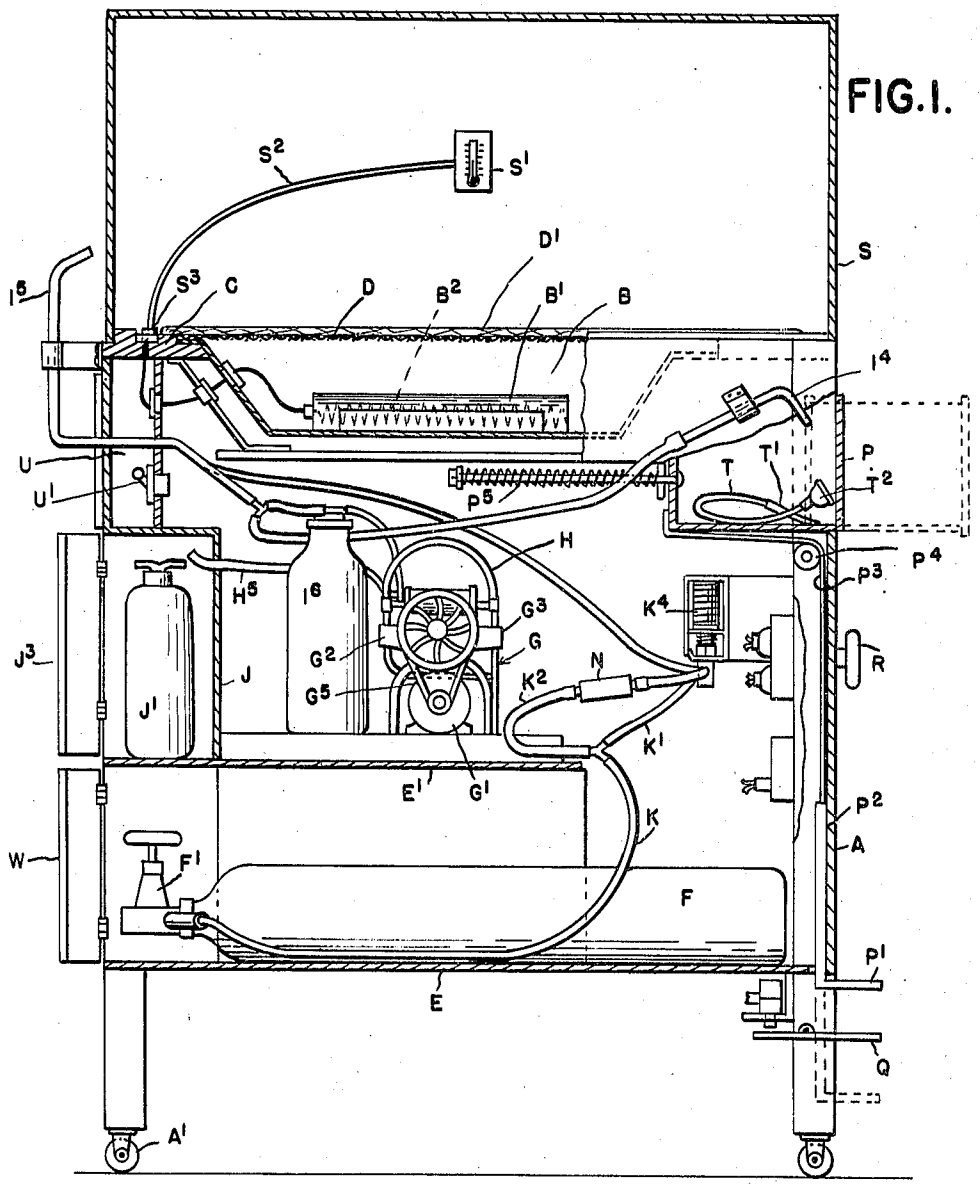
April 25, 1944. H. M. KIRSCHBAUM 2,347,326

COMBINED INFANT RESUSCITATOR AND INCUBATOR

Filed Feb. 9, 1942 3 Sheets-Sheet 1

FIG. I.



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COMBINED INFANT RESUSCITATOR AND INCUBATOR

Filed Feb. 9, 1942 3 Sheets-Sheet 2

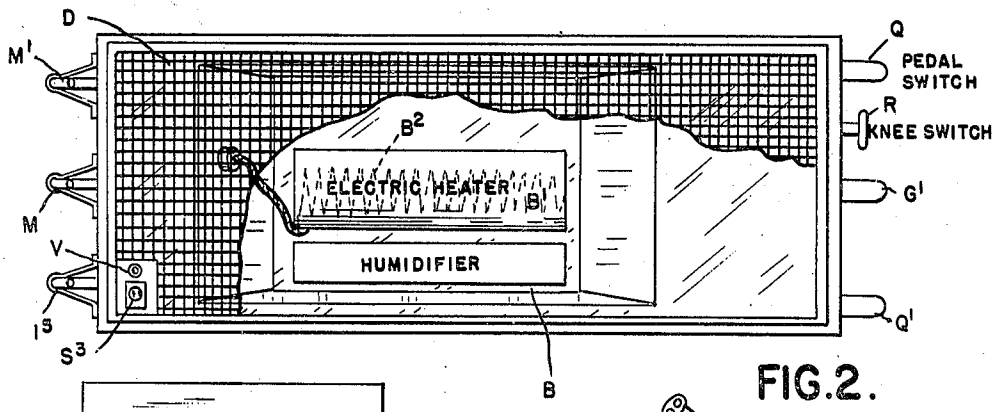


FIG.2.

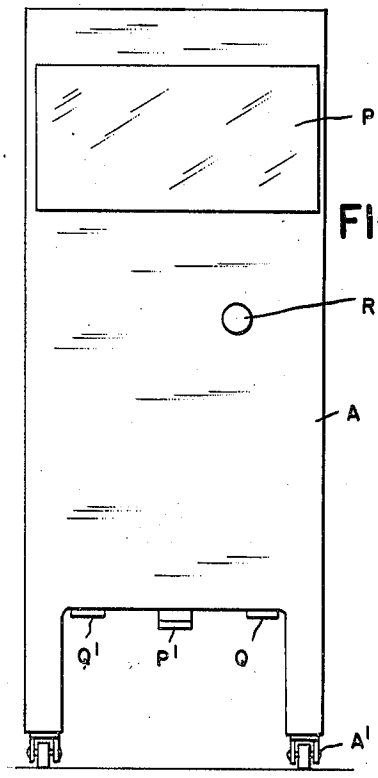
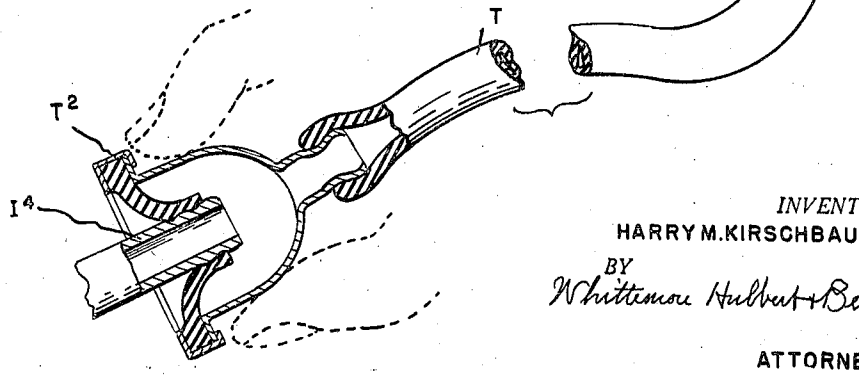


FIG.3.



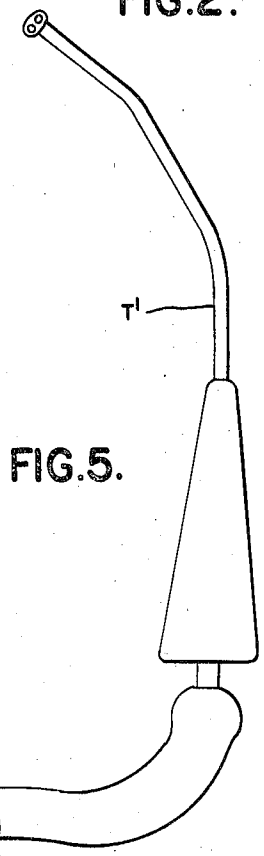


FIG.5.

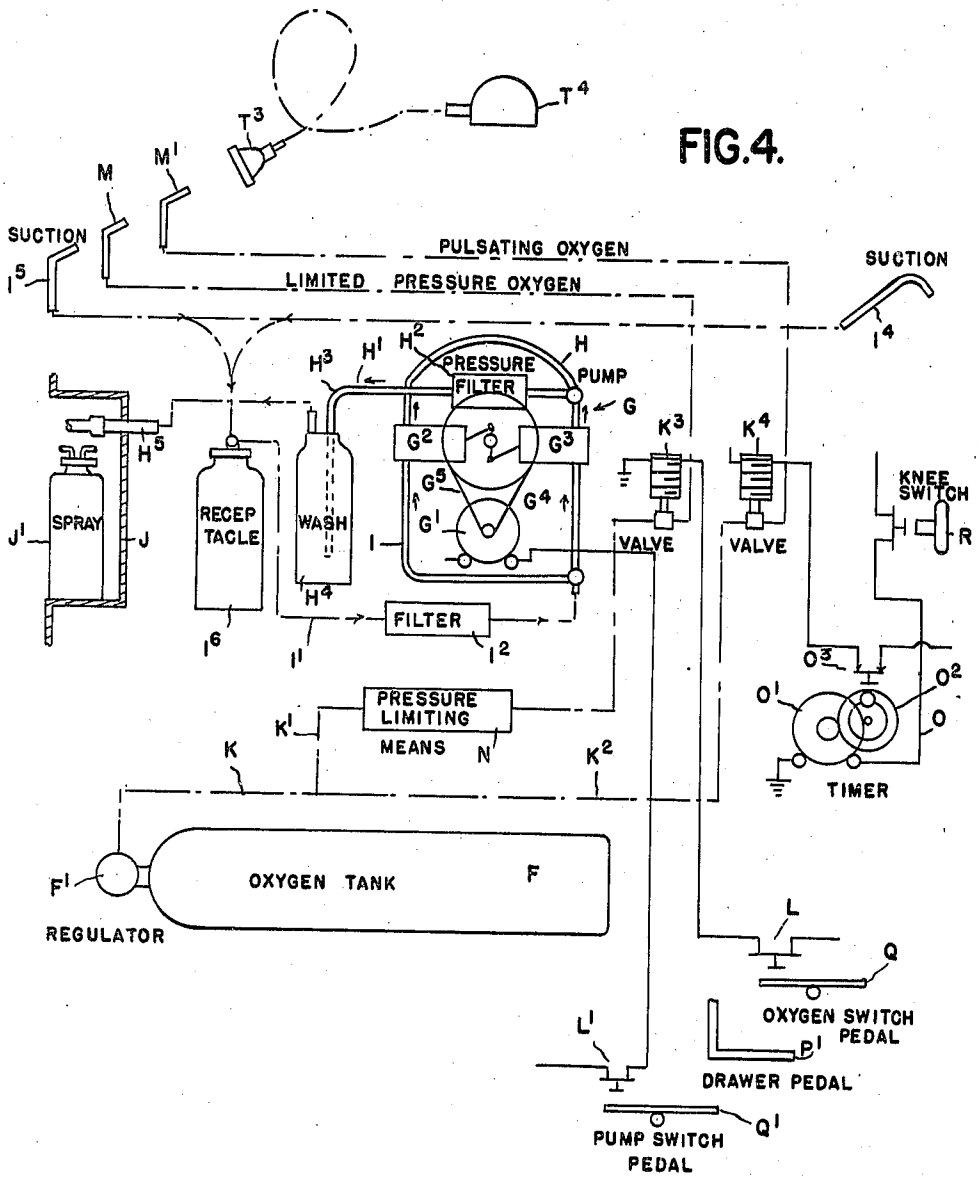
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Filed Feb. 9, 1942 3 Sheets-Sheet 3

FIG.4.



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UNITED STATES PATENT OFFICE

2,347,326

COMBINED INFANT RESUSCITATOR AND INCUBATOR

Harry M. Kirschbaum, Detroit, Mich.

Application February 9, 1942, Serial No. 430,139

1 Claim. (Cl. 128—1)

In obstetrical operations, the attendant surgeon has the double responsibility of caring for the mother and for the newborn infant. It frequently happens that for the proper care of the infant different pieces of apparatus are necessary which are not always immediately available. Furthermore, it is absolutely essential that in the care for the infant the physician should not lose his sterile technique.

It is an object of the invention to obtain a portable apparatus which provides for all of the needs of the infant and which may be placed in close proximity to the operating table on which the mother is lying.

It is a further object to provide controls for this apparatus which may be operated by the physician while still maintaining his sterile technique.

Still further, it is an object to obtain an apparatus which after use as a resuscitator can be converted into an incubator for the infant and in which it may be transported to the nursery.

With these and other objects in view, the invention consists in the construction as hereinafter described.

In the drawings:

Fig. 1 is a vertical longitudinal section through the apparatus with the parts shown in elevation;

Fig. 2 is a plan view with the incubator housing removed;

Fig. 3 is an end elevation;

Fig. 4 is a diagram illustrating the mechanical and electrical connections to the various instrumentalities; and

Fig. 5 is a sectional elevation showing one of the sterilized resuscitating instruments and means for coupling the same.

A is a frame for holding all of the various devices needed for the care of the infant as well as some for the mother. The top of this frame forms a bed or table on which the newborn infant may be laid, and for maintaining this at proper temperature, there is provided beneath the top a chamber B containing an electrical heating unit B′ and a humidifier B^2. This chamber is preferably formed of a metal pan having its margin secured to the top C. D is an open mesh wire screen above the pan, which forms a support for a blanket D′ while permitting passage of warm and humidified air therethrough.

Mounted in the lower portion of the frame is a bottom or supporting shelf E for carrying an oxygen tank F. This tank is provided with the usual controls F″ for discharge of gas therefrom, so that the same quantity of gas will be discharged in equal time intervals without regard to the diminishing pressure within the tank. Above the shelf E is a second shelf E′ on which is placed an electrically operated air pump G. As shown, this pump comprises a motor G′ and a pair of opposed cylinders G^2 and G^3, with an intermediate crank or eccentric G^4 for operating the pistons (not shown). A belt connection G^5 between the motor and a pulley on the crank shaft serves to drive the latter. Cross-connecting the two cylinders of the pump is the pressure air conduit H having a discharge line H′ therefrom. The cylinders are also cross-connected by a suction conduit I with an outleading suction line I′. Suitable valves (not shown) are provided in each cylinder for controlling the outgoing and incoming air. The pressure line H′ preferably includes a filter H^2 and a flexible conduit H^3 leading to a wash bottle H^4 and thence to a discharge nozzle H^5. This nozzle is preferably located to project into a chamber J at one end of the frame, in which chamber is placed a spray bottle J′ and a length of tubing for connecting it to the nozzle. A hinged door J^3 normally closes this chamber, but provides access to the spray when needed.

The suction line I′ includes a filter I^2 and a flexible conduit I^3 leading to a pair of suction nozzles I^4 and I^5. These are located at opposite ends of the frame, the nozzle I^4 being conveniently used while the child is still with the mother, and the nozzle I^5 when the child is laid upon the blanket D′. A receptacle I^6 is so connected to the tubing I^3 as to receive any liquid which may be drawn from the nozzles I^4 and I^5.

The gas from the tank F, after passing through the regulator F′, enters a conduit K which has two branches K′ and K^2. These branches are respectively controlled by electromagnetically operated valves K^3 and K^4, which in turn are controlled by circuit closing switches L and L′. The branch conduit K′, after passing the valve K^3 leads to a nozzle M which may be connected to tubing, as hereinafter explained. The branch conduit K^2, after passing the valve K^4, leads to a nozzle M′ adapted to be connected to a tubing for directly administering oxygen to the infant.

It is very essential that the gas administered to the infant should not exceed a pressure above 15 to 20 mm. of mercury, as otherwise there is danger of rupturing the infant's lungs. I therefore place in the branch K′ a pressure regulator N which may be set to deliver gas therethrough at not over this limit of pressure.

Another important feature in the administration of gas to the infant is that it should be delivered in pulsations timed to correspond to the natural rhythm of the infant's breathing. This I accomplish by providing a timing mechanism O, driven by an electric motor O′ and through the medium of reducing gears O^2 operating an electric switch O^3 for closing the operating circuit of the electromagnetically operated valve K^4. The arrangement is such that when the timing

mechanism is operated, the valve K^4 will be periodically opened for an instant and then closed. The motor O' is preferably a synchronous motor running at constant speed, and the reducing gears O^2 will determine the length of interval between successive openings such, for instance, as 23 openings per minute. As this corresponds to the natural rhythm of the infant's breathing, it will be effective in resuscitation.

One of the first operations in the resuscitation of a newborn infant is the removal of mucus from the mouth and throat. This may be accomplished by the use of a tracheal catheter, which may be connected to one of the suction nozzles I^4, I^5. It is essential, however, that the surgeon in the use of this instrument should not bring his hands in contact with anything which is nonsterile, and I have therefore provided means for insuring the sterility of all instruments which he may handle. To this end, there is provided at the end of the frame, to the right (Fig. 1), a normally closed drawer P which may contain various instruments such as the catheter, together with lengths of tubing and coupling devices which have all been thoroughly sterilized. The drawer is opened by pressing on a pedal P' at the same end of the frame, this being connected to a slidable shank P^2 which in turn has the flexible connection P^3 passing around a sheave P^4 and attached to the rear end of the drawer. A spring P^5 normally holds the drawer in closed position, but upon depression of the pedal P', it will be drawn open, as indicated in dotted lines (Fig. 1). As soon as the pedal pressure is released, the spring P^5 will again close the drawer. Thus it is not necessary for the surgeon to touch any object or surface that has not been sterilized, while at the same time he is provided with the necessary instruments in convenient proximity which may be needed in the resuscitation of the infant.

As has been stated, the electromagnetically operated valves K^3 and K^4 are operated by electric circuits controlled by the switches or circuit closers L and L'. These in turn may be operated by pedals Q and Q' which are arranged on opposite sides of the pedal P', to be actuated by the surgeon's foot. The timer O is controlled by a knee switch R conveniently positioned at the end of the frame.

To convert the apparatus into an incubator, I have provided a removable hood or cover S, which may be placed over the table C to enclose the space thereabove. The nozzles I^4, I^5, M and M' are located to be outside of the space occupied by this hood, so as not to interfere either with its removal or replacement. The hood has arranged therein a thermostatic control S' for the heating element B', which may be electrically connected to this element by a conductor cord S^2 and a plug socket S^3 in the table C.

Operation

The frame A being mounted upon casters A' may be easily rolled into convenient position for use. Preferably, this is adjacent to the foot of the bed or operating table on which the mother is placed, to extend at right angles thereto. Before the birth of the child the attendant nurse may take the spray J' from the chamber J, attaching it by a tube to the nozzle H^5, for use in spraying the body of the mother. For this operation it is only necessary that the surgeon should start the pump G by depressing the pedal Q which closes the switch L', and this he can do without touching his hands to any nonsterile object. After the delivery of the child, it is placed on the blanket D' which has been warmed to the proper temperature by the heater B'. The surgeon may then depress the pedal P', opening the drawer P and removing therefrom the instrument for extracting mucus from the mouth and throat of the infant. This includes a length of flexible hose T, with a nozzle T' at one end thereof and a coupler T^2 at its opposite end. All of these parts being sterilized, the surgeon may take the coupler T^2 in his hands and engage it with the nozzle I^4 without touching his hands to the latter. He may then press the pedal Q to close the switch L' and start the pump G. The nozzle T' is then inserted in the mouth of the infant, and the suction will remove the mucus therefrom, depositing it into the receptacle I^6. If it is desirable to administer oxygen, the knee switch R is operated to start the motor O' of the timer O, which will periodically operate the electromagnetic valve K^4 to supply pulses of oxygen to the nozzle M'. A sterile tube and coupler T^3 is connected to this nozzle M', the opposite end having a mask T^4 which is placed over the infant's nose and mouth. As soon as resuscitation has been accomplished, the nurse will place the hood S over the infant still resting on the blanket D', and the whole apparatus may be rolled away to the nursery. The external electrical connections (not shown) may be stored in suitable compartments such as U, and controlling switches such as U' may also be conveniently arranged therein. These are for the use of the attendant nurse and therefore need not be sterilized. When the device is being transported, the external electrical connections will be temporarily uncoupled, but the heat stored in the apparatus is sufficient to maintain the desired temperature until the electrical connections are reestablished at the new location.

It is sometimes desirable to administer oxygen to the infant while in the incubator. For this purpose, a tube V extends out through the frame, to have its discharge end within the hood S, the lower end of said tube having connection with the oxygen tank. Access to this tank and the controls for the discharge of gas therefrom is obtained by opening a hinged door W to the compartment in which these members are placed.

What I claim as my invention is:

A combined infant resuscitator and incubator comprising a portable frame forming a carriage for resuscitating apparatus, a bed or operating table formed on top of said frame on which the new born infant may be laid in accessible position for resuscitation, said bed including an open mesh screen for supporting the bedding, a chamber within said frame beneath said screen, air heating and humidifying means within said chamber, and a removable enclosure engageable with the top of said frame for surrounding the infant on said bed after resuscitation and forming an incubator.

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