at the required level. The inflow tube is then opened and the space beneath the cover allowed to fill with fluid. When the level of the fluid in the reservoir has ceased to fall the inflow should be closed and the outflow opened. The ensuing establishment of negative pressure causes a "setting" of the circumferential flanges to the contour of the skin. The apparatus is now in readiness for the institution of ebb and flow irrigation (see fig. 4).

Regulation of the Irrigation.—It is not possible at this time to lay down rules as to the degrees of pressures, and the alternations to be employed in the various types of wound. Each case must be judged upon its merits and the pressures graded accordingly. The avoidance of any pain, no matter how slight, is a guiding principle of the first importance.

Positive Pressure.—In all cases where there is much discharge, pressure, to start with, should be low—usually from 6 to 12 in.—as measured by the height of the column of fluid above the level of the wound. When no free pus issues from the mouth of the wound upon removal of the device, and little or none can be expressed by milking along its tracks, the pressure may be increased. It is doubtful whether it is ever necessary to go beyond a pressure as represented by an 18 in. elevation above the part, though the employment of positive pressure above this, even up to 3 ft., has in no way been associated with untoward effects.

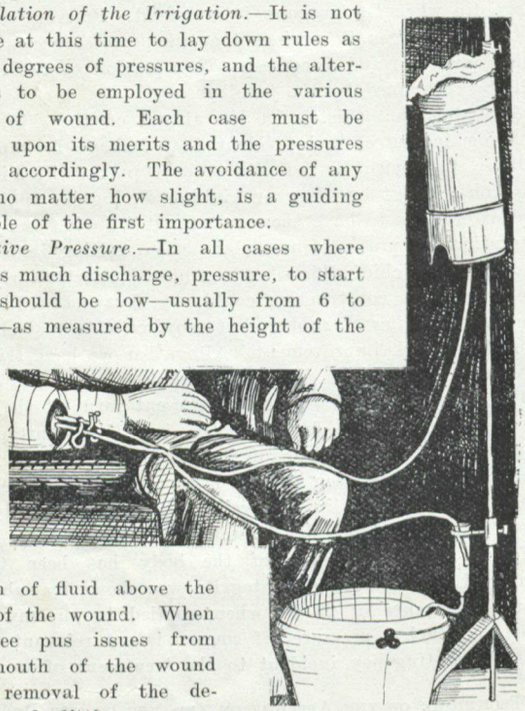

Fig. 4.

Negative Pressure.—More care must be exercised in the use of negative pressure. In old chronic sinuses, even though discharging profusely, the maximum amount of negative pressure which the height of the ordinary military bed permits—about 2½ ft.—may be used with impunity. In acute cases, on the other hand, it must be greatly reduced, and our one reliable criterion is the causation of pain, freedom from which should be absolute. Large "doses" of negative pressure produce a profound reaction in the wound, and while this is salutary in chronic cases, it, possibly, may be otherwise in an acutely inflamed wound. In our earlier cases, which were mostly of the chronic type, we underestimated the potency of negative pressure, and were much puzzled by the occurrence, sometimes, of a slight initial rise of temperature (½° to 1°) after the device had been in operation for a few hours. As this rise ran parallel to a marked cleansing and freshening of the wound, and a notable improvement of all local signs, it struck us in the light of a phenomenon, until the same pressure was employed in an acute case when the stimulating effects of negative pressure became rather too evident. In this case the patient had complained of pain; nevertheless, in a few hours the wound opening, which had been previously pouring pus, was found to be filled with lymph and blood; there was an improvement in the general appearance, there was less swelling and tenderness, and yet the temperature was elevated. We then came to look upon this rise of temperature as being of a reactionary nature and consequent upon the pouring out of lymph and the extravasation of blood, with their content of ferments, into the cavity of the wound. We have been led, therefore, to consider it of kindred nature to the aseptic fever following operations and accidents.

In very acute cases minus pressure may be greatly reduced or even abolished until the more urgent symptoms subside. To measure its amount with accuracy we use the barrel of an ordinary 3-oz. glass syringe, which is attached to the reservoir stand by means of a sliding collar, and thereby adjustable to any level (see fig. 5). The outflow tube arising from the device is made to empty into the glass barrel, whilst a length of tubing attached to the syringe nozzle leads into the waste pail.

The depth of the pendant column of fluid upon which the negative pressure depends is in this way varied as desired.

In cases with much swelling it may be necessary, as this disappears, to readjust the bandage. Sometimes the subsidence of swelling is remarkably rapid, in which event, of course, the bandage may become loose and the device thereby allowed to rise from the skin.

Alternations of Pressure.—The variations between positive and negative pressures are accommodated, as regards duration, to the particular features of the case. At the commencement, and until the effluent becomes fairly clear, the alternations should be of about fifteen minutes each, or fifteen minutes positive, and from five to ten minutes negative.

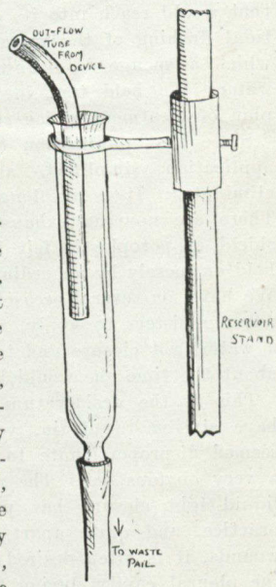

Fig. 5.

After this the positive pressure is prolonged to half an hour or so, and the duration of negative adapted to the type of wound, being long in chronic and short in acute cases. As a general rule the duration of negative pressure should not exceed twenty minutes, and never be long enough to produce pain. These alternations may be regulated by the patient himself during waking hours, and, for the sake of convenience, the periods of positive pressure may be prolonged during the night, and the duration of negative be just sufficient to freshen the solution in the wound (about ten seconds).

A wound with a counter opening should be treated by the application of two devices. The device covering the main wound should have its *outflow* tube occluded by means of a short length of glass rod for the course of the case. The device covering the counter opening should have its *inflow* occluded in the same way. Thus through and through circulation of the fluid is provided for. It will be convenient to have devices for application to counter openings made much smaller, and furnished with an outflow tube only. This application of the method is particularly useful in the drainage of joints.

In the employment of the device in cases of empyema, positive pressure should be very low and its periods of short duration. The negative pressure exerted in the intervals should equal that of the normal pleural cavity, i.e., about a 3-in. column of water. To what extent this may be increased to encourage lung expansion we do not know, but as much as 12 in. has been used without ill-effects. The device should be bandaged to the chest during expiration.

After irrigation with hypertonic saline has been in operation for from four to ten days—according to the severity of the infection—we are in the habit of removing the device for two or three hours. If then no pus appears, clear lymph and blood alone occupying the mouth of the wound, the device is re-applied, and irrigation continued with an antiseptic solution for forty-eight hours, our idea being to effect a final sterilization. Latterly we have been using a 1 in 5,000 solution of flavine in hypertonic saline.

RESULTS.

Certain phenomena have been observed to follow so constantly the employment of this method of irrigation that we are able now to predict their appearance. Though our investigations as yet have been largely confined to stubborn old sinuses, and not to recent wounds, this form of irrigation has, on many occasions, been instituted at the time of an acute flare-up. We have not, it is true, an imposing array of cases as regards number, but our results have been of a very positive nature. We do not propose to weary our readers with individual instances, but shall wait until our series is compiled for presentation in tabulated form. The results which we have observed may be epitomized as follows:—