Dec. 13, 1938. C. J. PILLING ET AL 2,140,113

SURGICAL DECOMPRESSION APPARATUS

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Fig. 1.

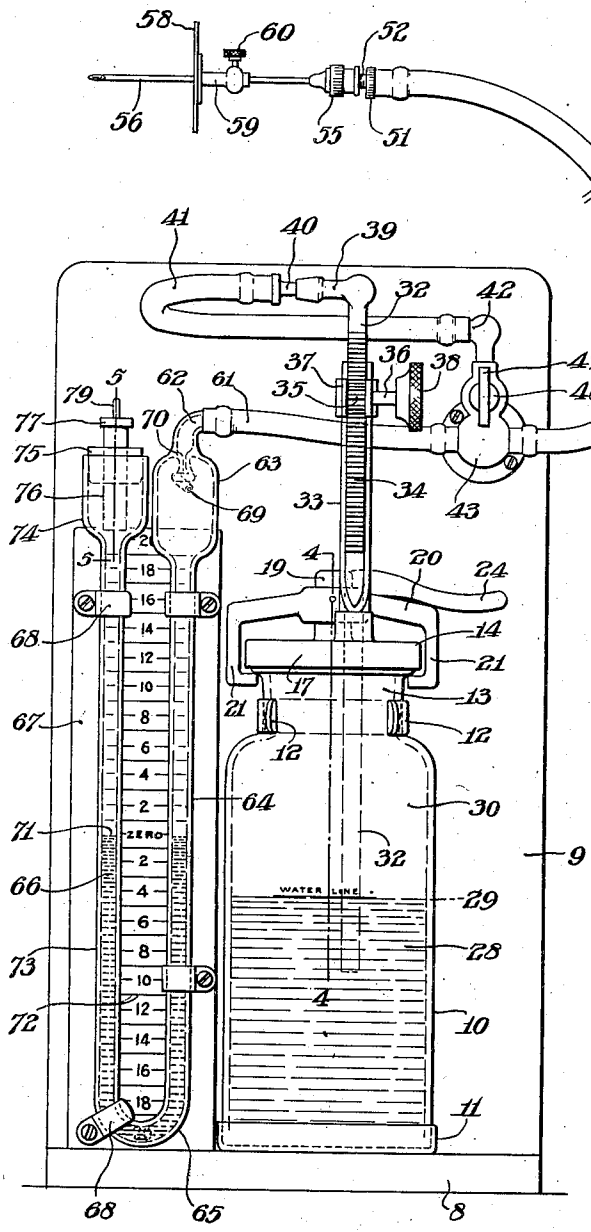
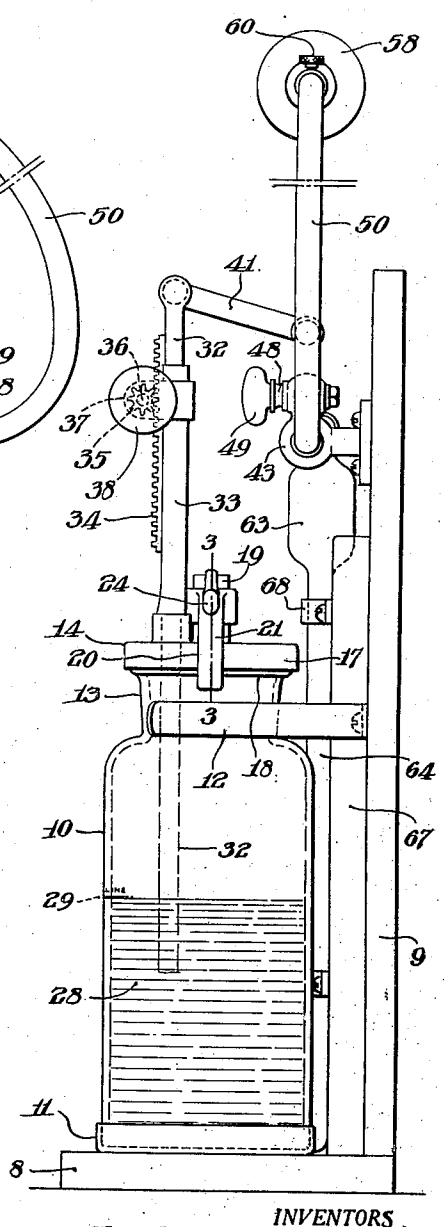


Fig. 2.



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Fig. 3.

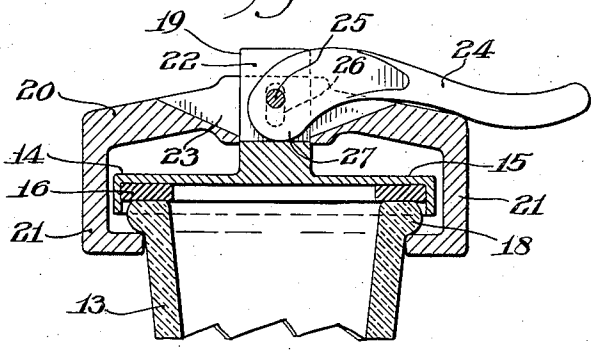


Fig. 4.

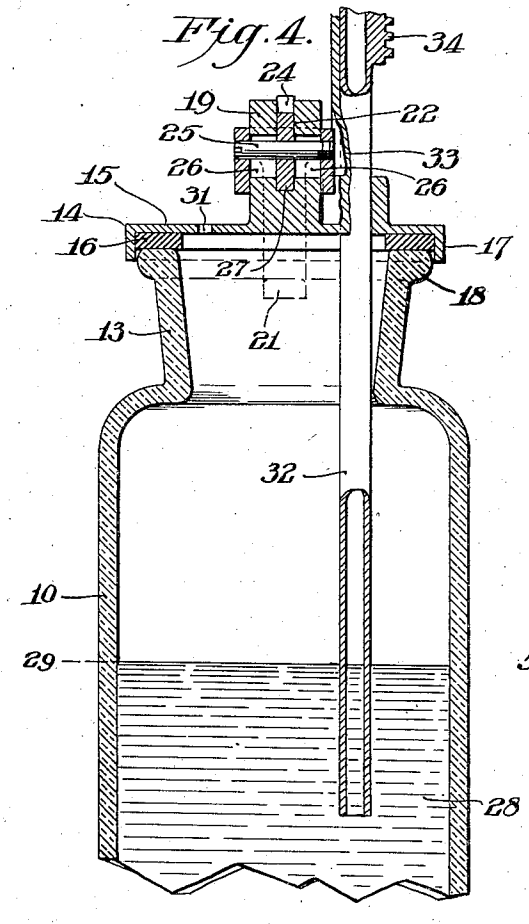


Fig. 5.

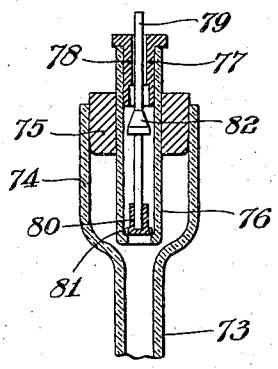


Fig. 6.

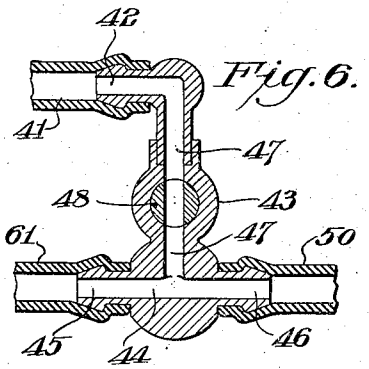
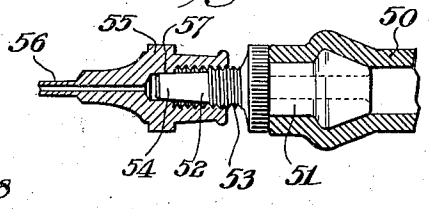


Fig. 7



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2,140,113

SURGICAL DECOMPRESSION APPARATUS

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Application April 8, 1936, Serial No. 73,292

3 Claims. (Cl. 128—275)

This invention relates to improvements in surgical decompression apparatus for the displacement of air from within the pleural cavity in the treatment of persons afflicted with pneumothorax and such other disorders of the lungs which permit the passage of air therefrom into the pleural cavity.

An object of the invention is to provide a novel and advantageous apparatus for permitting and controlling the displacement or expulsion of air from within the pleural cavity.

Another object is to provide adjustable devices for regulating the extent to which air is permitted to pass from within the pleural cavity.

Another object is to provide a manometer in association with other parts of the apparatus, whereby the pressure of air within the pleural cavity will be indicated at all times when the apparatus is in service.

The invention resides in the elements and the combinations of them hereinafter described and claimed.

In the accompanying drawings, illustrating the invention,

Figure 1 is a front view of a decompression apparatus illustrating one form of embodiment of the invention.

Figure 2 is a side view thereof.

Figure 3 is a sectional detail, on line 3—3 of Fig. 2, showing the means for clamping the closure on the jar.

Figure 4 is a detail in section showing a portion of the jar, the closure thereon, and the air tube extending through the closure and into the jar, the section through the clamping means for the closure being taken on line 4—4 of Fig. 1.

Figure 5 is a sectional detail of a part of the manometer, on line 5—5 of Fig. 1.

Figure 6 is a vertical section through the air controlling valve and portions of the flexible tubes connected thereto.

Figure 7 is a longitudinal section through the means for detachably connecting the needle and its flexible tube.

Referring to the drawings, the supporting frame or structure of the apparatus comprises a base board 8 and an upright panel 9 rising fixedly therefrom.

Mounted upon the base board 8 is a suitable closed container which, as herein illustrated is in the form of a transparent glass jar 10. The jar 10 rests within a metal cup 11 which is secured upon the board 8 and from which the jar may be removed when desired. The upper end of the jar is removably held in place by and between the side arms of a spring clip 12. The clip 12 is secured to and projects forwardly from the panel 9, and the side arms of the clip are fitted to and embrace the neck 13 of the jar.

The jar 10 is provided with a cover 14 comprising a metal body 15 having a rubber cushioning washer 16 interposed between it and the top of the jar, and having a downwardly-extending annular flange 17 which surrounds an outwardly-extending annular flange 18 on the neck 13 to position the cover 14 thereon. The cover 14 has a post 19 rising fixedly from the central part of the body 15 thereof. Slidable vertically on the post 19 is a yoke 20 having arms 21 which embrace and extend under opposite sides of the flange 18 of the neck of the jar. The post 19 and the yoke 20 have alined slots 22 and 23 respectively, for the reception of a clamp arm or lever 24 which is pivoted or fulcrumed on a pin 25 which extends through sides of the yoke 20 and through the lever 24 and through vertical slots 26 in sides of the post 19. The lever 24 is provided with a cam 27 which is constructed to engage the bottom wall of the slot 22 and raise the yoke 20 relatively to the body of the cover 14 and thus cause the yoke to firmly clamp the cover upon the jar when the clamp lever 24 is moved to the right hand side of the post 19, as shown in Figs. 1 and 3. When the clamp lever 24 is moved to the left hand side of the post 19, the yoke 20 is lowered relatively to the body of the cover 14 the pressure of the cover upon the jar is removed permitting the removal of the cover from the jar 10.

The lower portion of the container or jar 10 provides a water receiving and containing space 28 below the line 29 and the upper portion of the jar 10, above the line 29, provides an air receiving space 30. This space 30 is open to the atmosphere through an aperture 31 in the body of the cover 14.

Extending vertically through the cover 14 is a metal tube 32 which also extends through a supporting and guiding bracket or post 33 rising fixedly from the body 15 of the cover 14. The lower end portion of the tube 32 extends into the water space 28 of the jar 10, and the tube 32 is slidable vertically within the cover 14 and post 33 to different positions of adjustment to raise and lower the lower end of the tube within water contained within the space 28.

The upper portion of the tube 32 is provided with a gear rack 34 whose teeth are engaged by

the teeth of a small gear wheel 35 fixed on a shaft 36 and located between plate-like arms 37 which are formed on or secured to the upper end portion of the post 19 and project forwardly therefrom on the respective sides of the gear rack 34. One end of the shaft 36 extends outwardly and has a suitable head or wheel 38 fixed on the outer end thereof, by means of which the shaft 36 may be turned to cause the gear wheel 35 in co-operation with the rack 34, to either raise or lower the tube 32 in accordance with the direction in which the head or wheel 38 is turned.

The upper end of the tube 32 terminates in a laterally extending head or arm 39 to which a nipple 40 on the forward end of a flexible rubber tube 41 is detachably connected. The tube 41 is in communication with the tube 32 through a passage formed in the head or arm 39 and extending through the nipple 40.

The rearward end of the tube 41 is connected to a lateral projection 42 on the upper end of a metal fitting 43 which is secured to the panel 9. The flexibility of the tube 41 and its disposition with relation to the tube 32 and fittings 43 are such as to permit the easy up and down adjustment of the tube 32 relatively to the fixed fitting 43. The fitting 43 has a horizontal passage 44 in the lower portion thereof which extends through projections 45 and 46 on the respective sides thereof, and the fitting also has a vertical passage 47 therein whose lower end communicates with the passage 44 and whose upper end communicates with the tube 41 through the lateral projection 42 on the fitting. The vertical passage 47 is interrupted by a valve 48 which is constructed to be turned within the fitting 43 and which is provided with a suitable operating head or handle 49, by means of which the valve 48 may be turned to open or close the passage 47 as desired.

One end of a long flexible rubber tube 50 is connected to the projection 46 of the fitting 43 and communicates with the passage 44 therein. The other end of the tube carries a metal fitting 51 having a projecting nipple 52 provided with a threaded base 53 and a ground tapered free end portion 54. The nipple 52 extends into a head 55 which forms the base of a tubular needle 56, and which is constructed to be detachably connected to the nipple 52. The interior of the head 55 is threaded for the reception of the thread 53 of the nipple, and the interior of the head has a ground tapered seat 57 for the reception of the tapered portion 54 of the nipple. The parts of the nipple 52 and head 55 are so related that when the head 55 is screwed tight upon the nipple 52, the tapered end portion of the nipple will be forced into contact with the seat to form a tight joint between the nipple and the head. The parts just described provide a construction which prevents the accidental withdrawal of the head 55 from the nipple 52 when the apparatus is in service, and in which the needle may be readily detached from the nipple, when desired, by unscrewing the head 55 from the thread of the nipple.

The needle 56 has a pointed free end and it is constructed to be forced into the body of the person or patient to be treated until the open pointed end of the needle is in communication with the pleural cavity of the patient.

The needle 56 is surrounded by a guard disc 58 carried by a sleeve 59 which surrounds and is slidable on the needle and is provided with a set screw 60 to secure it and its disc 58 to the needle in positions of longitudinal adjustment thereon. The disc 58 serves as a guard to engage the body of the patient and prevent the insertion of the needle beyond the desired point for communication with the pleural cavity.

The projection 45 of the fitting 43 is connected by a flexible tube 61 to a projection 62 on the expanded upper end portion 63 of one limb 64 of a U-shaped manometer tube 65 containing a suitable pressure indicating liquid, such as colored water 66. The tube 65 is formed of transparent glass and it is mounted on a backing plate 67 by means of brackets 68, and the plate 67 is secured to the panel 9 of the apparatus. The passage 44 of the fittings 43 communicates with the expanded portion 63 through the tube 61 and projection 62 and a small curled glass tube 69 which extends from a wall 70 which closes communication between the projection 62 and expanded portion 63 around the tube 69. The expanded portion 63 and the small curled tube 69 serve to prevent the indicating liquid 66 of the manometer from accidentally entering the tubes 61 and 50 during the handling or tilting of the entire apparatus.

The normal level of the water or other liquid 66 in the manometer tube 65 is at the zero line 71, and the forward surface of the backing plate 67 is provided with a vertical series of markings 72 uniformly spaced above and below the zero line 71 and also with suitable indicia in the form of numerals progressively increasing in value both upwardly and downwardly from the zero line 71 and designating the liquid level in either the limb 64 or the limb 73 of the manometer tube 65 the degree of air pressure above atmospheric pressure that is present in the tubes 61 and 50 and needle 56, and also in the pleural cavity of the patient, when the apparatus is in service.

The limb 73 of the manometer tube 65 is provided with an expanded upper end portion 74 whose upper end has a yieldable rubber stopper 75 inserted therein. Extending centrally through the stopper 75 is a tube 76 having a slightly contracted lower end and having a plug 77 inserted into the upper end thereof. The plug 77 has an axial opening 78 therein through which a small rod or shaft 79 extends. The diameter of the opening 78 is greater than the diameter of the rod 79 to permit the free passage of air through the opening. The lower end of the rod 79 has a head 80 secured thereto and resting normally on the contracted lower end of the tube 76 and closing the same save for slight air passages formed by indentations 81 in the head 80. The rod 79 carries a valve body 82 which rests normally below the bottom of the plug 77 and which is adapted to seat against the bottom of the plug and close the opening 78 when the rod 79 is raised.

The purpose of providing the valve 82 and its associated parts is to prevent a sudden increase in air pressure above the manometer liquid in the limb 73 of the tube 65, such as would be produced by the coughing of a patient being treated. Such sudden increase in air pressure would cause the manometer liquid 66 to drive air above the same in the limb 73 out through the tube 76 and passage 78 and cause such air to impinge against the bottom of the head 80 and raises the rod 79 and closes the valve 82 and thus immediately closes the opening 78 and prevents further discharge of air from the limb 73, and, consequently prevents the discharge of any of the liquid 66 from the manometer. The expanded upper end

portion 74 of the limb 73 of the manometer also serves to receive and prevent the accidental discharge of the indicating liquid 66 from the manometer during the handling or tilting of the apparatus.

The operation of the apparatus when it is in service is as follows:

The head 38 is turned to lower the tube 32 well into the water within the jar 10, valve 48 is closed, the guard 58 is adjusted to the desired position on the needle 56, and the needle is projected into the body of the patient to be treated until the pointed open end of the needle is in communication with the pleural cavity. Air within the cavity then passes through the needle 56 and tubes 50 and 61 into the manometer 65 and acts upon the liquid 66 and causes it to indicate the degree of the intrapleural pressure. The physician in charge now opens the valve 48 to open communication between the tubes 50 and 61 and the tubes 41 and 32, and the intrapleural pressure then acts upon the water within the tube 32, the level of the water within the tube being normally at the line 29. If the degree of pressure indicated by the manometer is such that it is desired to reduce the same, the head 38 is turned to raise the tube 32 until the air can overcome the water pressure within the tube 32 and pass from the lower end thereof up through the body of water within the jar 10 exteriorly of the tube. The extent to which the tube 32 projects into the body of water within the jar 10 determines the air pressure that is necessary to overcome the water pressure within the tube 32 to permit the air to escape from the lower end of the tube; and, therefore, it will be understood that by raising the tube the quantity of air that is permitted to pass from the pleural cavity may be nicely regulated.

By raising the tube 32 and observing the air bubbles discharged from its lower end and observing the changing degrees of pressure indicated by the manometer, the discharge of air from the pleural cavity may be regulated and controlled until the pressure has been reduced to the desired extent, whereupon the needle 56 is removed from the body of the patient.

At any time during the operation of the apparatus, the valve 48 may be closed to close communication of the tubes 50 and 61 with the tube 32 for an accurate reading of the manometer, or for observing the rising and falling operations of the manometer in accordance with the changes in pressure in the pleural cavity occasioned by the breathing operations of the patient, or for any other purpose.

We claim:

1. In a surgical decompression apparatus, the combination of a container providing a water receiving space, a rigid tube provided with a gear rack, means for slidably supporting said tube with its lower end portion extending into said space, a gear wheel in mesh with said rack, means operable to turn said wheel to raise and lower said tube, a body penetrating tubular needle, and a flexible tube associated with the needle and the first named tube and establishing communication between them.

2. In a surgical decompression apparatus, the combination of a jar providing a water receiving space in the lower portion thereof, a cover upon the jar, means for detachably securing the cover to the jar, a rigid tube extending through the cover and into said space, means carried by the cover for slidably supporting said tube, means operable to raise and lower said tube, a body penetrating tubular needle, and a flexible tube associated with the needle and the first named tube and establishing communication between them.

3. In a surgical decompression apparatus, the combination of a jar providing a water receiving space in the lower portion thereof, a cover upon the jar, means for detachably securing the cover to the jar, a rigid tube provided with a gear rack and extending through the cover and into said space, means carried by the cover for slidably supporting said tube, a gear wheel in mesh with said rack, means operable to turn said wheel to raise and lower said tube, a body penetrating tubular needle, and a flexible tube associated with the needle and the first named tube and establishing communication between them.

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