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AUTOMATIC INTERMITTENT BLADDER IRRIGATOR

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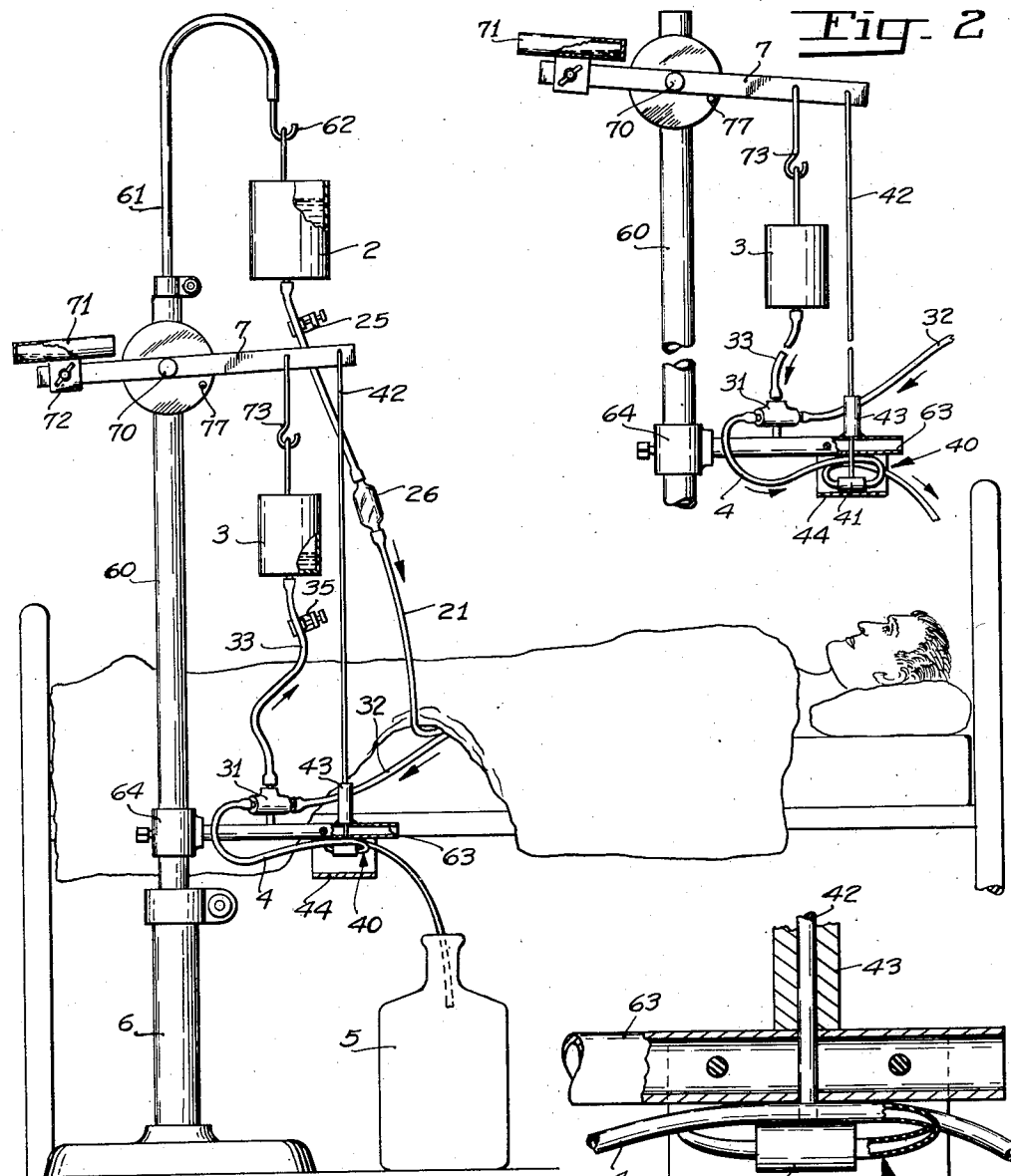


Fig. 1

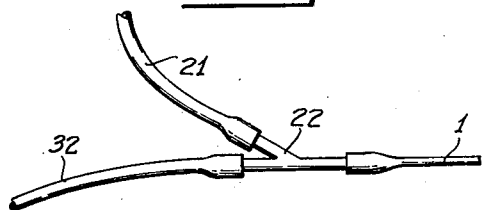


Fig. 3

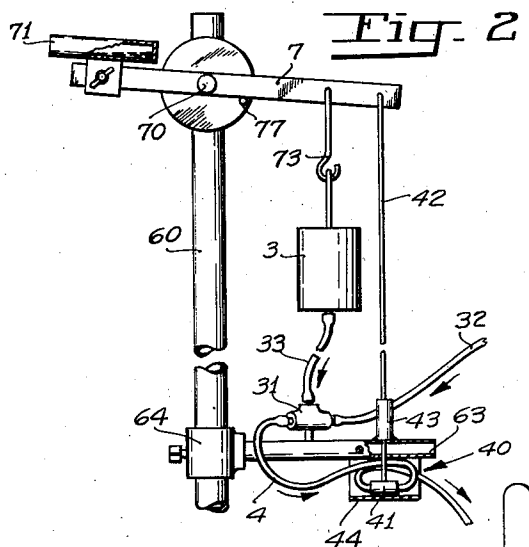


Fig. 2

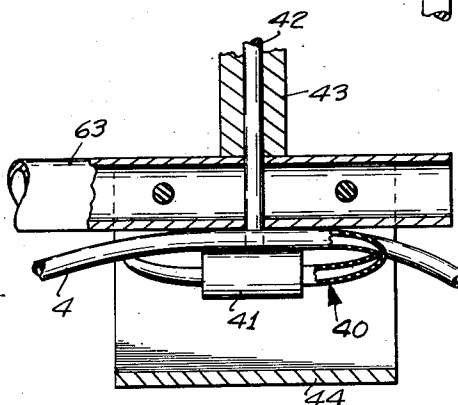


Fig. 4

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AUTOMATIC INTERMITTENT BLADDER
IRRIGATOR

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12 Claims. (Cl. 128-227)

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As a result of disease or injury to the nerves or muscles that control the function of the urinary bladder, the patient is frequently unable to void, hence artificial means must be used to empty the bladder.

The condition that causes neurogenic vesical obstruction varies from irreparable damage to the spinal cord to temporary malfunction from shock or operation upon pelvic or abdominal organs. Under such conditions the closer the man-made or artificial way to urinate comes to simulating the normal physiological process of voiding, the less will the damage be from vesical obstruction. Irreversible damage to the kidneys and heart is the sequela if vesical obstruction is severe or of long standing.

By alternately filling and emptying the bladder, at regular intervals, many patients who have paralysis from spinal cord injury develop an "automatic bladder." This means that the bladder will fill to a certain degree of distension and empty itself even though the spinal cord is severed so that no nerve impulses can go from the brain to the neuromuscular structures of the bladder. Therefore, such a patient can be rehabilitated to a considerable degree.

An automatic intermittent irrigator is of value:

- (1) To relieve vesical obstruction.
- (2) To exercise the muscles of the bladder by periodic distention and releasing a full bladder.
- (3) To irrigate the bladder with antibiotic solutions to control infection.

While there are devices intended to enable such periodic evacuation or irrigation of the bladder, experience has demonstrated that these devices are so delicate in adjustment, and so apparently difficult to set and adjust correctly, that persons specially skilled in so doing must be constantly available in the hospital, as disturbances of adjustment are of frequent occurrence because of the necessity of the nurses and orderlies caring for the physical wants of the patient. Since it is inconvenient and sometimes impossible, even in hospitals, for persons so specially skilled to be always available or to be free to attend to such things at the time when attention is needed, and yet regularity of voiding is essential to the establishment of the "automatic bladder" in such cases, it is extremely desirable to provide mechanism to accomplish such irrigation and evacuation which is so simple and substantially automatic in its operation that no great skill is required to adjust it and set it, wherefore, once set, it is not subject to disturbance, and it can be set up and adjusted initially, or after disturb-

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ance or dismantling, by the nurses or orderlies on duty, without more than routine training.

Accordingly, it is a primary object of this invention to provide a device which has a positive action in the nature of an automatic irrigator, capable of intermittent or periodical operation, which is simple and convenient to place in operation, and to adjust for trouble-free operation over long periods of time.

It is also an object to provide an irrigator of the character mentioned wherein adjustment may be conveniently accomplished, to regulate the rate of flow, and the periodicity of the automatic irrigation, in such manner as will best fit the needs of various patients.

It is also an object to provide in such an irrigator a trip or control therefor determinative of the periodicity of operation, which is of such construction as to insure substantially complete evacuation before shutting off the drainage flow.

It is, of course, an object to provide such an irrigator which is portable and readily transported from one location to another for the use of successive patients as required.

A still further object is the provision of an irrigator of this nature which is constructed in the main of simple parts, readily available in hospitals, and easily taken apart for sterilization or similar purposes, and as readily set up again for operation without likelihood of maladjustment.

With such objects in mind, and others as will appear hereinafter, this invention comprises the novel irrigator and the novel construction and arrangement of the parts thereof, as shown in the accompanying drawings, and as will be more fully described hereinafter, and the principles whereof will be defined in the appended claims.

In the accompanying drawings, the invention is shown embodied in a representative form, and it will be understood that the form, character and arrangement of the parts may be varied as conditions may require, within the principles hereinafter made clear.

Figure 1 is a side elevational view of the irrigator, shown in operative relationship to a patient, and with its parts in normal liquid-supplying positions, and Figure 2 is a similar view, parts being omitted, but showing the operative parts in draining position.

Figure 3 is an elevation of the catheter and the branch ducts leading thereto and therefrom, and Figure 4 is a detail sectional view of a typical valve mechanism.

Such irrigation is produced by the aid of a catheter 1 which is inserted into the patient's bladder,

Liquid for irrigation or medication is supplied from a suitable source, such as the elevated tank 2, by means of a duct 21 leading to the catheter by way of a Y-branched fitting 22, to one branch of which the duct 21 connects, to another branch of which the catheter 1 connects, and from the third branch of which extends a liquid outlet duct 32. The latter should trend downwardly for good drainage.

Supported at a level above the patient but below the liquid supply tank 2 is a liquid receiver 3. Below it, at a level somewhat below the level of the catheter 1 is a T-fitting 31, to one branch of which connects the liquid outlet duct 32. A riser duct 33 extends from a second branch of the T-fitting 31 to the bottom of the receiver 3. From the third branch of the T-fitting 31 a drain duct 4 extends generally downwardly. The lower end of the drain duct 4 extends to a waste drain or to a collector, such as the jug 5, which rests upon the floor and which serves to indicate or as a measure of the liquid output of the patient.

Intermediate the ends of the drain duct 4 is a valve, generally indicated by the numeral 40. Since the several ducts already mentioned are preferably lengths of rubber tubing, the valve 40 may be merely a loop in the drain duct 4, together with means for pinching the loop upon itself to close, or for permitting the loop to expand so that passage of liquid is unrestricted. It is shown in detail in Figure 4, and is of a type commonly used in hospitals. It will be understood, of course, that this is only a form which is convenient, and that any other suitable type of valve mechanism may be used in lieu thereof. As the means for opening and closing the valve I have shown a sleeve 41 encircling the loop at one point and a link 42 extending upwardly from sleeve 41, and by its movement upwardly accomplishing closing of the valve, and by its downward movement opening the valve.

The entire mechanism is conveniently supported from the stand 6 that rests upon the floor, supporting for vertical adjustment a tubular post 60, the latter in turn supporting for vertical adjustment a rod 61, having a gooseneck at its top terminating in a hook 62 whereon is hung the supply tank 2. Upon the post 60, and vertically adjustable thereon so that it will always be located below the catheter level, is an arm 63, the adjustment being accomplished by means of the collar and set screw at 64, and this arm supports the T-fitting 31 and a guide 43 for the link 42, as also a shield 44 for the valve.

Supported tiltably at 70 near the upper end of the post 60 is a tiltable lever 7 whereon, through the medium of a hook 73, is supported the receiver 3, and to which is connected the upper end of the link 42. The receiver 3 is supported at one side of the tilting pivot 70, and on the opposite arm of the lever 7 is adjustably supported a counterweight 71, the adjustment being indicated as by means of a sleeve and set screw at 72. Preferably this counterweight is of particular type, that is to say, it is an elongated tube extended lengthwise of the lever 7 and filled with a heavy liquid, such as mercury. By such an expedient as this, when the lever is tilted as far in one direction as engagement of the sleeve 41 with the shield 44 will permit, as shown in Figure 1, the mercury collects near the outer end of the tube 71, and it requires a considerable weight of water collected in the receiver 3 to overbalance the mercury and to tilt the lever 7 to open the valve 40. However, once the lever 7 has been

thus tilted from the position of Figure 1 to that of Figure 2, and is stopped by engagement with the stop 77, the mercury will run to the inner end of the tube 71, lessening its mechanical advantage, and it will now require that substantially all the liquid drain from the receiver 3 before the counterweight will again overbalance the arm 7 and tilt it in the opposite sense, to close the valve 40. Thus is assured substantially complete drainage of the receiver 3, and as will shortly be explained such drainage can occur only coincident with or after substantially complete evacuation of the patient's bladder, and so full and complete evacuation is assured automatically. Such a counterweight action may be likened to a snap action, and a snap action device might be substituted therefor, for the aim is to deter or prevent opening of the valve until a substantial quantity of liquid has collected in and distends the bladder and also arises to collect in the receiver 3. Then, when so much liquid has collected, full and substantially complete evacuation thereof is desired before the valve is again closed.

It will be observed that there is a tube clamp 25 in the riser duct 33 just below the receiver 3, and there is also a tube clamp 25 in the liquid supply duct 21 just below the liquid supply tank 2. These function as metering valves, and actual valves or cocks might be substituted therefor. The clamp regulates the supply of liquid from the tank 2 generally to a low rate, drop by drop, and the rate of supply can be observed in the sight glass 26 which is inserted in the supply duct 21 below the clamp 25. The clamp 35 does not greatly impede the rise of liquid into the receiver 3, but serves to slow down the rate of discharge from the receiver, so that that rate is less than the rate of discharge by way of the outlet duct 32 and drain 4.

In use, after the catheter 1 has been inserted into the patient's bladder, its free end is connected to the Y-fitting 22. The arm 63 is adjusted upwardly or downwardly on the post 60, as may be necessary to locate the T-fitting 31 and the valve 40 at a level below the catheter. The post 60 is adjusted vertically in the stand 6 to locate the receiver 3 at the desired elevation above the catheter. The elevation of supply tank 2 is not particularly critical, since the liquid is supplied therefrom rather slowly, as determined by the pinch clamp 25. Adjustment of the clamp 35 is made as may be necessary, primarily for the purpose of slowing down discharge from the receiver 3. It is important, of course, that the riser duct 33 be not closed completely, in order that a sufficient quantity of liquid may collect therein in the predetermined time to overbalance the counterweight 71. None of these adjustments are particularly critical, hence require no special skill to accomplish, for the rate of liquid supply as determined by the clamp 25 can be determined by sight in the sight glass 26, and otherwise it is only necessary to observe that the T-fitting 31 is below the level of the catheter and the receiver 3 is at a level somewhat above the catheter. It may readily be determined whether the clamp 35 is closed down too much, and it is unlikely that it will be closed too little.

Now liquid is supplied to the supply tank 2, and incidentally, instead of a static tank the supply might be from a main or other supply source. This liquid trickles down through the supply duct 21, and while it will also flow through the outlet duct 32 and into the drain duct 4 until it reaches

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the closed valve 40 and then it will back up into the riser 33, this is only when initially setting the system into operation. Thereafter it will begin to collect within the bladder, entering by way of the catheter 1, and eventually the bladder will be distended and the liquid, having no other place to go, will begin to rise into the receiver 3. When sufficient liquid has collected in the receiver that its weight overbalances the counterweight 71 the lever 7 tilts, and, as shown in Figure 2, the valve 40 opens. Liquid begins to drain from the liquid outlet 32 and drain 4 into the waste receiver 5, and of course, liquid may drain by way of the riser 33 into the drain duct 4, but because of the restriction at 35 in the riser 33 the liquid drains more slowly from the receiver 3 than from the liquid outlet duct 32, and in consequence the bladder will be completely evacuated before sufficient liquid has drained from the receiver 3 to permit the counterweight 71 to tilt the lever 7 back into the Figure 1 position. As soon as sufficient liquid has drained from the receiver 3, the lever 7 will tilt back, closing the valve 40 and the cycle recommences. The periodicity may be anything desired, but ordinarily the parts will be so adjusted as to effect evacuation approximately once each hour.

While liquid will continue to drop from the supply tank 2 during drainage, the rate of supply, as determined by the clamp at 25, is so low that there is no appreciable waste of liquid on this account. It will be understood that the liquid at 2 may be clear water or may be a medicated solution.

I claim as my invention:

1. A bladder irrigator of the character described comprising, in combination with a catheter, a liquid receiver supported at a level above the catheter, a first duct interconnecting the catheter and receiver for discharge of liquid from the catheter into the receiver, following distention of the patient's bladder, a downwardly trending drain duct connected to said first duct intermediate the latter's ends, and affording means to drain the receiver and the bladder, a normally closed valve in said drain duct, means to supply liquid at a predetermined rate to the catheter, and means operatively interconnecting the receiver and the valve, and sensitive to the weight of liquid in the receiver, to retain the valve normally closed, but to open the valve when a sufficient weight of liquid has backed up in the receiver from the catheter and the patient's bladder.

2. A bladder irrigator as in claim 1, including means to regulate the rate of flow in the receiver-connected duct.

3. A bladder irrigator as in claim 1, including means to maintain in the receiver-connected duct, between the receiver and the connection of the drain duct, a lesser flow rate than in the drain duct, including that portion of the said first duct between the catheter and the drain duct.

4. A bladder irrigator as in claim 1, including a balance lever on one arm whereof the receiver is hung, a counterweight on the opposite arm, and a valve-actuating link interconnecting the balance lever and valve, the whole constituting the operative interconnection between the receiver and the valve.

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5. A bladder irrigator as in claim 4, wherein the counterweight is formed as a liquid-filled tube extending lengthwise of the balance lever, to effect tilting and retention of the latter in each tilted position until a material change occurs in the weight of the receiver-contained liquid.

6. A bladder irrigator as in claim 4, including means to adjust the counterweight lengthwise of the balance lever, to vary the timing of valve opening.

7. A bladder irrigator as in claim 1, including means adjustable to vary the time interval between successive openings of the valve.

8. A bladder irrigator as in claim 1, including means to retain the valve in either open or closed position until a substantial change has occurred in the weight of the receiver-contained liquid.

9. A bladder irrigator as in claim 1, including a liquid supply tank supported at a level above the catheter and the liquid receiver, and connected to the catheter, constituting the means to supply liquid to the catheter.

10. A bladder irrigator as in claim 9, and means to adjust the elevation of the supply tank relative to the catheter and the receiver.

11. A bladder irrigator of the character described comprising, in combination, a first tri-branched fitting, a catheter connected to one arm of said fitting, a liquid supply duct connected to another arm, and a liquid outlet duct connected to the third arm; a second tri-branched fitting connected by one branch to the other end of the liquid outlet duct, a drain duct connected to a second branch and extending thence downwardly to a drain, and a riser duct connected to the third branch of the second fitting and extending thence upwardly; a liquid receiver connected to the upper, opposite end of the riser duct, and located at a level above the catheter; a valve in the drain duct; and means operatively interconnecting the liquid receiver and the valve, and sensitive to the weight of liquid in the liquid receiver, to hold said valve normally closed, but to open the same upon collection in the liquid receiver of a predetermined weight of liquid.

12. A bladder irrigator as in claim 11, including a balance lever on one arm whereof the receiver is hung, a liquid-filled counterweight tube mounted on the opposite arm for adjustment lengthwise such arm, and a link interconnecting the balance lever and the valve, the whole constituting the operative interconnection between the receiver and the valve.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
844,478	Spalding	Feb. 19, 1907
1,794,404	Herradora	Mar. 3, 1931

FOREIGN PATENTS

Number	Country	Date
203,551	Switzerland	June 16, 1939