act synergistically to produce the full effect of a complete O.B.E., the hot bath playing little or no part.

According to Reynolds *et al.* (1954) there is a direct relationship between the intensity of uterine activity in the later weeks of pregnancy and the time of onset of labour: the greater the uterine activity the earlier labour begins. Therefore, as the work done by the uterus is increased by the administration of an O.B.E., it seems highly probable that this procedure will often expedite the spontaneous onset of labour or, alternatively, increase the effectiveness of other methods of induction, such as artificial rupture of the membranes.

It is possible that another more palatable purgative could be proved to have the same oxytocic activity as castor oil.

Summary

The effect of castor oil, a soap enema, and a hot bath (a complete O.B.E.) and its individual components on the activity of the pregnant human uterus near term has been studied, using the guard-ring tocodynamometer.

The marked increase in uterine activity produced by an O.B.E. justifies its retention in obstetric practice as a method of induction of labour or as a prelude to other induction procedures.

A hot bath, while not contributing to this response, has other obvious effects which favour its continued use.

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A HAND-OPERATED RESUSCITATOR

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In the first-aid treatment of respiratory failure from any cause, speed in applying artificial respiration is essential. Any form of ventilation, whether manual or otherwise, may be life-saving if it is applied at once, and there is a growing view that positive pressure, either in the form of mouth-to-mouth or by machine, is more effective. Possibly because of aesthetic considerations, the mouth-to-mouth method has never achieved the popularity it deserves, and, although many positive-pressure machines are now available, most of them can be operated only by trained medical personnel, and are complicated and cumbersome because they need oxygen cylinders.

The ideal machine should be simple, portable, and robust; cheap to manufacture so that it can be available in large numbers; and designed in such a way that it can be used by untrained personnel. A simple hand-operated resuscitator, which appears to meet all these requirements, has been developed by the Ministry of Supply.

It consists of three main components: (1) rubber facepiece, (2) exhalation valve unit, and (3) air supply unit (Fig. 1). All the metal parts are anodized aluminium, and all the rubber parts are of high quality, with a life of at least ten years. The components are connected together by simple screwed joints, so that they can be disconnected for cleaning. The whole apparatus can be sterilized by autoclaving or by boiling.

The Apparatus

Rubber Facepiece.—This consists of a rubber oronasal mask which has been specially designed for the resuscitator to meet the requirements of a close pressure-tight fit on as wide a range of faces as possible, coupled with support of the lower jaw. The fit on the face is achieved by a large anatomically shaped pneumatic cushion, which is formed integrally with the wall of the mask. This cushion is filled with air at atmospheric pressure, and can be opened and closed manually by means of a small knurled screw (not shown in Fig. 1), turning in a special metal pressure-release plug situated on the left cheek of the mask. This enables the air in the cushion to be maintained at atmospheric pressure, and provides a means of venting the cushion during sterilization of the facepiece. Attached to the front of the mask is a female screw adapter which is so positioned that when the facepiece is connected to the rest of the apparatus it is at the correct angle to thrust the patient's jaw upwards when the bellows are operated, thus ensuring a clear airway (Fig. 2).

Exhalation Valve Unit.—The valve is a slightly concave, moulded rubber diaphragm with a central circular orifice which is closed by a hinged rubber flap. In its resting position, the diaphragm is lightly pressed against a circular metal seating on the bellows side of the unit. When the bellows are compressed the diaphragm is raised off its original seating by the air pressure and seals against a larger circular seating on the facepiece side of the unit, and air passes through the central orifice into the facepiece. At the end of the compression stroke the valve returns to its resting position and the patient exhales freely to atmosphere through a gap around the periphery of the unit. The hinged flap over the central orifice in the diaphragm ensures that the air will not leak back past the diaphragm, and thus that no exhaled air can be drawn into the bellows. The flap is reinforced by a slightly larger disk of rubber riveted to it to prevent it from becoming inverted irreversibly. The diaphragm valve is contained in a flat circular metal housing, which has a male screw adapter at one side and a female screw adapter at the other, which prevents the unit from being assembled in the resuscitator the wrong way round.

If necessary, for civil defence purposes an anti-gas canister can be fitted between the facepiece and the exhalation valve unit.

Air Supply Unit.—The unit consists of a circular rubber bellows, with a male screw adapter at one end for connexion to the exhalation valve unit. At the outer end of the bellows, mounted on a metal plate, are

FIG. 1.—General arrangement diagram of the resuscitator.

(1) a knob handle for working the bellows ; (2) a rubber disk inlet valve ; and (3) a spring-loaded metal disk safety-valve, which is set to release at a pressure of 22 mm. Hg (30 cm. H₂O) to prevent over-inflation of the lungs. Incorporated in the safety-valve is a whistle to give audible warning that the patient is being ventilated too vigorously or that air is not reaching the lungs. When used for resuscitation the bellows will deliver approximately 2.5 litres per stroke.

Application of the Resuscitator

The whole apparatus weighs just under 2 lb. (0.9 kg.) and is contained in a rigid box, 10 by 6 by 6 in. (25 by 15 by 15 cm.), with a carrying-handle. Inside the lid of the box are the following instructions for use of the device.

FIG. 2.—Resuscitator in use.

1. Place the mask firmly on the patient's face with the lower rim under the chin and the upper rim as high on the bridge of the nose as possible.

2. Work the bellows steadily at about 16 strokes a minute. The thrust of the bellows should be upwards on the face, so that the jaw is kept up.

3. Watch the chest. It should rise with each down stroke of the bellows, and fall during each up stroke. *If the chest does not rise and fall—First* make sure that the mask is tight on the face. *Then* listen to the bellows during the down stroke. If a whistling noise is heard the patient's throat is blocked and must be cleared. Insert a finger, covered with a handkerchief, down his throat to remove mucus or other obstruction. *If the chest rises and falls and the whistle is heard, the pumping is too vigorous. Reduce the force being used.*

4. Continue resuscitation until the patient breathes naturally, or for at least two hours.

Comment

This device has been thoroughly tested during the past eight years, both experimentally and clinically, on a large number of unconscious subjects in Service and civilian hospitals under widely varying climatic conditions, from the Arctic to the tropics, and has been found to be entirely satisfactory. It has been used successfully on cases suffering from poliomyelitis being transported by air, for emergency resuscitation in hospital wards, and by hospital orderlies previously untrained in its use. It has also formed part of a controlled study on artificial respiration (Lucas and Whitcher, 1958).

The design of the resuscitator has been developed at the Chemical Defence Experimental Establishment under the general direction of one of us (C. G. T.), but the details are due to a number of past and present members of the staff of that establishment.

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