AN IMPROVED ARTIFICIAL PNEUMOTHORAX APPARATUS.

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When dealing with penetrating wounds of the chest, the introduction of air into, or the withdrawal of air from the pleural space may be of great therapeutic value, and this procedure is rendered infinitely more easy and accurate if an artificial pneumothorax apparatus is available.

Such an apparatus, however, is not part of the standard equipment of emergency hospitals situated in the more remote regions of the world and it becomes necessary to devise one from the materials available in the medical store.

Fortunately, almost all the parts necessary for the construction of an artificial pneumothorax apparatus are to be found in the standard Army pattern blood transfusion apparatus which may be temporarily dismantled and subsequently re-assembled without deleterious effect to its original purpose.

On page 164 is a photograph of the completed apparatus. It is designed on the Lillingston and Pearson pattern, and consists essentially of two bottles connected together in such a manner that water may be displaced from one to the other at will.

By this means it is possible to drive a known volume of air out of the second bottle, through a rubber tube and suitable needle into the pleural space. Or, alternatively, air may be withdrawn from the pleural space into the bottle.

A water manometer is included in the system so that pressure changes may be observed.

The first essential in the construction of an artificial pneumothorax apparatus is the provision of air-tight connexions and, for this reason, it is necessary to have rubber stoppers for the bottles. Such stoppers, already bored with two holes and provided with glass tubes, are fitted to the blood transfusion bottles and hence this problem is solved immediately.

In the apparatus in the photograph, the longer of the glass tubes in each bottle was replaced by a new one which had been bent to a right angle to prevent any possibility of kinking of the rubber connexion. The long tube should reach to the bottom of the bottle; the short tube extends not more than half an inch within the neck.

The blood transfusion bottles are provided with a wire handle, which is attached to the base of the bottle by means of a metal band. This latter is unclipped and the wire handle disengaged from it and turned inside out so that the hook at either end points outward instead of inward. The handle is then attached to the neck of the bottle with a piece of string.

This wire handle now serves to support the bottle on the hook on the manometer stand and saves the operator the trouble of holding it while the apparatus is in operation.

A strip of one inch adhesive strapping is stuck longitudinally on to bottle
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number two, the bottle is calibrated by means of a measuring glass and graduated on the strapping at intervals of 50 c.c.

A four-way connexion is next prepared. This can easily be done by joining together with a short length of rubber tubing two glass Y connexions—part of a Carrel Dakin's apparatus.

The manometer is made by bending into the shape of a U a piece of glass tubing approximately 80 cm. in length, so that each limb of the U is about 40 cm. long. But if this operation presents difficulties an equally satisfactory manometer can be made by joining two straight glass tubes with a short length of rubber tubing.

The manometer is supported on a piece of board of the appropriate size and shape, held upright by two struts as a base, all of which can be obtained, as was done in the apparatus in the photograph, from the side of a packing case.

A hook or nail is inserted into the side of the manometer stand at such a height as will allow fluid to flow from one bottle to another without causing the
manometer to overflow from the pressure produced when one of the bottles is elevated on to the hook.

The manometer is secured to the stand by means of strapping and is graduated in centimetres by means of ink marks on the board.

To one of the limbs of the manometer is attached a piece of rubber tubing which is brought down behind the board and secured to the anterior extremity of one of the struts at the base. If a short length of glass tubing is inserted at this point the remaining parts of the apparatus can be separated from the manometer for sterilization.

Several lengths of rubber tubing are necessary all of which should be of the same calibre as that of the glass manometer.

Finally, four spring clips are needed to open or close the rubber connexion as may be necessary when the apparatus is in operation. One is attached to the rubber tube between the two bottles; a second between bottle number two and the four-way connexion; a third closes off the rubber tube leading to the needle and a fourth that leading to the atmosphere.

A short length of glass tubing containing a small piece of sterile cotton-wool to act as an air filter may be inserted near each outlet of the apparatus.

One of the bottles is filled with a weak solution of dettol, or other antiseptic, and the two bottles are connected together by joining with a piece of rubber tubing each of the longer glass tubes (vide fig.).

If now a little air is blown into the full bottle, a siphon action is started and fluid will flow from one bottle to another until the level is equal in both.

The manometer is half filled—that is, to the zero mark, with a watery solution of red ink which does not stain the glass.

The apparatus may now be assembled by joining to the four-way connexion the manometer, bottle number two, the intra-pleural needle with its rubber tubing and the extra outlet to the atmosphere.

The air-tightness of the connexion should be tested by closing the spring clips at each outlet of the apparatus and opening the remaining two. When one of the bottles is elevated on to the hook on the manometer stand the fluid will rise in one of the limbs of the manometer and should remain stationary when the clip between the two bottles is closed.

An ordinary serum needle does quite well for introducing the air into the chest since in these surgical cases the lung is collapsed and is not likely to be injured by the sharp pointed needle.