March 25, 1924. 1,488,206

F. KOENIGKRAMER

ACTUATING MECHANISM

Filed Aug. 8. 1921 2 Sheets-Sheet 1

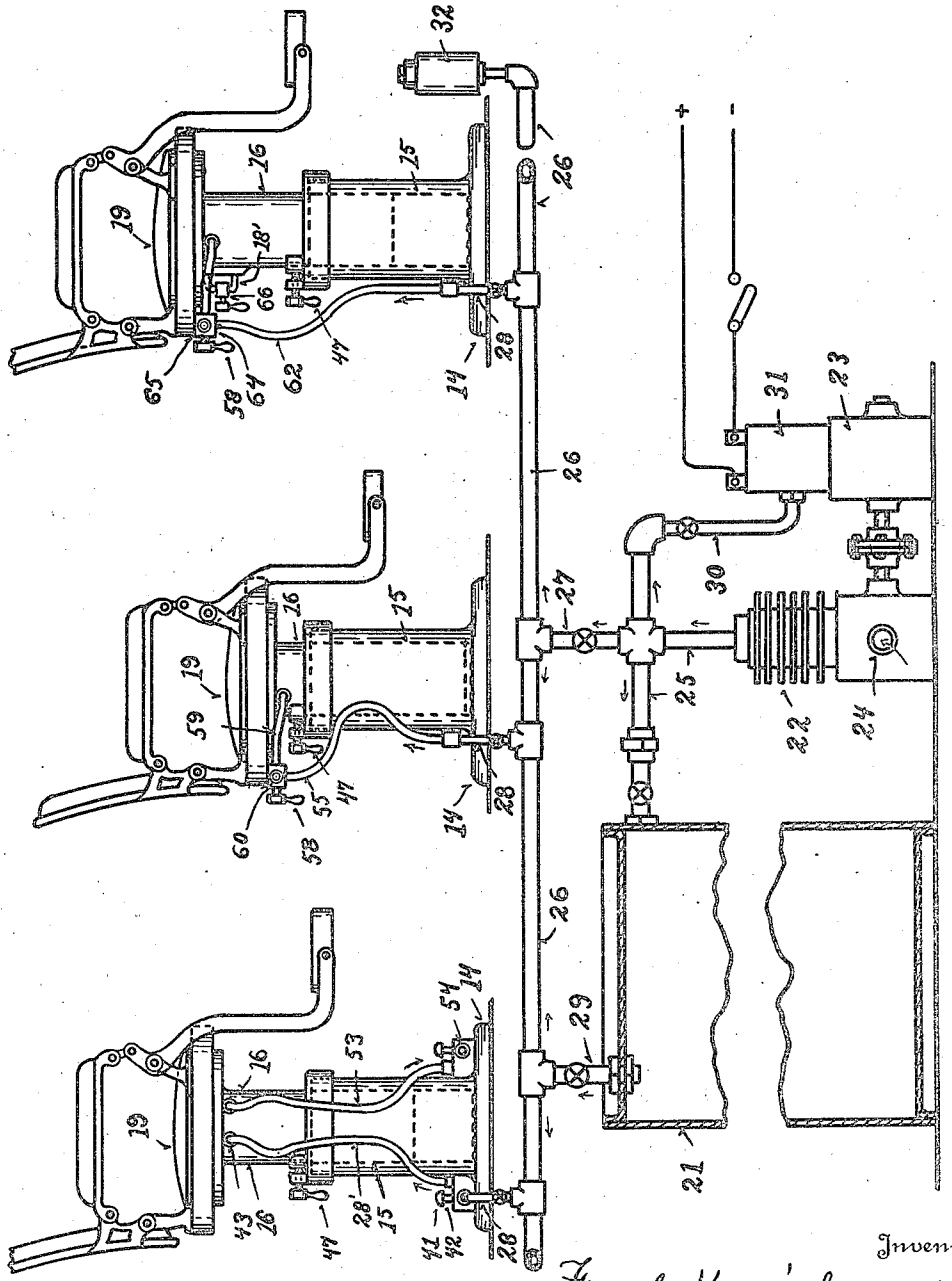

Fig. 1.

Inventor
Frank Koenigkramer,
By C. W. Miles,
Attorney

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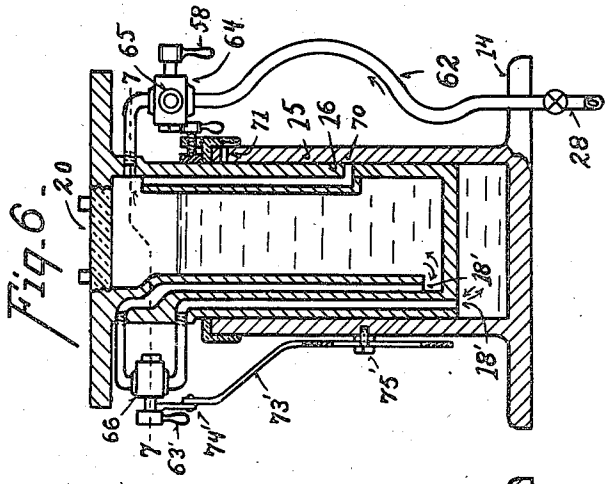

Fig. 6.

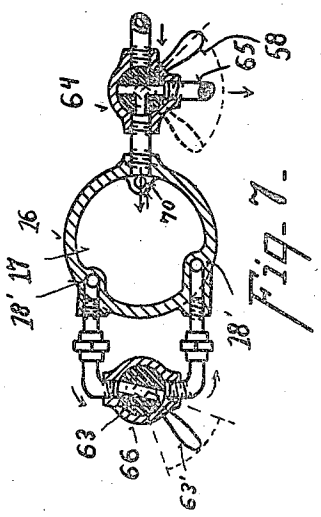

Fig. 7.

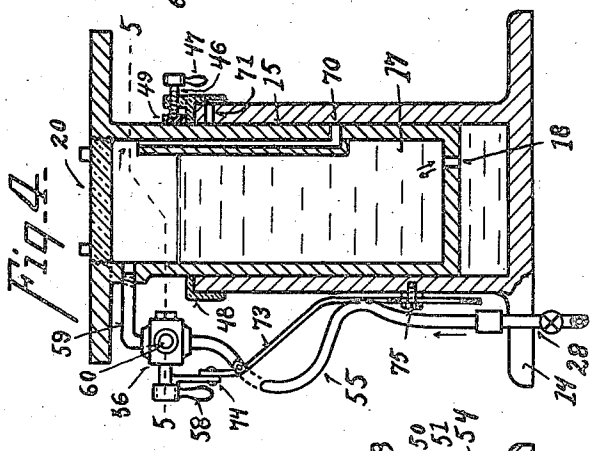

Fig. 4.

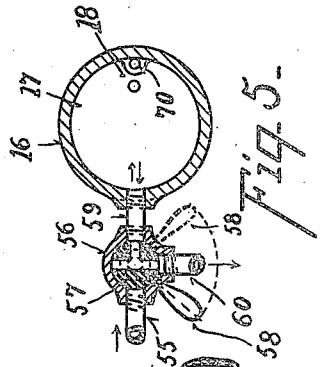

Fig. 5.

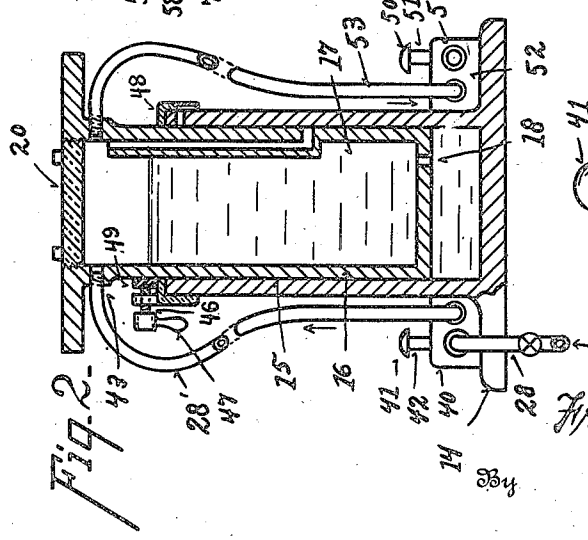

Fig. 2.

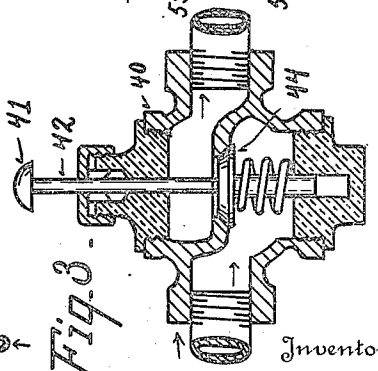

Fig. 3.

Inventor

Frank Koenigkramer,

By C. W. Miley.

Attorney

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UNITED STATES PATENT OFFICE.

FRANK KOENIGKRAMER, OF CINCINNATI, OHIO.

ACTUATING MECHANISM.

Application filed August 8, 1921. Serial No. 490,590.

To all whom it may concern:

Be it known that I, FRANK KOENIGKRAMER, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Actuating Mechanism, of which the following is a specification.

My invention relates to improvements in method and means to apply power to independently operate any one of a group of members, as for instance dental or barber chairs or similar mechanism. One of its objects is to enable the several chairs or mechanisms to be independently and reliably actuated from a common source of power. Another object is to apply power from a common reservoir or source independently to any one of several chairs to raise and lower the same. Another object is to provide an improved method and means to store and apply energy to independently actuate a plurality of members. Another object is to provide improved means to actuate dental and similar chairs. My invention also comprises certain details of form combination arrangement, and order of procedure, all of which will be fully set forth in the description of the accompanying drawings in which—

Fig. 1, is a diagrammatic plan of a plurality of chairs and means to raise and lower the same embodying my improved method and apparatus.

Fig. 2, is a central vertical section through a portion of a chair elevating mechanism illustrating one modification of my invention.

Fig. 3, is a sectional detail through one of the actuating valves detached.

Fig. 4, is a view similar to Fig. 2, illustrating a modification thereof.

Fig. 5, is a diagrammatic sectional detail on line 5—5 of Fig. 4.

Fig. 6 is a view similar to Fig. 2, illustrating another modification.

Fig. 7, is a diagrammatic sectional detail on line 7—7 of Fig. 6.

The accompanying drawings illustrate the preferred embodiments of my invention in Figs. 1 and 2, of which 14 represent chair bases designed to be rigidly attached to the floor and provided each with a cylindrical bore 15 in which is mounted a hydraulic plunger 16 adapted to be energized by a flow of liquid to and from the space within the cylinder below the plunger to raise and lower the plunger within the cylinder. An air and liquid tight reservoir 17 is preferably formed within the plunger and is utilized for the storage of a liquid such as lubricating oil for instance, to be employed in the cylinder to raise and lower the plunger. As illustrated in Figs. 2 and 4 a port 18 through the bottom wall of the plunger enables the liquid to flow from the cylinder to the reservoir or from the reservoir to the cylinder as may be required to raise or lower the plunger.

A chair 19, as for instance a dental, surgical, or barber chair, provided with such type of back, arm, foot-rest and other attachments as may be desired is mounted on the upper end of the plunger to move therewith. A screw plug 20 is preferably employed to close the upper end of the plunger with an air tight joint.

An air storage reservoir 21 is preferably employed in which air or other gas may be stored under pressure, and this reservoir 21 may be stored in a basement, closet, or out of the way portion of the room in which the chairs are located or an adjacent room. An air compressor 22 driven by a motor 23, preferably an electric motor, may be located in any convenient out of the way place, preferably adjacent to the reservoir 21. Air is taken into the compressor through the port 24, and after being compressed is conducted through the air conduit 25 to the storage reservoir, of if preferred direct to a main air supply conduit 26 through a branch conduit 27. A branch air supply conduit 28 leads from the main air supply conduit 26 to each of the chair actuating mechanisms. The conduit 26 takes its air supply preferably from the storage reservoir 21 through the connecting conduit 29, but may also be supplied with compressed air if desired or in emergency directly from the compressor 22 through the conduit 27. A branch air conduit 30 leads from the air conduit 25 to an automatic switch or starter mechanism 31 by means of which the motor 23 may be automatically started and stopped so as to automatically maintain air under pressure between prescribed pressure limits within the conduits 25 and 30, and the reservoir 21. Where it is inconvenient from any cause to employ a storage reservoir 21, an automatic air escape valve 32 may be connected to the conduit 26 and the compressor started and

stopped as often as may be required, thereby relying entirely upon the compressor to maintain a sufficient supply of air under pressure. In the event of the reservoir 21 failing temporarily to function the compressor may be relied upon to supply air under pressure until the reservoir has been repaired or replaced. Also in the event of the motor or compressor failing temporarily to function, the supply of compressed air in the reservoir 21 may be sufficient to actuate the plungers until the motor or compressor has been restored to operating condition.

By custom the operators of certain types of chairs, for instance dental chairs, prefer to employ a treadle or foot actuated lever or member to raise or lower the chair, while other operators, for instance barbers generally employ hand operated means to raise or lower the chair. In Figs. 2 and 3, and at the left hand chair of Fig. 1, I have illustrated means to be actuated by the foot of the operator to raise or lower the chair, comprising a valve casing 40 see Fig. 3 interposed in the branch air supply conduit 28, and adapted to be opened by foot pressure upon the head 41 of the valve stem 42, to thereby admit air under pressure through the valve 44 to a flexible section 28′ of the conduit 28, and thence through a port 43 in the upper portion of the wall of the reservoir 17 so as to exert a resilient pressure upon the upper surface of the fluid in the reservoir 17 and thereby to force the fluid slowly through the port 18 into the space in the cylinder below the plunger, and thereby forcing the plunger upwardly in the cylinder to raise the chair. As soon as foot pressure is released from the valve stem head 41, the spring 45 acts to close the valve 44 and cut off the air supply through the tube section 28′ to the reservoir 17. When the plunger 16 and chair 19 have reached the desired height the plunger may be rigidly locked to the base 14 by means of a set screw 46 actuated by a hand lever 47 and threaded through a lug projecting upwardly from an annular collar 48 which fits loosely but snugly over the top of the base where it forms the rim of the cylinder. The end of the set screw 46 bears upon a friction shoe 49 thereby at one operation forcing the shoe 49 into locking engagement with the plunger 16 and causing the collar 48 to engage and lock itself to the rim of the cylinder to hold the plunger and base rigidly in their adjusted position against pressure tending to either raise or lower the plunger. The set screw 46 may be employed or not as desired. When it is desired to lower the plunger Fig. 2, the operator releases the set screw 46 and then by foot pressure depresses the head 50 and valve stem 51 of a valve 52 constructed as shown in Fig. 3, and described for the valve 44 and which valve 52 serves to withdraw the compressed air through a flexible conduit 53 from the upper portion of the reservoir 17 and to discharge the air to the atmosphere through the valve 52 located conveniently to the foot of the operator or to a waste conduit through an exit port 54, and to thus enable the liquid to flow slowly through the port 18 from the cylinder to the reservoir 17, and to thereby permit the plunger 16 to descend by gravity into the cylinder 15 and lower the chair.

In Figs. 4 and 5, and the middle chair of Fig. 1, I have illustrated means suited to be hand operated as for instance by a barber or surgeon, in which air under pressure through the branch air conduit 28 is conducted further by a flexible extension conduit 55, to a valve casing 56 in which is located a three-way cock 57 actuated by a hand lever 58 and preferably located near the upper end of the plunger where it can be conveniently reached by the hand of the operator. An air conduit 59 leads from the valve casing 56 to the upper portion of the reservoir and a port 60 in the valve casing 56 enables air to be discharged to the atmosphere or to a waste conduit. With the three-way cock 57 set as shown in Fig. 5, the upper portion of the reservoir 17 is connected with the atmosphere and is under atmospheric pressure so that when the set-screw 46 is released the fluid is free to flow from the cylinder through the port 18 into the reservoir 17. When the hand lever 58 is shifted to the opposite extremity of its move ment Fig. 5, the flow of air through the port 60 is cut off and air under pressure is admitted from the conduit 55 through cock 57 and conduit 59 to the upper portion of reservoir 17 where it exerts a pressure upon the fluid in the reservoir 17 and forces the liquid through the port 18 from the reservoir 17 to the cylinder below the plunger and forces the plunger upwardy in the cylinder to raise the chair. The hand lever 58 may be used exclusively to raise and lower the chair or the hand lever 58 and set screw 46 may be used jointly as described to control the movements of the chair.

As illustrated in Figs. 6, 7, and at the right hand chair of Fig. 1, a further control and regulation of the movements of the chair is obtained by varying the proportions of the ports by means of which the liquid flows from its storage reservoir to the cylinder and return. Air under pressure is conducted from a branch air conduit 28 through a flexible extension air conduit 62 to a three-way valve 64 such as shown at 56 and 57 in Fig. 5, and heretofore described which serves to admit air under pressure to the upper portion of the reservoir 17 or to cut off the supply of air under pressure and to discharge the air

under pressure from the reservoir 17 to the atmosphere through the port 65. A loop shaped passage or port 18′ is cored in wall of the plunger 16 and a two way cock 63 in a valve casing 66 is interposed in said passage 18′ to enable said passage to be more or less throttled or restricted as required to provide for a relatively small or extensive flow of liquid through said passage either to or from the cylinder, and thereby to provide for a relatively rapid or a relatively slow movement of the plunger 16 either upwardly or downwardly, depending upon the amount of restriction effected by the cock 63 upon the passage 18′. The cock 63 may be hand adjusted and left in one position for a considerable length of time, or it may be actuated by hand during the movement of the plunger 16 to accelerate or retard its movement as desired. The cock 63 may be employed to entirely cut off the flow of fluid through the passage 18′ and thus serve to lock the plunger 16 against movement relative to the base. Thus by actuating the three-way valve 64 and the two-way valve 63 by hand the operator has an extensive control over the movements of the plunger 16 both as to its movements upwardly and downwardly, and also as to the relative speed of its movement even to locking it against movement.

In order to limit the upward movement of the plunger within the cylinder, and to prevent accidentally forcing the plunger entirely out of the cylinder I provide a passage 70 cored in the wall of the plunger which registers with a port 71 through the cylinder wall near the top thereof, and when the plunger has been sufficiently elevated so that the ports 70 and 71 register the air under pressure escapes automatically through the ports 70 and 71 and between the collar 48 and the outer wall of the cylinder to the atmosphere without liability to discharge liquid from the reservoir 17 through said ports 70 and 71. The collar 48 does not make an air tight joint with the outer wall of the cylinder, hence air under pressure is enabled to pass freely through the port 71 and between the collar 48 and the outer wall of the cylinder to escape from the interior of the plunger to the atmosphere when the ports 70 and 71 register one with the other. I also contemplate employing a slotted lever 73 pivotally connected to an arm 74 carried by the three-way cock 57, Figs. 4 and 5, and having a limited sliding movement relative to a bolt 75 passing through its slot and attached rigidly to the base 14, whereby when the plunger 16 reaches the upper limit of its movement, the bolt 75 reaches the lower limit of the slot in lever 73, and thereupon the lever 73 pulls upon the arm 74 and shifts the three-way cock so as to discharge the compressed air from reservoir 17 to the atmosphere. Similar members 73′, 74′ and 75′ serve to automatically actuate the valve 63 of Figs. 6 and 7.

Since the weight to be lifted by such plungers varies widely it is impractical, and would be liable to injure the occupant or others were a compressible gas employed directly in the cylinder to raise or lower the plunger, and by employing an interposed substantially incompressible liquid and a port of predetermined dimensions through which the liquid flows to and from the cylinder, the movement of the plunger may be so regulated and controlled as to be slow regular and reliable to lift the chair irrespective of the weight of the occupant, and not to force the plunger entirely out of the cylinder, or to raise or lower the plunger at an excessive rate of speed, and I am enabled to employ relatively small bodies of fluid, and a pressure reservoir charged with a compressible fluid and to apply the compressible fluid to the surface of the liquid while the liquid is energized to act upon the plunger to raise the plunger and the energized liquid being incompressible is more readily and reliably controllable than the compressed gas would be.

The method and apparatus herein illustrated and described are capable of considerable modification without departing from the principle of my invention.

I claim:—

1. An actuating apparatus comprising a cylinder, a plunger mounted in said cylinder and movable relative to said cylinder, a member operatively connected to and adapted to be actuated by the relative movement of said cylinder and plunger, a storage reservoir containing a substantially non-compressible liquid, a port through which said liquid may flow to the interior of said cylinder, a valve operable to positively vary and control the rate of flow of said liquid through said liquid port in either direction, and means controllable to alternately provide a pneumatic pressure in said storage reservoir above the surface of said liquid and to release said pneumatic pressure.

2. An actuating apparatus comprising a cylinder, a plunger mounted in said cylinder and movable relative to said cylinder, a member operatively connected to and adapted to be actuated by the relative movement of said cylinder and plunger, a storage reservoir located in said plunger and containing a substantially non-compressible liquid, a port connecting said reservoir to the interior of said cylinder and through which said liquid may flow to and from the interior of said cylinder, a valve to open and close said liquid port to positively cut off and control the rate of flow of said liquid through said liquid port in either direction,

and means controllable to alternately provide a pneumatic pressure in said reservoir above the surface of said liquid and to release said pneumatic pressure.

3. An actuating apparatus comprising a cylinder, a plunger mounted in said cylinder and movable relative to said cylinder, a member operatively connected to and adapted to be actuated by the relative movement of said cylinder and plunger, a storage reservoir containing a substantially non-compressible liquid, a port through which said liquid may flow to the interior of said cylinder, a valve to open and close said liquid port to positively cut off the flow of said liquid through said liquid port in either direction, a pneumatic pressure and storage reservoir, a conduit leading from said pneumatic storage reservoir to said liquid storage reservoir, and controlling means to alternately admit pneumatic pressure in said liquid reservoir and to release the pneumatic pressure in said liquid reservoir.

4. An actuating apparatus comprising a cylinder, a plunger mounted in said cylinder and movable relative to said cylinder, a storage reservoir containing a substantially non-compressible liquid, a valve carried exteriorly of and by said plunger above said cylinder to control the rate of flow of said non-compressible liquid, ports for said non-compressible liquid leading through said plunger from said plunger reservoir to said liquid controlling valve and from said valve to the chamber of said cylinder, a pneumatic pressure and storage reservoir, a conduit leading from said pneumatic storage reservoir to said liquid storage reservoir, and controlling means to alternately admit pneumatic pressure in said liquid reservoir and to release the pneumatic pressure in said liquid reservoir.

5. An actuating apparatus comprising a cylinder, a plunger mounted in said cylinder and movable relative to said cylinder, a storage reservoir containing a substantially non-compressible liquid, a valve carried exteriorly of and by said plunger above said cylinder adjustable to variably control the rate of flow of said non-compressible liquid, ports for said non-compressible liquid leading through said plunger from said plunger reservoir to said liquid controlling valve and from said valve to the chamber of said cylinder, a pneumatic pressure and storage reservoir, a conduit leading from said pneumatic storage reservoir to said liquid reservoir, and controlling means to alternately admit pneumatic pressure in said liquid reservoir and to release the pneumatic pressure in said liquid reservoir.

6. An actuating apparatus comprising a cylinder, a plunger mounted in said cylinder and movable relative to said cylinder, a storage reservoir containing a substantially non-compressible liquid, a valve carried exteriorly of and by said plunger above said cylinder to control the rate of flow of said non-compressible liquid, ports for said non-compressible liquid leading through said plunger from said plunger reservoir to said liquid controlling valve and from said valve to the chamber of said cylinder, means operatively connected to and adapted to be actuated by the relative movement of said cylinder and plunger to automatically actuate said liquid controlling valve, a pneumatic pressure and storage reservoir, a conduit leading from said pneumatic storage reservoir to said liquid storage reservoir, and controlling means to alternately admit pneumatic pressure in said liquid reservoir and to release the pneumatic pressure in said liquid reservoir.

7. An actuating apparatus comprising a plurality of cylinders, a plurality of plungers mounted in said respective cylinders, and movable relative thereto, a plurality of members operatively connected to and adapted to be each actuated by the relative movement of a cylinder and plunger, a storage reservoir for each cylinder connected thereto by a port and containing a substantially non-compressible liquid, a pneumatic pressure and storage reservoir, an automatically controlled source of pneumatic pressure, connecting means to enable either said pneumatic storage reservoir or said pneumatic pressure generator to be excluded from the operative system, a pneumatic conduit system connecting each of said liquid storage reservoirs to said penumatic storage reservoir and with said pneumatic pressure generator means to enable either said pneumatic pressure storage reservoir or said pneumatic pressure generator to be excluded from the operative system, and independent controlling means for each liquid storage reservoir to admit pneumatic pressure to said respective liquid storage reservoirs and to release the pneumatic pressure therefrom.

In testimony whereof I have affixed my signature.

FRANK KOENIGKRAMER.