. Referring to Fig. 6 the downwardly extending end 53 of the tray-supporting U-bar 17 is recessed to receive a sleeve 55 which is fixed to the bar 17 and fits snugly but slidably into the tubular leg 3. Within the sleeve 55 there is a cylinder liner 57 having an upper end plate 59 that bears against the end 53 of U-bar 17 and is held in fixed position with respect to the end of the bar by a screw 61. The liner 57 extends downwardly through the sleeve 55 and leg 3 and is provided at its bottom with a cap 63. Thus the sleeve 55, liner 57 and cap 63 form the cylinder 41 that is connected to and moves with the U-bar 17. Centrally located within the liner 57 there is a tubular piston rod 65 at the top of which is mounted a piston 67 which is snugly fitted to the inner surface of liner 57.

Hydraulic fluid to operate the positioning cylinder 41 is supplied through a tube 69 which at its discharge end is provided with a vent plug 70 and near its discharge end is connected by means of a union 71 with a fitting 73 having an internal passage 75 that interconnects the supply tube 69 with the lower end of tubular piston rod 65. The lower portion of fitting 73 is provided with a pin 77 that extends through the fitting 73 and through the walls of the leg 3, thus holding pitson rod 65 and piston 67 stationary.

The operation of the structure just described is the reverse of normal piston and cylinder operation in that the piston is held stationary and the cylinder moves. Hydraulic fluid supplied through tube 69 flows through the internal passage 75 of the fitting 73, up through the central bore of the piston rod 65 to the chamber 79 defined by piston 67 and end plate 59 of the liner 57. Fluid pressure within the chamber 79 causes the cylinder 41 and U-bar 17 to move upwardly with respect to piston 67 which is held stationary by pin 77. This inversion of the normal piston and cylinder construction is a particularly noteworthy feature of the present construction. Since the sleeve 55 is in contact with the inside wall of leg 3 throughout most of the length of the sleeve 55, the tray-supporting bar and tray are supported in an unusually effective manner, especially in their upper position. The sleeve 55 may be made of the same material as the bar 17 and suitably polished so as to present a pleasing appearance and permit sterilization where required. Furthermore the danger of hydraulic fluid reaching the exposed portions of the tray-supporting structure is minimized.

Means are also provided to permit easy disassembly of the lifting cylinder structure. The lower portions of the lifting cylinder structure are concealed by the hemi-cylindrical cover plates 81 and 83 which are provided at their lower ends with lugs 85 and 87 that fit into holes in the wall of leg 3 in such manner that the cover plates are supported in vertical position against the leg 3. When it is desired to disassemble the cylinder 41 the cover plates 81 and 83 are removed, the pin 77 withdrawn and the union 71 disconnected, whereupon the entire lifting cylinder including piston 67, piston rod 65 and fitting 73 may be withdrawn from leg 3. In assembling the apparatus the above operations are carried out in reverse order.

Hydraulic pump

As previously pointed out hydraulic fluid is supplied by a duplex pump 27, the details of which are best shown in Fig. 8 of the drawings. Referring to Figs. 7, 8 and 9 the pump 27 comprises the cylinders 43 and 45 which are similar in construction. Cylinder 45 is provided with a piston 89 which may be of conventional construction and is mounted on a piston rod 91 that extends downwardly through a conventional packing gland 93 to a fitting 95. Cylinder 43 contains a similar piston and piston rod that is connected to a fitting 97. Fittings 95 and 97 are pivotally connected to a yoke 99 which through the pivoted fitting 101 is connected to the pump actuating shaft 31. As previously described the actuating shaft 31 is operated by the foot pedal 33, shown in Fig. 1.

Located between the cylinders 43 and 45 and mounted on the yoke 99 there is a cylindrical housing 103 within which there is a helical coil spring 105 effectively connected at its lower end to the yoke 99 and connected at its upper end to a ring 107 mounted on the housing 109 of the pump. The spring 105 tends to move piston 89 and its companion piston in cylinder 43 to their uppermost position and hence moves shaft 31 upwardly as described in connection with Fig. 1.

Hydraulic fluid to operate the hydraulic system is stored in a primary reservoir 111 located in the pump housing 109 above the cylinders 43 and 45 and in an auxiliary reservoir 113 mounted above the pump housing 109 and connected to the reservoir 111 by a pipe 115. Auxiliary reservoir 113 is connected by a pipe 117 to a plug 119 and the primary reservoir 111 is connected by a pipe 121 to a pipe "cross" 123, the lower connection of which is provided with a plug 125. In filling the primary and auxiliary reservoirs with hydraulic fluid the pump as a whole is inverted, the plugs 119 and 125 removed and hy-

draulic fluid poured in through pipe 117 while air is permitted to escape through the pipe 121. The plugs 119 and 125 are then replaced and the pump inverted to its operative position. Some air space is preferably left in the reservoir 113 to provide an air cushion to facilitate operation of the hydraulic system.

In order to achieve the desired flow of hydraulic fluid cylinder 43 (see Fig. 7) is provided with a pair of check valves 127 and 129 and cylinder 45 is provided with a pair of check valves 131 and 133. These check valves may be of similar and conventional construction. Referring to Fig. 8, the check valve 133 comprises an externally threaded bushing 135 having a central bore 137 that communicates with the interior of cylinder 45. Threaded onto the bushing 135 there is a cap 139 having a central bore 141 axially aligned with the bore 137 of bushing 135. Between the cap 139 and bushing 135 there is a ball valve 143 that is urged by a spring 145 against a seat 147 formed in the interior of cap 139. As best shown in Fig. 9 the interior of bushing 135 is provided at points adjacent the bore 137 with a plurality of recesses 149 to facilitate flow of hydraulic fluid through the passages 137 and 141 when the ball valve 143 is open. The ball valve 143 operates to permit flow of hydraulic fluid from the primary reservoir 111 through a connecting pipe 151 and T 153 to the interior of cylinder 45 but prevents back-flow of hydraulic fluid from the interior of cylinder 45 to the T 153.

Check valve 127 is similar to check valve 133 and performs a similar function with respect to cylinder 43. Check valves 129 and 131 are generally similar in construction to check valves 127 and 133 but operate in a reverse sense, i. e., check valve 129 operates to permit flow from cylinder 43 into a discharge pipe 155 but prevents return flow from pipe 155 into cylinder 43 and check valve 131 permits flow of hydraulic fluid from cylinder 45 into discharge pipe 157 but prevents return flow from discharge pipe 157 into cylinder 45.

The T 153 and the "cross" 123 are connected respectively to the fluid return lines 159 and 161. Hydraulic fluid that flows out of the tray-positioning cylinders as the tray moves downwardly returns to the primary and auxiliary reservoirs through these pipes 159 and 161. The return flow of the hydraulic fluid is more fully described hereafter.

The operation of the hydraulic pump is largely apparent from the foregoing description. The spring 105 moves the yoke 99 to its upper position and thereby moves the pistons to the top of cylinders 43 and 45. As the pistons move upwardly in their respective cylinders hydraulic fluid is withdrawn from the reservoir 111 through pipes 121 and 151 and check valves 127 and 133 into the cylinders 43 and 45. When the foot pedal 33 is depressed the pistons move downwardly, check valves 127 and 133 close, and check valves 129 and 131 open to cause a discharge of hydraulic fluid through the pipes 155 and 157. Air vents 163 and 165 are provided in the upper ends of the cylinders 43 and 45 to prevent evacuation of the space between the piston and the upper end of the cylinder and thereby reduce resistance to downward movement of the pistons.

Control mechanism

Referring now to Figs. 10, 11 and 12 of the drawings, and more particularly to Fig. 10, the three-way valves 49 and 51, which may be of conventional construction, are mounted for either joint or independent operation by the main control lever 29. The valves 49 and 51 are rigidly mounted in a frame 167 and are provided respectively with the gears 169 and 171 by means of which the valves are operated. Manipulation of the control lever 29 rotates the gears 169 and 171 by mechanism now to be described to effect desired interconnection of the different elements of the hydraulic system.

Control lever 29 is vertically pivotable about an axis designated as 173 and at its inner end is provided with a ball tip 175 that slides in a channel 177 of rectangular cross section formed in the frame 167. As indicated in Fig. 11 the channel 177 is of arcuate shape to conform with the path of movement of ball tip 175. The channel 177 and ball tip 175 operate as a bearing or pivot when the control lever 29 is moved laterally.

As shown in Fig. 11 the portion of the control lever 29 near its axis of rotation is formed in the shape of a hollow square 179 which encircles a square shaft 181 on which the control lever is indirectly mounted in the following manner. The square 179 (see Fig. 12) is connected by means of pins 183 and 185 with a pair of generally U-shaped yokes 187 and 189. The pins 183 and 185 are fixed to the square 179 and pass through elliptical holes 191 (see Fig. 10) in the yokes 187 and 189. The holes in the yokes are made slightly elliptical to permit the necessary relative movement of pins 183 and 185 and yokes 187 and 189 as the control lever is moved laterally.

Referring to Figs. 10 and 12, the yoke 187 is connected to a gear segment 193 that meshes with the gear 169 of valve 49, the gear segment being mounted for sliding movement on the square shaft 181. The yoke 189 is connected to a gear segment 195 that meshes with the gear 171 of valve 51 and is also mounted for sliding movement on the square shaft 181. At its ends the square shaft is provided with the round extensions 197 and 199 which are mounted respectively in the fixed journal bearings 201 and 203 which are in turn supported on the valve bodies of valves 49 and 51. Between the bearing 201 and gear segment 193 and surrounding the square shaft 181 there is a helical spring 205 which is normally in compression and tends to urge gear segment 193 to the left as shown in Figs. 10 and 12. A similar spring 207 is provided between the bearing 203 and the gear segment 195, the joint effect of the springs 205 and 207 being to position the control lever 29 in its horizontally central position. At the ends of the shaft 181 tightly coiled springs 209 and 211 are provided which at their outer ends are connected to the valve bodies 49 and 51 and at their inner ends are connected to the extensions 197 and 199 respectively. The springs 209 and 211 are so biased as to cause the shaft 181 to rotate clockwise (as shown in Fig. 11) and thereby urge control lever 29 toward its uppermost position. The channel 177 is provided at its ends with the stops 213 and 215 to limit upward and downward movement of the control lever 29.

As indicated in Fig. 11 the maximum range of movement of the lever 29 in a vertical direction is abount 90°. However most conventional three-way valves operate through an arc of 180° and hence the radii of the gear segments and gears are so chosen that 90° rotation of gear segments 193 and 195 will produce 180° rotation of gears 169 and 171. It will be noted that the face of gear 169 is substantially wider than the face of gear segment 193 and that the gear segment 193 is normally positioned near the inner or left-hand

edge of gear 169. In similar manner the gear 171 is provided with a substantially wider face than the gear segment 195 and the segment 195 is normally positioned near the inner or right-hand face of gear 171.

The operation of the control mechanism is as follows: The action of the springs 209 and 211 is such that the control lever 29 is normally located at its uppermost position and the action of the springs 205 and 207 is such that the control lever 29 is normally located in its central horizontal position. Thus the control lever under the influence of these springs tends to assume its upper central position. As the lever is manually depressed gear segments 193 and 195 are rotated to actuate the valves 49 and 51 jointly, the gear segments being driven through the pins 183 and 185, which are effectively a part of the control lever, and the yokes 187 and 189 that are connected to the gear segments 193 and 195, respectively. The depression of the control lever through an angle of 45° actuates the valves 49 and 51 to permit raising of the tray 13 and depression of the control lever through an angle of 90° actuates valves 49 and 51 to cause the tray 13 to move downwardly.

When it is desired to actuate the valves 49 and 51 independently the control lever 29 is shifted in a horizontal direction, i. e., laterally. If, for example, it is desired to lower the foot end of the tray 13 without moving the head end, the tray control lever 29 would be moved first to its upper right-hand position. Referring to Fig. 10, in moving to the right the control lever 29 would pivot about its ball tip 175 and shift gear segments 193 and 195 to the right. This movement to the right will disengage gear segment 195 and gear 171 and thus valve 51 will be unaffected by vertical movement of the control lever and the head end of the tray 13 will remain stationary. Gear segment 193 on the other hand will slide across the face of gear 169 and remain engaged therewith. The control lever is then depressed to its lowermost position to rotate gear 169 through an angle of 180° and actuate valve 49 to produce a downward movement of the foot end of the tray 13.

In similar manner the head end of the tray 13 may be positioned without changing the position of the foot end of the tray by shifting control lever 29 to the left as shown in Fig. 10 thereby disengaging gear segment 193 from gear 169. Either upward or downward movement of either the head end or foot end of the tray may be produced in a wholly independent manner.

The hydraulic system

The manner in which the different elements of the hydraulic system are interconnected is semi-diagrammatically shown in Fig. 13. Figs. 14, 15 and 16 are diagrams illustrating the positions of the three-way valve 51 and Figs. 17, 18 and 19 are diagrams illustrating the positions of the three-way valve 49. In Figs. 14 through 19 the letters U, C and L are used to designate the upper, central and lower ports of the three-way valves respectively.

Referring to Fig. 13 the discharge port of cylinder 43 of the hydraulic pump is connected by a pipe 155 to the lower port of the three-way valve 51. The center port of the three-way valve 51 is connected by the pipe 161 and pipe 121 (see Fig. 8) to the reservoir 111. The upper port of the three-way valve 51 is connected by a pipe 217 to a T 219 and through branch pipes 221 and 223 to the tray-positioning cylinders 35 and 37 respectively at the head end of the tub.

In similar manner the discharge port of the cylinder 45 of the hydraulic pump is connected by pipe 157 with the lower port of the three-way valve 49. The center port of three-way valve 49 is connected by pipe 159 and pipe 151 (see Fig. 8) with the reservoir 111. The upper port of three-way valve is connected through a pipe 229 with a T (not shown) similar to the T 219 but at the foot end of the tub and supplies hydraulic fluid to the hydraulic positioning cylinders 39 and 41 at the foot end of the tub.

The manner in which movement of control lever 29 positions the three-way valves to regulate the supply of hydraulic fluid is best shown in Figs. 14 through 19. Fig. 14 indicates the position of the three-way valve 51 when the control lever 29 is in its uppermost position. In this position of the lever 29 pipes 155 and 161 are interconnected and pipe 217 and cylinders 35 and 37 are disconnected. Hence operation of the foot pedal 33 merely circulates hydraulic fluid and the head end of the tray is held in fixed position.

Fig. 15 indicates the position of the three-way valve 51 when the control lever 29 has been depressed through an angle of 45°. In this position of the control lever pipes 155 and 217 are interconnected and pipe 161 is disconnected. Hence operation of the foot pedal 33 produces a flow of hydraulic fluid through pipes 155, 217 and through branch pipes 221 and 223 to the positioning cylinders 35 and 37 to raise the head end of the tray 13.

Fig. 16 indicates the position of the three-way valve 51 when the control lever 29 has been depressed through an angle of 90°. In this position of the control lever pipe 155 is disconnected and pipes 161 and 217 are interconnected. Hence hydraulic fluid from the positioning cylinders 35 and 37 may flow through branch pipes 221 and 223, pipes 217, 161 and 121 back to the reservoir 111 and the head end of the tray 13 will move downwardly.

In like manner Figs. 17, 18 and 19 indicate positions of the three-way valve 49 corresponding to the upper, central and lower positions of the control lever 29, which respectively hold the foot end of the tray stationary, produce upward movement of the foot end of the tray and produce downward movement of the foot end of the tray. As previously pointed out independent actuation of the three-way valves 49 and 51 is achieved by shifting control lever 29 to the right or left respectively.

From the foregoing description it is apparent that the present structure provides exceptional flexibility in operation and permits the attendant to position the body of the patient being bathed in a variety of ways to suit the requirements of his particular condition. The controls are conveniently located at the head end of the tub and easily operable. The working parts are insofar as possible concealed within the tub structure thus minimizing the introduction of dirt, grease or oil into the tub and also permitting sterilization of such parts of the tub as require sterilization. The sliding cylinder construction of the tray-positioning mechanism provides a rugged support for the tray and at the same time permits effective positioning of the tray at desired levels.

It is to be understood, of course, that the invention is not limited to the illustrative embodiment described herein and that many changes may be made without departing from the spirit of the invention. Thus the tub need not be pro-

vided with the casters 5 but may be constructed as a permanent installation, if desired, with a permanent drain connection and water supply. As previously pointed out the construction of the tray 13 and the materials of which it is constructed may be varied as desired. Other modifications within the scope of the invention will be obvious to those skilled in the art.

We claim:

1. In a bathtub adapted to be used in bathing a hospital patient in a generally horizontal position, in combination, a rectangular tub for receiving and holding a washing liquid, said tub being supported at each corner thereof by a hollow leg, a body-supporting member adapted to receive and support a body in a generally horizontal position and movable into and out of the liquid in said tub, a hydraulic cylinder formed in each of said hollow legs and effectively connected to said body-supporting member and hydraulic pumping means for supplying hydraulic fluid under pressure to each of said cylinders to position said body-supporting member.

2. In a bathtub adapted to be used in bathing a hospital patient in a generally horizontal position, in combination, a tub for receiving and holding a washing liquid, a body-supporting member adapted to receive and support a body in a generally horizontal position and movable into and out of the liquid in said tub, a plurality of hollow legs for supporting said tub, each of said legs being provided with hydraulic positioning means for positioning said body-supporting member, each of said positioning means comprising a cylinder slidable in said hollow leg and effectively connected to said body-supporting member, a piston mounted within said cylinder and held in fixed position with respect to said leg and a source of hydraulic fluid connected to the interior of said cylinder at a point above said piston to actuate said cylinder to position said body-supporting member.

3. In a bathtub adapted to be used in bathing a hospital patient in a generally horizontal position, in combination, a tub for receiving and holding a washing liquid, a body-supporting member adapted to receive and support a body in a generally horizontal position and movable into and out of the liquid in said tub, a plurality of hollow legs for supporting said tub, each of said legs being provided with hydraulic positioning means for positioning said body-supporting member, each of said positioning means comprising a cylinder slidable in said leg and effectively connected at its upper end to said body-supporting member, a piston mounted in said cylinder, and a hollow piston rod connected at one end to said piston and its other end effectively connected to said hollow leg, hydraulic pumping means connected to each of said piston rods to cause hydraulic fluid to flow through said hollow piston rods to and from the spaces between said cylinders and said pistons to actuate said cylinders to position said body-supporting member and control means interposed between said hydraulic pumping means and said hydraulic positioning means for regulating flow of hydraulic fluid to and from said positioning means.

4. In a bathtub adapted to be used in bathing a hospital patient in a generally horizontal position, in combination, a tub for receiving and holding a washing liquid, said tub being provided with hollow walls, a body-supporting member adapted to receive and support a body in a generally horizontal position and movable into and out of the liquid in said tub, a plurality of hollow legs for supporting said tub, a hydraulic cylinder formed in each of said hollow legs and effectively connected to said body-supporting member and a hydraulic pump mounted within said hollow wall of said tub for supplying hydraulic fluid to said hydraulic cylinders to position said body-supporting member.

5. In a bathtub adapted to be used in bathing a hospital patient in a generally horizontal position, in combination, a tub for receiving and holding a washing liquid, said tub being provided with hollow walls, a body-supporting member adapted to receive and support a body in a generally horizontal position and movable into and out of the liquid in said tub, a plurality of hollow legs for supporting said tub, a hydraulic cylinder formed in each of said hollow legs and effectively connected to said body-supporting member, a hydraulic pump mounted within said hollow wall of said tub for supplying hydraulic fluid to said hydraulic cylinders to position said body-supporting member and control means for controlling the supply of hydraulic fluid to said hydraulic cylinders, said control means comprising valve means located within said hollow wall for regulating the supply of hydraulic fluid to said cylinders and a control lever connected to actuate said valve means and extending through the wall of said tub to the outside thereof.

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