J. S. DEAN.

SURGICAL DEVICE FOR EXPANDING COLLAPSED LUNGS.

APPLICATION FILED JULY 21, 1909.

978,708. Patented Dec. 13, 1910.

Fig. 1.

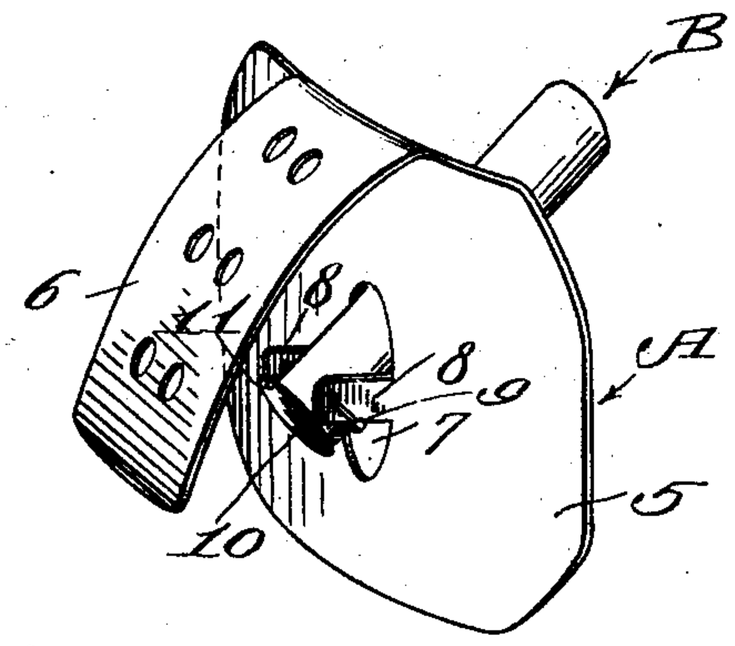


Fig. 2.

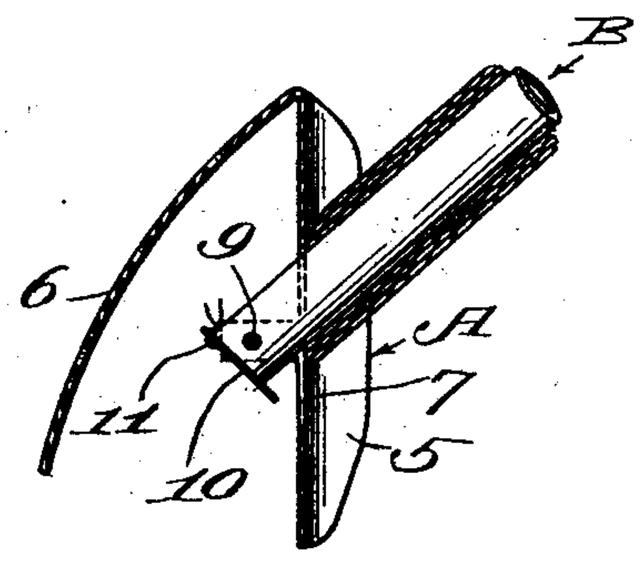


Fig. 3.

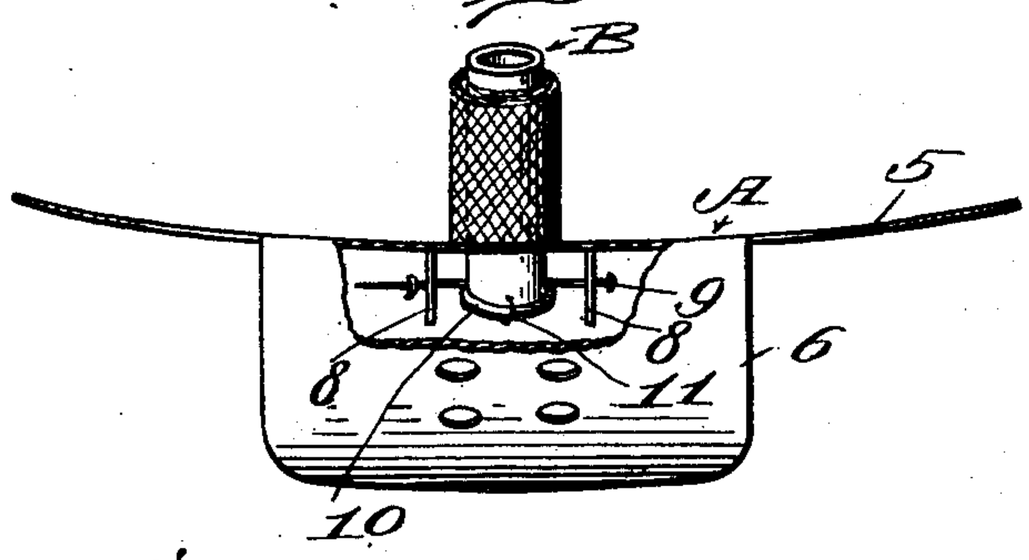


Fig. 4.

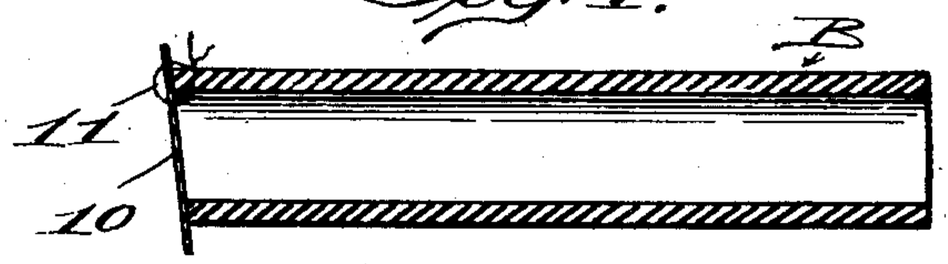


Fig. 5.

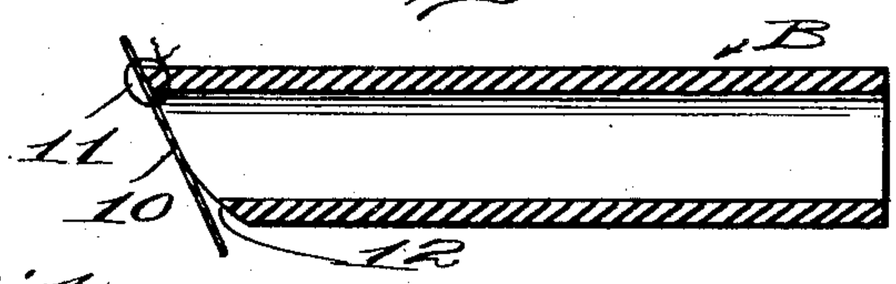
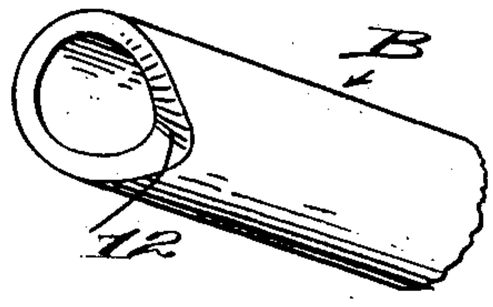


Fig. 6.



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SURGICAL DEVICE FOR EXPANDING COLLAPSED LUNGS.

978,708. Specification of Letters Patent. Patented Dec. 13, 1910.

Application filed July 21, 1909. Serial No. 508,744.

To all whom it may concern:

Be it known that I, JOHN S. DEAN, a citizen of the United States, residing at Wheatland, in the county of Clinton and State of Iowa, have invented new and useful Improvements in Surgical Devices for Expanding Collapsed Lungs, of which the following is a specification.

The present invention is an improvement in surgical devices for the treatment of collapsed lung, a diseased condition which is due primarily to the presence of pleural effusions.

When an operation for removal of pleural effusion is performed, a section of rib is first removed, fluid evacuated, and a drainage tube then inserted. As soon as this has been done, the atmospheric pressure against the external surface of the lung, and that introduced internally thereof through the bronchi and trachea will virtually balance. Consequently, the lung that has been collapsed by pressure of the pleural effusion will not expand under normal conditions. In treating a "case" of this character, it was therefore formerly considered necessary to apply a heavy dressing to the external wound, thereby partly excluding the air from the latter, and to either make use of a Wolff's bottle or to blow through a constricted tube, so as to force moderately-compressed air from the healthy lung into the collapsed lung. Frequently, however, adhesion of the lung to the chest wall took place before expansion could be effected, and in such instances, the only course was to resect the ribs and to cave the soft parts of the chest in against the collapsed lung.

It is the object of this invention, broadly stated, to produce a device by means of which normal respiration may be established immediately upon the insertion of the drainage tube, thereby insuring prompt expansion by preventing adhesion.

Further, such object comprehends the production of a device of the above specified type in which the drainage tube is so constructed and so arranged with reference to its support as to provide for its ready and accurate insertion in the wound irrespective of the angular trend of the incision, and for its retention in position when inserted therein, thus insuring perfect drainage and at the same time avoiding irritation and maceration of the tissues consequent upon the tube becoming displaced; to obviate the necessity for "secondary" operations or decortication; to render the patient more comfortable than was possible under the old method of treatment; and to materially reduce the time necessary to obtain a cure.

Finally, the invention contemplates the production of a device which may be subjected to complete sterilization.

These objects are effected by the present invention, which, briefly described, comprises essentially two members, a support and a drainage tube. The support consists, in turn, of base and wing members constructed from a single blank of suitable flexible sheet material, the base member being provided with a central opening, through which the drainage tube projects. This tube is pivoted adjacent its lower or outlet end to the base member, and has a diameter considerably less than that of the above mentioned opening, through which it projects, as already stated. For this reason, the tube is capable of a swinging movement in a vertical plane, so as to accommodate itself to the angularity of the incision in which it is to be inserted. At its outlet end, the tube is provided with a flexible valve. The wing member of the support extends in front of and thus protects the drainage tube.

The preferred embodiment of the invention is illustrated in the accompanying drawings, wherein:

Figure 1 is a perspective view of the improved device. Fig. 2 is a transverse vertical sectional view thereof. Fig. 3 is an enlarged plan view of Fig. 1. Figs. 4 and 5 are detail longitudinal sectional views of different forms of drainage tubes employed. Fig. 6 is a fragmental perspective view of the tube shown in Fig. 5, with the valve omitted.

Reference being had to said drawings, and to the characters marked thereon, A denotes in a general manner, the support, and B the drainage tube, of which two elements the device essentially consists.

The support A is constructed from a single die-struck blank of suitable thin sheet metal and comprises a relatively long base member 5, and a wing 6, the latter member being formed upon the central portion of the upper edge of the member first-mentioned. Member 5 has a slight transverse bowing and is provided with a circular opening 7 located centrally thereof. At the

edge of this opening, there are formed two diametrically-opposite perforated lugs 8.

The drainage member B employed in connection with the support is in the form of a short rubber tube of a diameter considerably less than that of the opening 7 through which it is designed to project. To support this tube, there is passed through its front or lower end a pin 9, the ends of which project through the perforations in lugs 8. The pin, therefore, serves as the axis upon which the tube swings. It may, as shown, be in the form of a straight wire strip provided at its ends with heads, one of which is removable, or it may be in the form of a safety pin of the ordinary type. At its outlet end, the tube carries a valve 10, formed by a disk of oiled silk, which is stitched directly to the upper surface of said end, as indicated by the numeral 11, the stitches passing through said end at a point removed from the face thereof. This valve is normally in closed position, when the device is in use. There is a definite and important relation existent between the rapidity of the operation of the valve and the angle of the lower end face of the tube with respect to the axis thereof, the valve being designed to close the outlet end of the tube during inhalation of the patient, and to move away from and open said end during exhalation.

It is obvious that the length of the arc through which the valve moves during its closing movement is directly proportional to the time consumed in such movement under a constant force. Consequently, as the length of such arc increases, the speed at which the valve moves will decrease. Assuming, then, that if the outlet end face of the tube forms a right angle with its axis, the valve will close instantly upon inhalation, any rearward beveling of said face will have the effect of causing the valve to close more slowly. Therefore, it may be stated that if said face be oblique rather than perpendicular to the axis of the tube, the degree of such obliqueness will control the rapidity of the operation of the valve. Tubes in which the principle is embodied are illustrated in Figs. 4 and 5.

In operations for the removal of pleural effusion, it is considered advisable to permit more or less air to enter the pleural cavity at first for the purpose of lessening the intra lung pressure by way of the trachea and bronchi, and to gradually reduce the amount of air admitted, to gently dilate the lung from day to day. To effect the initial entrance of air, a notched tube such as is shown in Fig. 6 is employed, the valve being omitted, however, in said figure, to more clearly disclose the notch which is indicated by the numeral 12 and is formed in the lower surface of the outlet end of the tube, so as to admit air into the tube behind the valve. In practice, it is advisable to employ the notched tube immediately after the operation, gradually decreasing the length of the notch day by day, then to utilize a tube of the type shown in Fig. 4, in which the notch is omitted, and finally, to employ the tube in Fig. 2, in which the outlet end face is perpendicular to the axis of the tube.

Referring, again, to the wing member 6 of the support A, it will be seen that said member projects in a downward and outward curve directly in front of the outlet end of the tube, thus affording adequate protection therefor from interference on the part of the dressing and from the discharge from the wound. The wing is also intended to neutralize the movement of the chest wall of the patient during respiration, and to this end a bandage is passed around said wing and around the chest with sufficient tightness to force the wing far enough inward to exert an even pressure upon the chest wall. It has been considered unnecessary to illustrate this bandage, however, as well as the dressings and other bandages applied. The base member of the support is likewise adapted to flex under bandage pressure, to conform to the shape of the chest wall.

Owing to the pivotal mounting of the tube, it will be appreciated that the latter can readily accommodate itself to incisions of various inclinations, and when in position it cannot turn or be otherwise displaced. This is a matter of considerable importance, since such turning movement, if possible, might irritate the tissues of the wound and cause the same to become infected. A similar result is also avoided by preventing the matter discharged through the tube from coming into contact with the tissues, and by wrapping the tube with several thicknesses of gauze or other suitable material, saturated with a 5% solution of iodoform, or otherwise appropriately medicated. This wrapping, which is indicated in dotted lines in Fig. 2, serves to prevent the entrance of air around the outer surface of the drainage tube into the pleural cavity, as well as to keep the wound sterile. It also has the effect of preventing the discharge from being sucked back into the pleural cavity, thereby avoiding reinfection. Moreover, the construction of the device as a whole is such that it can be readily sterilized without injury to any of the parts thereof. It may, finally, be stated that the valve may be constructed of foil, or of any other light and flexible waterproof material, rather than of oiled silk, if considered desirable, and that owing to the positive attachment of the drainage tube to the shield, a very short length of tube may be made use of, thereby completely avoiding protrusion of the inlet end of the tube into the pleural

cavity. In actual practice, the length of the tube is such that its working portion is exactly equal to the combined thickness of the chest wall of the patient and the wrapping of medicated gauze.

What is claimed is:

1. A surgical drainage device comprising a drainage tube having one end thereof adapted for reception in a wound, and a support to which said tube is pivoted, to accommodate itself to the trend of the incision.

2. A surgical drainage device comprising a drainage tube provided at one end with a valve and having its other end adapted for reception in a wound, and a support to which said tube is pivoted for movement relative to said support in a vertical plane.

3. A surgical drainage device comprising a support formed with a centering opening, and a drainage tube pivoted to said support for angular adjustment with respect thereto, and having one of its ends projecting through said opening and adapted for insertion in a wound.

4. A surgical device for drainage pleural effusions comprising a base member, a drainage tube attached thereto, and a flexible wing connected to said base and extending in front of said tube, to protect the same.

5. In a surgical device for draining pleural effusions, a drainage tube and a support therefor, said support being provided with a member upon which the tube is pivoted and by which it is held against turning, and with an additional member extending in front of said tube for protecting the same.

6. In a surgical device for draining pleurai effusions, a resilient support comprising integrally-connected base and wing members, and a drainage tube pivoted to the base adjacent its outlet end and behind said wing, and provided with a valve at said end, said base being formed with an opening through which said tube projects.

7. A surgical drainage tube having a valve pivoted to its outlet end and having a notch formed in said end to admit air behind the valve.

8. A surgical drainage tube having a valve pivoted to the upper surface of its outlet end, and having the face of said end extending rearwardly and obliquely to its axis.

9. A surgical drainage tube having a valve pivoted to the upper surface of its outlet end, and having the face of said end rearwardly beveled, the lower surface of said end having a notch formed therein to admit air behind the valve.

10. In a surgical device for draining pleural effusions, a support comprising a member adapted to flex under bandage pressure, to conform to the chest wall of the patient, and a flexible member connected to the first mentioned member for neutralizing the movement of said wall during respiration; in combination with a drainage tube attached to one of said members.

11. A surgical drainage tube, having a movable valve of flexible sheet material stitched to its outlet end for closing the same, the stitches passing through said end at a point removed from the face thereof, to permit portions of said end to be cut away for varying the angle of said face to the axis of said tube, to control the rapidity of the operation of said valve.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

JOHN S. DEAN.

Witnesses:

EDWARD J. RIEDESEL,

ALBERT DIECKMANN.