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Beld et al.

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[54] **COMPREHENSIVE INFANT CARE SYSTEM**

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[52] **U.S. Cl.** ..... **128/1 B**

[51] **Int. Cl.** **A61g 11/00**

[58] **Field of Search** ..... 128/1 B, 204, 145 R, 172.1, 128/212, 395, 371, 372; 98/1.5; 21/83; 312/117, 123, 209, 241, 350, 249, 250, 251, 252, 284, 312, 237; 220/35, 36, 89 B, 8; 119/43; 34/99; 5/362; 248/162; 217/60 E

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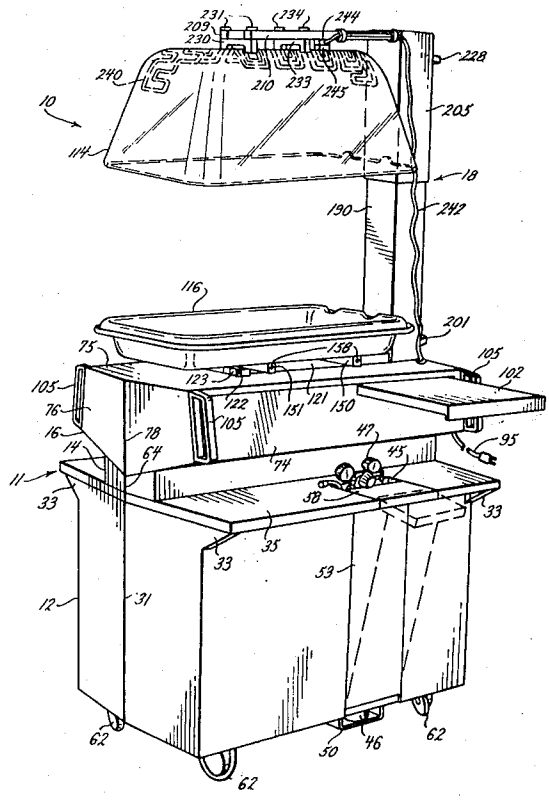
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Assistant Examiner—Henry J. Recla
Attorney, Agent, or Firm—Rogers, Ezell & Eilers

[57] **ABSTRACT**

This invention relates generally to an incubator and more particularly to a comprehensive infant care system comprising an environmental chamber for the infant which chamber has a base and a transparent dome adapted to fit over the base. Means are provided for moving the dome relative to the base between a closed position in engagement with the base and a predetermined open limit position and for holding the dome at various positions between the open limit and closed positions. The chamber, including the dome and base, as well as the dome-moving means is mounted on a supporting structure and there is included means for tilting the entire chamber to a selected tilt position. The system further comprises a chassis portion within the supporting structure having internally wired compartments, modular electronic units adapted to plug into the compartments, and means for electrically connecting the modular units to the chassis wiring upon plugging the units into the compartments. Means are also provided for supplying infrared heat to the chamber.

51 Claims, 10 Drawing Figures



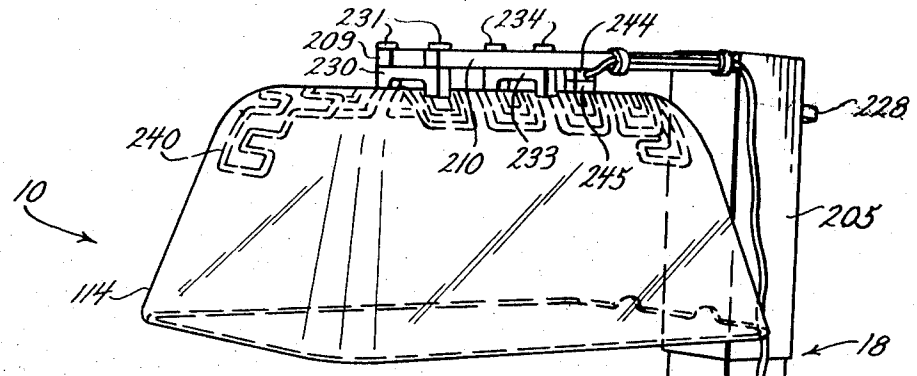
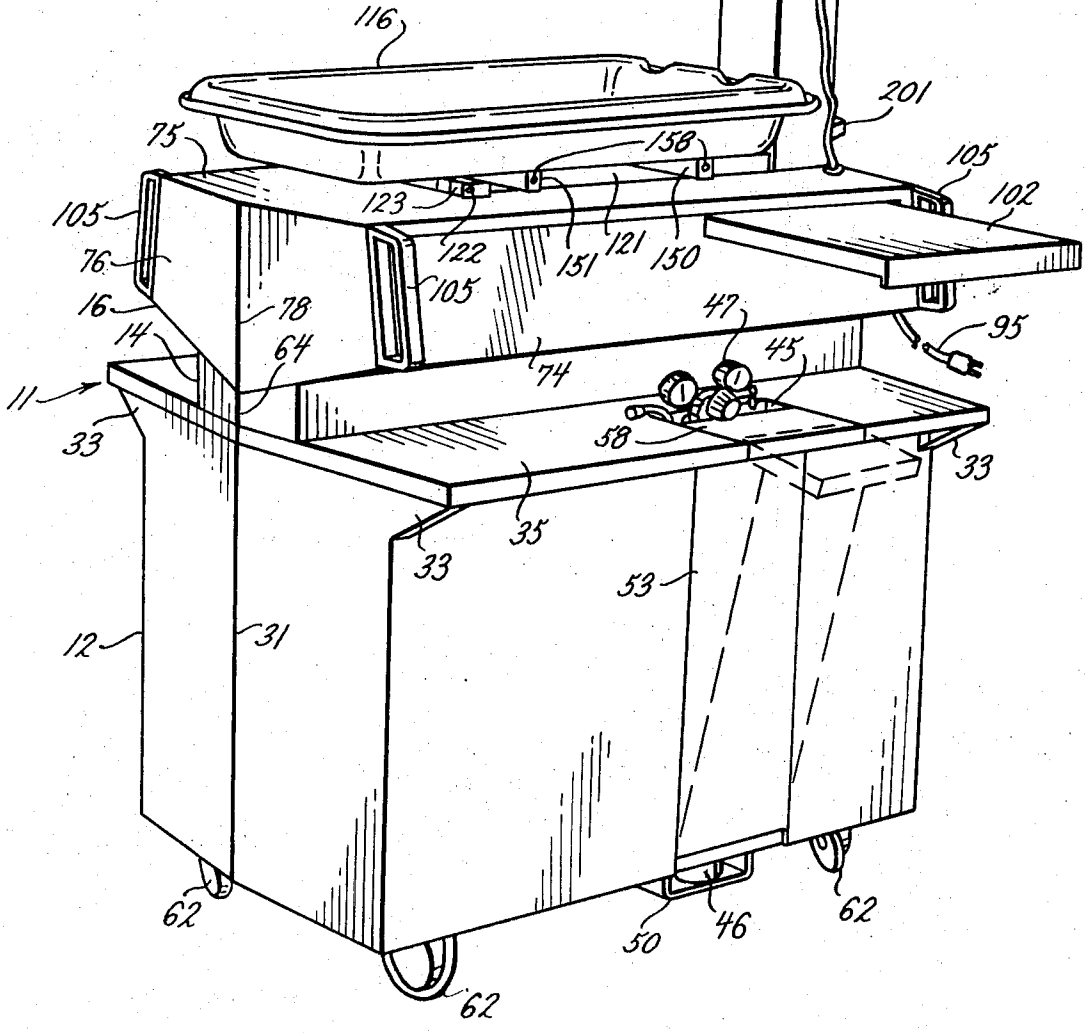

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FIG. 1.


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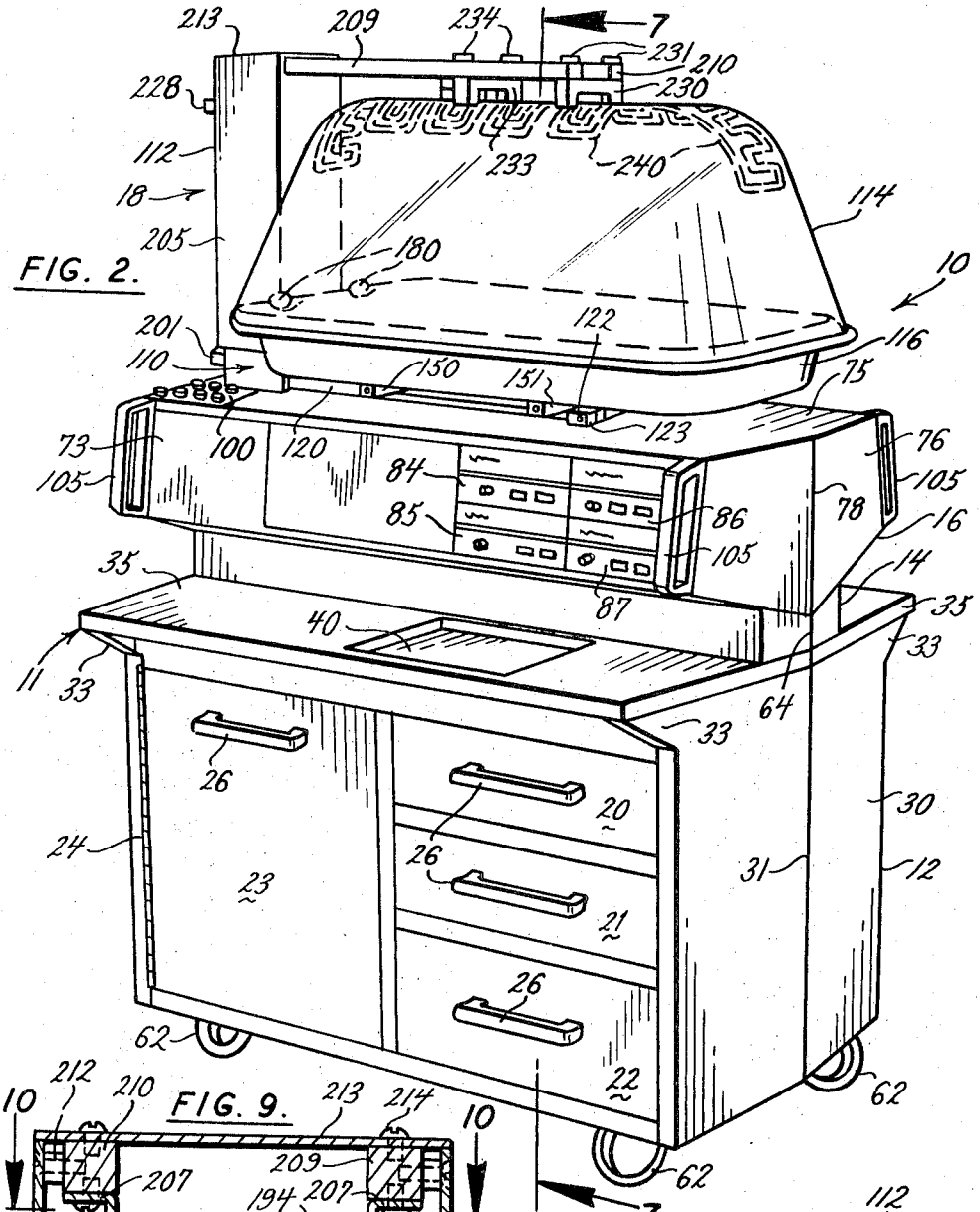


FIG. 2.

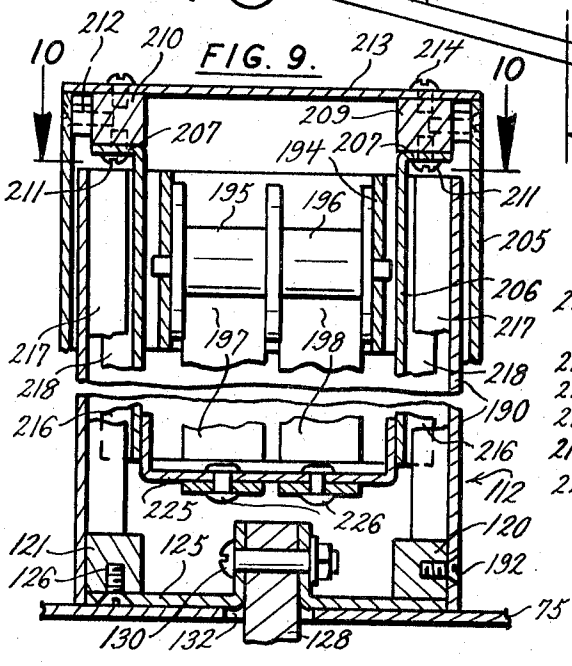


FIG. 9.

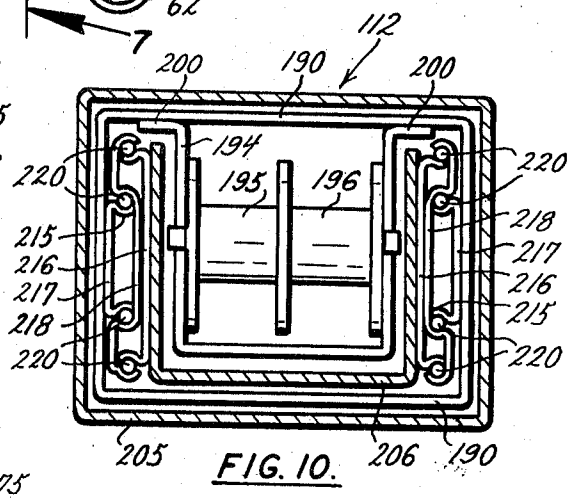


FIG. 10.

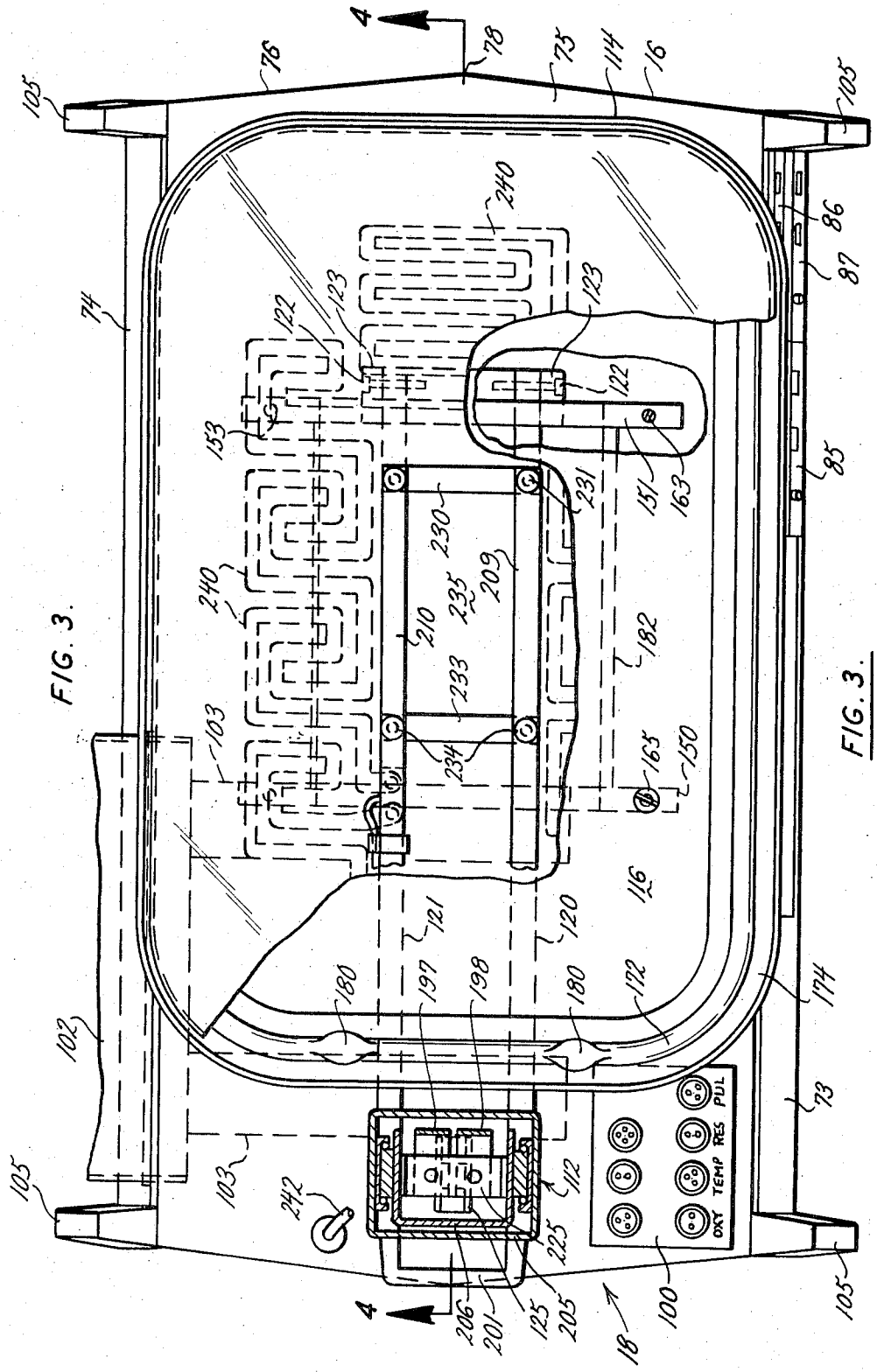

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FIG. 3.

FIG. 3.

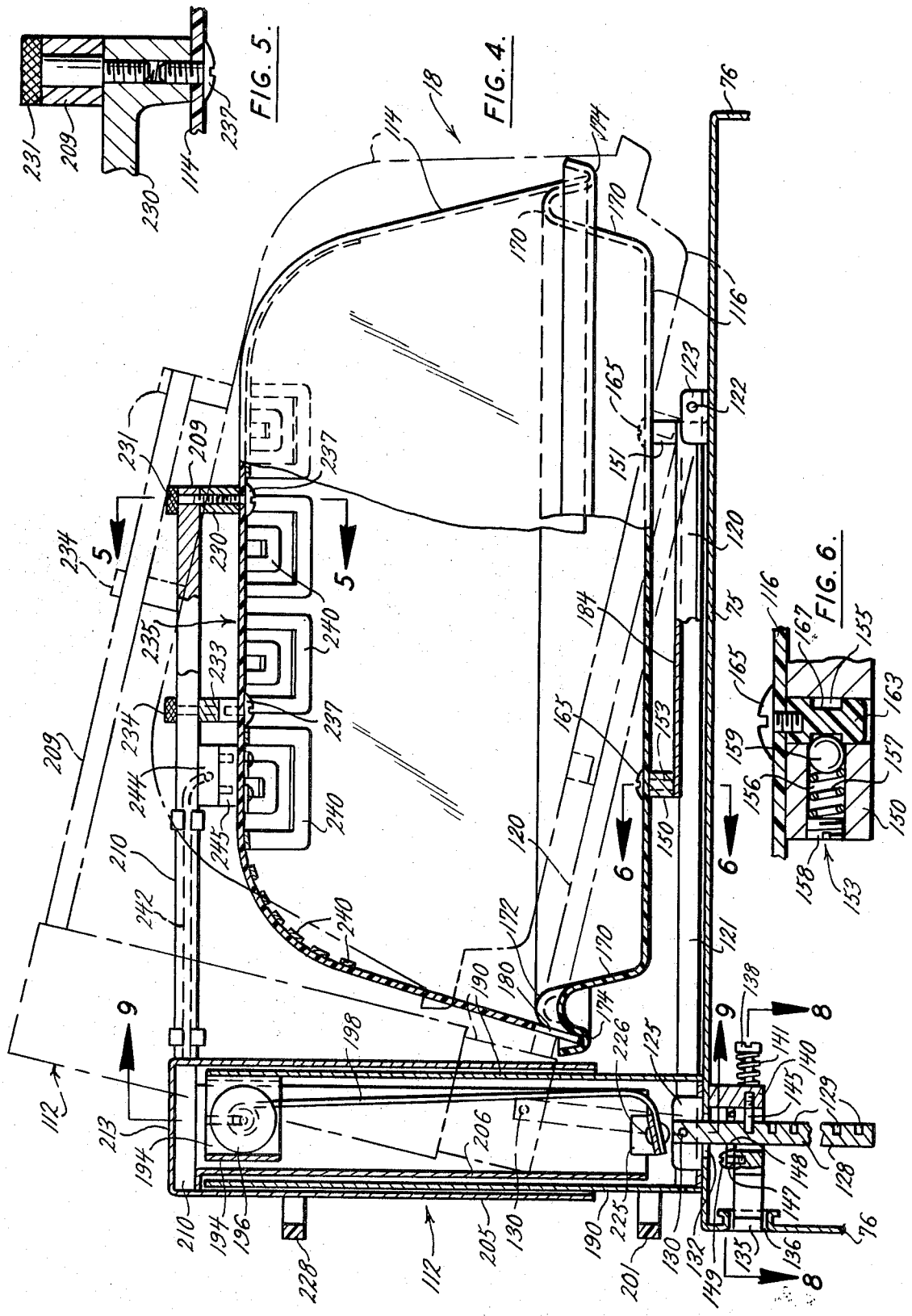

FIG. 5.
FIG. 4.
FIG. 6.

FIG. 8.

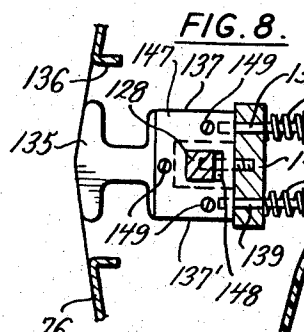

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FIG. 7.

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COMPREHENSIVE INFANT CARE SYSTEM

BACKGROUND AND SUMMARY OF THE INVENTION

Incubator equipment for infants to date has not been designed with an emphasis on total infant care from the date of birth. Total care should begin in the delivery room with environmental controls which aid the infant in adapting to his new surroundings. The ideal system facilitates the performance of emergency procedures and detects abnormal vital signs immediately after birth. Infants with problems are then transported to the nursery where intensive care or observation is continued. An incuabtor system of ideal design should fulfill all of these requirements, but existing incubators do not.

Existing individual instruments for diagnosis or life support satisfy specific needs in the nursery but are not suited for total organized care. Nurseries are forced into purchasing equipment from various sources in an attempt to improve care, presenting many problems because of the absence of a comprehensive design. There has been confusion and difficulty with use of the equipment, poor utilization of limited space, a cluttered working environment, and limited access to the infant. For example, incubators presently used were not originally designed for use with auxiliary equipment now considered necessary for patient care; instruments must be gathered and set up around the incubator as needs arise, an annoying and time-consuming chore; the remote location of instruments hinders the attachment of sensors with exposed sensor leads and power cords getting in the way and limiting access to the infant; many individual instrumentation units require supporting cabinets which reduce effective utilization of floor space; and extensive disassembly of the incubators is necessary for thorough cleaning.

The need for total infant care is fulfilled by this invention which is a comprehensive infant care system bringing together necessary components for total care. This invention provides among other features unobstructed access to the infant, obsolescence protection including expandability of instrumentation and environmental control equipment through a modular concept, clean infrared heating, versatility, an attractive appearance, supply storage, the elimination of clutter, easy accessibility to those parts which must be cleaned or sterilized, convenience surfaces for administration of drugs, performance of other medical procedures and general working surface, necessary ease of operation.

Generally the infant care system of this invention includes a support structure having a base cabinet primarily for storage of equipment, medicines, and the like including a compartment for containing an oxygen bottle and associated indicators and controls. On top of the base cabinet is a large work surface within which is mounted a recessed tray for the placement of certain small instruments, medicants, and the like while attending the infant. The support structure also includes a pedestal portion mounted on top of the base cabinet, which pedestal portion is relatively narrow so as to leave ample work surface on each side, and which has a primary function of supporting a chassis portion in elevated relationship with respect to the cabinet top.

The chassis portion has a group of compartments for receiving modular electronic units, each of which is designed for electronic monitoring of one or more physical parameters such as pulse, respiration, and the like, or control of an environmental parameter such as oxygen. Each electronic module slides into a compartment and automatically makes electrical connection with a prewired receptacle located within the compartment, thus eliminating the requirement of connecting various inputs and outputs of individual electronic units. With this invention, connecting the instrumentation, both mechanically and electrically, is foolproof.

Mounted on top of the chassis portion is a dome assembly generally including a tub or base in which the infant is placed, a transparent plastic dome, means for moving the dome into and out of covering relationship with respect to the base and means for tilting the entire dome assembly.

The tilting means generally includes a carriage assembly on which the dome base is mounted, the carriage assembly being pivotally mounted to the top of the chassis portion at one end and having adjustable locking means at the other for selecting the degree of tilt. The dome moving means generally includes a tower assembly vertically mounted to the adjustable end of the carriage assembly and having a cantilevered arm mounted at its top with means at the outer end of the arm for mounting the dome thereto. The tower is designed to telescope vertically such that the dome can be moved quite easily into and out of engagement with the dome base to provide a full incubator environment in the fully closed position, and complete access to the infant in the fully open position.

An infrared heating element, such as of an etched, film-laminated type is permanently bonded to the upper inside surface of the dome, thus providing an exceptionally clean heating system and eliminating forced air circulation.

A tray for receiving an X-ray cassette is located beneath and formed as part of the dome base. The design of this invention provides an unobstructed X-ray path between an X-ray gun located above the dome and the X-ray cassette located beneath the dome base allowing the infant to be X-rayed without disturbing him. Both the dome and base are easily removable for cleaning or sterilizing as required.

Hence, it is a general object of this invention to provide a comprehensive infant care system of the type heretofore described providing complete incubator environment with greatly improved access to the infant, and which otherwise overcomes the problems of the prior art.

Other objects of this invention will become apparent from the detailed description to follow.

DESCRIPTION OF THE DRAWINGS:

FIG. 1 is a rear isometric view of the infant care system of this invention showing the dome assembly in its open position;

FIG. 2 is a front isometric view of the infant care system of this invention showing the dome assembly in its closed position;

FIG. 3 is a plan view on an enlarged scale of primarily the upper portion of the infant care system of this invention with parts broken away for purposes of illustration;

FIG. 4 is a view in section taken along the line 4—4 of FIG. 3;

FIG. 5 is an enlarged view in section taken along the line 5—5 of FIG. 4;

FIG. 6 is an enlarged view in section taken along the line 6—6 of FIG. 4;

FIG. 7 is an enlarged view in section taken along the line 7—7 of FIG. 2;

FIG. 8 is a view in section taken along the line 8—8 of FIG. 4;

FIG. 9 is an enlarged fragmentary view in section taken along the line 9—9 of FIG. 4; and

FIG. 10 is a view in section taken along the line 10—10 of FIG. 9.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT:

In the drawing there is shown an infant care system **10** of this invention generally including a support structure **11** having a cabinet base **12,** a pedestal **14,** and a chassis portion **16,** and the system further generally including a dome assembly **18.**

The base cabinet **12** has a lower portion of generally rectangular configuration including drawers such as the drawers **20, 21,** and **22** and a door **23** suitably hinged as at **24** for access to a storage area behind it. Each of the drawers and door has a suitable handle **26.** The drawers **20** through **22** are preferably removable for easy cleaning and compartmentalized and labeled for the storage and unit dose dispensing of medicants for the infant. Suitable locks could also be provided for the storage of narcotics and the like.

The cabinet **12** has a right side wall **30** creased outwardly as at **31** for added strength, the upper portion of each side wall **31** having outward extensions **33** for supporting the outer extremities of a cabinet top **35.** The left side (not shown) of the cabinet **12** is the same as the right. The cabinet top **35** covers the entire length and width of the cabinet including the extensions **33** and is preferably covered with a durable, easily cleaned surface such as FORMICA or the like. The added width of the top **35** provided by the extensions **33** provides an exceptionally large work surface for ease in recording data and performing other tasks without increasing the width of the cabinet **12.** The overhang also shields the cabinet **12** and its contents against accidental spillage. A tray **40** is flush mounted in the top **35** at the front side of the incubator for the placement of small instruments used in attending the infant to prevent them from rolling or sliding off the top.

Referring primarily to FIGS. **1** and **7,** a compartment **45** is built into the rear side of the cabinet **12** for containing an oxygen bottle **46** having mounted thereon suitable oxygen controls and gauges **47.** At the location of the compartment **45** the bottom **48** of the cabinet **12** has an opening **49** with a U-shaped support bracket **50** depending thereunder. The bottom of the oxygen bottle **46** extends through the opening **49** and rests on the support bracket **50.** The compartment **45** is defined at the sides and front by suitable wall members **52** and at the rear by a panel **53** which is pivotally mounted at its lower end as at **54** to the rear edge of the bottom of the cabinet **12,** and which is formed at the top in a horizontal flange **56** for supporting a work surface section **58.** The top section **58** is secured to the flange **56** by suitable means such as screws **60,** sized such that with the drawer **53** closed a sufficient gap remains between the cabinet top **35** and the top section **58** for the oxygen controls **47** to protrude therethrough for easy access at all times. Suitable stops (not shown) are provided to define the closed position (shown by the solid lines) and the opened position (shown by the dashed lines) of FIG. **1** for the panel **53.** When the panel **53** is closed, it and the top section **58** fit flush with the rear wall of the base **12** and top **35,** respectively.

To insert the oxygen bottle **46** into the compartment **45,** the panel **53** is pivoted to its open position, the bottle and controls inserted, and the panel **53** pivoted closed.

The entire unit is mounted on casters **62** of preferably a conductive material to minimize static charge.

As best seen in FIGS. **1, 2,** and **7** the chassis portion **16** is separated from the base cabinet **12** by the relatively narrow pedestal **14** which not only provides additional service area for fuses, accessory power outlets and the like, and an integral wiring duct for the instrumentation contained in the chassis portion **16** to be described, but also raises the chassis portion **16** above the top **35** to effectively increase the width of the work surface **35.** The side walls of the pedestal **14** are creased outwardly as at **64.**

The chassis portion **16** houses electronic monitoring and control equipment and generally includes upwardly sloping bottom walls **70** and **71,** front and rear walls **73** and **74** which slope inwardly toward the top, a flat top wall **75,** and end walls **76** creased outwardly as at **78** to be continuous with the creases **31** and **64.** A plurality of compartments **80** are formed internally at the front of the chassis portion **16** and defined by structural wall members **82** (see FIG. **7**) for receiving self-contained instrumentation modular units such as units **84, 85, 86,** and **87.** The units **84** through **87** are of a self-contained plug-in type which automatically make electrical connection by way of mating connectors **90** and **91.** The connectors **91** are prewired within the chassis portion **16.** Each of the modular units **84** through **87** slides on suitable tracks within a compartment **80** to insure proper mating of the conductors **90** and **91.** It should be noted that while four such modular units are shown, accommodations can be provided for more or less depending on the monitoring and control requirement. Preferably, each modular unit is designed to monitor a specific function such as pulse and respiration, or control an environmental parameter such as oxygen supply, or supply required power to the other circuits in the system, with each module utilizing integrated circuit and digital readout technology. The back panel **74** is removable for easy access to the wiring harness and other components within the chassis portion **16.**

This novel modular electronic design as applied to incubators provides many advantages. The modular units **84** through **87** are mounted in a neat, orderly manner so as not to interfere with access to the infant. Each unit slides into its compartment in a precise manner so that electrical hookup is automatic and foolproof. The modules are interchangeable between incubator units so that a full set of electrical modules need not be supplied with each unit. The face of each instrument module fits flush with the inclined front panel surface **73** for easy reading of the instrument displays and operation of the controls. External wiring and electrical outlets are eliminated.

Power is supplied to the unit from a single external power cord **95** and a wiring harness within the incubator unit. Also connected by way of the internal wiring harness to the power and instrumentation is a centralized sensor connector panel **100** into which sensors can

be plugged for monitoring the desired parameters, thus eliminating awkward, unsightly, and tangled wires.

A surgical tray **102** is slidedly mounted on guides **103** in the back and at the top of the chassis portion **16** for use in performing minor or emergency surgical procedures with the infant in the incubator. The surgical tray **102** preferably locks in position when fully opened but is completely removable for cleaning and sterilizing as necessary. Handles **105** are located at each corner of the chassis portion **16** for maneuvering the unit.

The dome assembly **18** is mounted on top of the instrument enclosure portion **16** and generally includes a carriage assembly **110**, a tower assembly **112**, a dome **114**, and a dome base or tub **116**. As will be described the entire dome assembly **18** can be tilted as a unit and the dome **114** raised or lowered with respect to the dome base **116** as desired.

The carriage assembly **110** includes a pair of parallel rods **120** and **121** extending from the left end of the incubator unit as viewed in FIG. **2** part way across the top of the chassis portion **16**, each of which is pivotally mounted at its right end by means of a pin **122** to a bracket **123** which is suitably secured to the top of the chassis portion **16**. The left end of each of the parallel rods **120** and **121** is secured at one end of an L-shaped bracket **125** such as by screws **126** (best seen in FIG. **9**), which brackets **125** form the bottom of the tower assembly **112**. A vertical rod **128** having a series of spaced apertures **129** is secured at its top between the L-shaped brackets **125** by means of a nut and bolt assembly **130**, the lower end of the rod extending downwardly through an opening **132** in the top and at the left end of the chassis portion **16**.

Beneath the opening **132** and within the chassis portion **16** is a T-shaped handle **135** accessible through an opening **136** in the left side wall of the chassis portion **16**.

The T-handle **135** has parallel **137** and **137'** extending therefrom. Pins **138** and **139** are secured in the end of the arms **137** and **137'**, respectively, and extend through suitable apertures in a plate **140** depending from and suitably secured to the top wall of the chassis portion **16** on the side of the opening **132** opposite the T-handle **135**. Springs **141** and **142** are located around the pins **138** and **139** between their heads and the plate **140**. Another pin **145** is secured in the plate **140** and extends toward the T-handle **135** into an appropriate one of the apertures **129** in the rod **128** as will be described.

A plate **147** having a square opening **148** through which the rod **128** extends, is secured on the top of the arms **137** and **137'** by screws **149** or the like.

OPERATION OF TILT MECHANISM

To operate the tilt mechanism associated with the carriage assembly **110**, it is only necessary to pull the T-handle **135** against the force of the springs **141** and **142**, which in turn causes the plate **147** to engage the rod **128** pivoting the rod about the nut and bolt assembly **130** to the left as viewed in FIG. **4**, thus disengaging the rod **128** from the pin **145**. The rod **128** and hence the left end of the carriage assembly **110** are now free to be adjusted vertically to any position defined by the pin **145** and an associated aperture **129**. When the carriage is in the chosen position, the T-handle **135** is released with the springs **141** urging the T-handle **135**, the plate **147**, and hence the rod **128** to the right with an appropriate one of the apertures **129** engaging the pin **145** to lock the carriage in the selected position.

On top of the bars **120** and **121** and suitably secured thereto are a pair of parallel crossbars **150** and **151**. Near each end of the bars **150** and **151** is a spring catch **153**, as best shown in FIG. **6**, having a vertical bore **155** and an intersecting horizontal bore **156**. A spring **157** is mounted within the horizontal bore **156** between a screw cap **158** at the outer end and a steel ball **159** at the end intercepting the vertical bore **155**. The end of the horizontal bore **156** is made slightly smaller to restrict the ball **159** to extend only partially into the vertical bore **155**.

The tub or dome base **116**, preferably of nonconductive molded plastic, is releasably mounted on the carriage assembly **110** by means of pins **163** which mate with the spring catches **153**. The pins **163** are secured to the bottom of the tub by means of screws **165**, each pin **163** having an annular groove **167** within which the ball **159** catches when the pins are forcibly pressed into the vertical bores **155**. In this described embodiment there are four such pins and catches to hold the dome base to the carriage assembly.

The base **116** is a molded one-piece plastic unit having side wall portions **170** of sufficient height to prevent the infant from falling even with the dome **114** opened. The top of the wall **170** is formed in a smooth downward fold **172** followed by a smooth upward fold **174**. The downward fold **172** is used as a convenient handle formed completely around the base for ease in mounting, removal, and carrying, while the upwardly formed fold **174** and the small section of wall between the folds **172** and **174** provide a seating surface for the lower edge of the dome **114** to provide an automatic alignment when the dome is closed. All surfaces are smooth and all corners of the dome rounded for ease in cleaning and to insure infant protection. The dome **114** and base **116** have mating depressions defining integral ports **180** through which sensor conductors extend from within the dome to the central connector panel **100**. At the underside of base **116** is located a tray **182** having a short rear wall **183**, a bottom wall **184**, and a frontal opening **185** for receiving an X-ray cassette. As will be described, this is part of the design feature for taking X-rays of the infant in the incubator without disturbing him, and without introducing the cassette, which is biologically contaminated through handling, into the infant's environment.

The tower assembly **112** has telescoping members, one of which remains stationary with respect to the carriage assembly **110** and the other of which moves axially with respect to the one member for the purpose of adjusting the height of the dome **114** in relation to the base **116** as will be hereinafter described.

Referring to FIGS. **4**, **9**, and **10**, the tower assembly **112** includes a first generally rectangular column **190** secured at its bottom to the left end of the rods **120** and **121** such as by screws **192** or other suitable means. Hence, the column **190** moves with the left end of the rods **120** and **121** depending on their pivotal position as adjusted by the tilt mechanism heretofore described. At the upper end of the column **190** is a generally U-shaped bracket **194** (FIG. **10**) within which is pivotally mounted a pair of spools **195** and **196** about which are wound a pair of ribbon-type springs **197** and **198**, respectively, when not in tension. The upper ends of the springs **197** and **198** are suitably secured to the spools

195 and 196. The U-shaped bracket 194 has flanges 200 suitably secured to the right wall of the column 190 as viewed in FIG. 4. A handle 201 is attached to the left wall near the bottom of the column 190 to aid in adjusting the left end in the carriage assembly 110 in a manner heretofore described.

The tower assembly 112 also includes a generally rectangular column 205 that fits in telescoping relationship outside the column 190, and a generally U-shaped column 206 which fits in telescoping relationship inside the column 190. The U-shaped column 206 has walls on all sides except the right side as viewed in FIG. 4. At the top of the inner column 206 are outwardly turned flanges 207. The outer and inner columns 205 and 206 are fastened together at the top by a pair of parallel rods 209 and 210, the left ends of which are secured to the flanges 207 by suitable screws 211 and to the top of the outer column 205 by suitable screws 212. The rod 209 is attached at the front side of the tower, and the rod 210 is attached at the back side of the tower as viewed in FIG. 2. A plate 213 covers the top of the tower and is fastened to the rods 209 and 210 by screws 214. With the outer and inner columns 205 and 206 fastened together at the top, they move together in telescoping relationship relative to the column 190.

To insure smooth telescoping movement between the columns suitable bearing guides 215, such as standard drawer guides, are mounted between the front wall of the column 190 and the front wall of the column 206, and between the rear wall of the column 190 and the rear wall of the column 206 as shown in FIG. 10. Each of the bearing guides has a member 216 secured to the inner column 206, a member 217 secured to the column 190, and a floating member 218 which move relative to one another as aided by ball bearings 220 as is conventional in the art.

A U-shaped bracket 225 is secured between the front and rear walls at the bottom end of the inner column 206 as best shown in FIGS. 4 and 9. The bottom ends of the springs 197 and 198 are secured by rivets 226 or the like to the bracket 225. A handle 228 is mounted on the left wall near the top of the outer column 205 as shown in FIG. 4.

The rods 209 and 210 project from the top of the tower assembly 112 over the top of the dome 114. A first bracket 230 shaped like a handle is secured beneath and at the right ends of the rods 209 and 210 with suitable bolts 231. Spaced from the handle bracket 230 toward the tower 112 is a second handle bracket 233 secured to the rods 209 and 210 by suitable bolts 234. Hence, when viewed from the top as in FIG. 3, the rods 209 and 210 and the handle brackets 230 and 233 define a window 235 for purposes to be explained.

The dome 114 is fastened to the underside of the handle brackets 230 and 233 by means of screws 237 so that the dome 114 can be removed from the tower assembly 112 for cleaning or the like by removing the bolts 231 and 234, leaving the handle brackets 230 and 233 attached to the top of the dome for ease in carrying.

The dome 114 is shaped as shown in the drawing and is molded of a shatterproof, optically transparent material. The bottom edge of the dome is dimensioned to conform to the wall portion between the folds 172 and 174 of the base 116 to automatically seat therewith when the dome is lowered on the base. These seating surfaces eliminate the need for auxiliary hardware and gasketing which harbor bacteria and make cleaning difficult.

All of the corners of the dome 114 are rounded for ease in cleaning and to insure infant safety. Also, the unique dome design offers improved visibility of the infant.

One of the features of this invention is the use of an infrared heater formed integrally with the dome 114, thus eliminating the need for forced air circulation requiring external air passages which can introduce bacteria, extensive cleaning problems, and problems with maintaining proper room temperature. Hence, the incubator of this invention includes an infrared heating element 240, which may be of the etched, film-laminated type and permanently bonded to the inside upper surface of the dome 114 as shown in the drawing. The heating element 240 covers generally the entire upper surface with the exception of the area beneath the window 235 defined by the rods 209 and 210 and the handle brackets 230 and 234. Thus, there is provided an unobstructed X-ray path from above the window 235 through the dome 114 and the base 116 to an X-ray plate positioned within the tray 182 under the dome base. With this invention it is possible to position an X-ray camera, shown by dashed lines in FIG. 7, above the window 235, insert an X-ray cassette in the tray 182, and X-ray the infant without removing the infant from the incubator.

Power is supplied to the heating element 240 from within the chassis portion 16, through conductors 242 (see FIG. 1), to the terminals of a connector 244 physically mounted to the rod 210. A mating connector 245 is physically mounted to the top of the dome 114 and has mating terminals electrically connected to the heating element 240. The connectors 244 and 245 are aligned such that connection and disconnection is automatically made upon mounting and unmounting, respectively, the dome 114 to the arms 209 and 210. A suitable sensor (not shown) can be located on the top of the dome 114, or some other suitable place, to protect against overheating by opening the heater circuit as is conventional in the art.

The dome 114, like the base 116, is easily removed for cleaning. It is contemplated that spare domes would be kept available for use while others are being sterilized or cleaned, thereby maintaining continual use of the remaining portions of the incubator unit. Hence, with this invention fewer incubators are needed to serve a given number of infants resulting in substantial cost saving. Further, cost savings are realized due to the reduced cleaning time, and hence the reduced labor staff required to support the equipment.

OPERATION OF THE DOME ASSEMBLY

It has already been explained how the tilting mechanism operates to pivot the carriage assembly 110. Because the base 116, the tower assembly 112, and hence the dome 114 are all mounted on the carriage assembly 110, all of these components which comprise the dome assembly tilt with the carriage assembly as shown by the dashed lines of FIG. 4. As heretofore stated the degree of tilt is adjustable by positioning the pin 145 in a select one of the apertures 129 in the rod 128 by use of the T-handle 135. Hence, with this invention it is possible to tilt the infant to a desired position com-

pletely externally of the dome and tube so as not to disturb the infant and his environment.

In addition to tilting, the dome **114** can also be positioned anywhere with respect to its base **116** between an open position shown in FIG. **1** and a closed position best shown in FIG. **2.** In this respect the tensions of the springs **197** and **198** are selected to very nearly counterbalance the cumulative weight of the inner and outer columns **205** and **206,** the rods **209** and **210,** and the remaining components supported thereon such as the dome **114** and heating element **240.** To raise the dome **114,** upward pressure is applied to the handle **228** causing the columns **205** and **206** to move upward with respect to the column **190,** aided by the drawer guides **215** and the springs **197** and **198** which coil around the spools **195** and **196.** Of course, the dome **114** moves with the columns **205** and **206** since it is physically attached thereto by means of the handle brackets **230** and **233** and the rods **209** and **210.** With the tower assembly **112** so balanced, the dome **114** will stay in any position in which it is placed so that with ease the dome can be placed in its fully open position for full access to the infant, its fully closed position, or any position therebetween.

It should further be noted that the design of this invention operation of the tower assembly **112** to position the dome **114** with respect to its base **116** is totally independent of the tilt position so that alignment of the dome and base is always maintained regardless of the tilt angle or dome height.

From the foregoing it is evident that there has been described a novel comprehensive infant care system providing complete incubator environment with greatly improved access to the infant, and which otherwise fulfills the objects set forth above.

Various changes and modifications may be made in this invention, as will be readily apparent to those skilled in the art. Such changes and modifications are within the scope and teaching of this invention as defined by the claims appended hereto.

What is claimed is:

1. An incubator for infants comprising a base on which the infant lies, a dome adapted to fit over the base and to define with the base an environmental chamber for the infant, the dome and base having mating surfaces which engage when the dome is closed, means for moving the dome relative to the base along a defined path between a closed position and an open position relative to the base, means for maintaining an equal distance between said mating surfaces for each dome position, whereby for a given dome position, the mating surfaces are the same distance apart, an infrared heating source for emitting infrared radiation to the infant, and means for mounting said heating source above the base in fixed relation to said dome to emit the same relative distribution of radiation energy over the infant for all positions of the dome relative to the base, whereby as the dome is moved between closed and opened positions, the relative distribution of radiation energy over the infant from the infrared heating source remains constant.

2. The incubator of claim **1** further comprising means for holding the dome at various positions between the open and closed positions.

3. The incubator of claim **1** further comprising a guide means having a first member connected to the base and a second member connected to the dome, the guide means further including means for moving the first member relative to the second member for movement of the dome with respect to the base.

4. The incubator of claim **3** wherein the guide means further comprises a tower assembly having a rigid first member and a rigid second member, means for slideably mounting the second member in telescoping relationship with respect to the first member, means for attaching the base to the first member, and means for attaching the dome to the second member.

5. The incubator of claim **3** further comprising means for counterweighting the second member and components connected thereto to hold the dome in any selected position relative to the base between the open and closed positions unless forcibly moved.

6. The incubator of claim **5** wherein the counterbalancing means is a spring means.

7. The incubator of claim **1** wherein the base includes side walls having surfaces for seating with the dome in its closed position.

8. The incubator of claim **1** further comprising means for tilting the dome, base, and dome-moving means as a unit, and mens for locking the unit in a selected tilt position.

9. The incubator of claim **8** further comprising a support structure, a carriage assembly pivotally mounted at one end on the top of the support structure, means at the other end of the carriage assembly to hold that end at a selected position above the support structure, the base and dome-moving means being mounted on top of the carriage assembly for tilting movement therewith.

10. The incubator of claim **1** further comprising a support structure, and means for mounting the dome base on the support structure, the support structure having a chassis portion for housing electronic circuitry for monitoring or controlling selected parameters.

11. The incubator of claim **1** including an infrared heating element secured to the top portion of the dome, and means for supplying electrical power to the heating element.

12. The incubator of claim **1** wherein the dome is transparent and all of the corners of both the dome and base are rounded for ease in cleaning and protection of the infant.

13. The incubator of claim **1** wherein the base includes a surface defining a plane for supporting the infant, and said dome movement between closed and open positions is along a path generally normal to said plane.

14. The incubator of claim **1** wherein the relative distribution of radiation energy for each position of the dome relative to the base is uniform.

15. An incubator for infants comprising a base on which the infant lies, a dome adapted to fit over the base and define with the base an environment chamber for the infant, means to move the dome relative to the base between a closed position in engagement with the base and an open position, a support structure including a cabinet portion and a chassis portion, a pedestal portion for supporting the chassis portion in spaced relation above the cabinet portion, the pedestal portion being substantially narrower than the chassis and cabinet portions, modular electronic units each designed to monitor or control selected parameters, the chassis portion including compartments for slideably receiving

the modules, the incubator further comprising means for mounting the dome base on the chassis portion.

16. The incubator of claim **15** wherein each of the modules includes an electrical connector and each of the compartments includes a prewired electrical connector that mates with the electrical connector on its associated module, and further including means for aligning the mating connectors for automatic connection when a module is inserted into its associated compartment.

17. The incubator of claim **16** including a central connector panel into which sensor leads may be connected, the panel being internally wired within the chassis portion and through the mating connectors to the modular units.

18. The incubator of claim **15** wherein the support structure further includes work surfaces on top of the cabinet portion at each side of the pedestal portion.

19. The incubator of claim **18** including a tray mounted in the top of the cabinet portion.

20. A comprehensive infant care system comprising a supporting structure having a chassis portion with compartments therein, modular electronic units adapted to plug into the compartments, the compartments being internally wired, means for electrically connecting the modular units to the chassis wiring upon plugging the units into the compartments, a carriage assembly, means for mounting the carriage assembly on the supporting structure for tilting movement of the carriage assembly with respect to the supporting structure, means for locking the carriage assembly in a selected tilt position, an incubator chamber in which the infant is placed having a base mounted on the carriage assembly, and a transparent dome for covering the infant, the system further comprising a first column member mounted at its bottom to the carriage assembly at one side of the dome and base, a second column mounted for sliding movement relative to the first column, an arm member, means for mounting one end of the arm member to the second column for movement therewith, and means for mounting the dome to the other end of the arm member with the dome in alignment with the base, whereby movement of the second column relative to the first moves the dome relative to the base between a closed position in contact with the base and a predetermined open position, and whereby tilting the carriage assembly correspondingly tilts the base, first and second column members, arm member, and dome as a unit.

21. The system of claim **20** including means for snapping the base onto the carriage assembly for easy installation and removal of the base.

22. The system of claim **20** including means for locking the carriage assembly in a selected one of several tilt positions.

23. The system of claim **20** including means for counterbalancing the cumulative weight of the second column and those components supported thereby to hold the second column in any slide position relative to the first column between the fully closed and open positions, and hence the dome in any position relative to the base between fully open and closed positions.

24. The system of claim **23** wherein the counterbalancing means further comprises a spring means, one end of the spring means connected to the top of the first column and its other end connected to the bottom of the second column, the tension in the spring means being such as to urge the second column away from the first.

25. The system of claim **20** wherein the dome and base are of molded plastic with all corners rounded.

26. The system of claim **20** wherein the means for mounting the dome to the end of the arm member includes handle brackets which stay with the dome when removed from the arm member for convenience in carrying the dome.

27. The system of claim **10** including an infrared heating element secured to the top portion of the dome, and means for supplying electrical power to the heating element.

28. The system of claim **20** wherein the incubator chamber is releasably mounted for quick removal from the remaining components of the system.

29. An incubator for infants comprising a base on which the infant lies, a dome adapted to fit over the base, an infrared heating element in the form of an array covering an upper surface portion of the dome, the array having an opening therein for the unobstructed passage of X-rays therethrough, a tray mounted beneath the dome base for receiving an X-ray cassette and means for defining an unobstructed X-ray path from the top of the incubator through the opening in the heating element, dome and base, to the X-ray cassette for X-raying the infant without inserting the cassette into the chamber.

30. An incubator for infants comprising a base on which the infant lies, the base including a surface defining a plane for supporting the infant, a dome adapted to fit over the base and to define with the base an environmental chamber for the infant, an infrared heating element secured to the top portion of the dome, means for supplying electrical power to the heating element, and means to move the entire dome toward and away from the base along a path generally normal to said plane between a closed position in engagement with the base and an open position relative to the base.

31. The incubator of claim **30** wherein the top portion of the dome where the heating element is secured is relatively flat and parallel to said plane, to provide even distribution of heat from the element over the infant regardless of the position of the dome between open and closed positions relative to the base.

32. The incubator of claim **31** further comprising means for tilting the dome, base, and dome moving means as a unit, and means for locking the unit in a selected tilt position.

33. The incubator of claim **32** further comprising a support structure, a carriage assembly pivotally mounted at one end on the top of the support structure, means at the other end of the carriage assembly to hold that end at a selected position above the support structure, the base and dome moving means being mounted on top of the carriage assembly for tilting movement therewith.

34. The incubator of claim **30** further comprising a tower assembly having a rigid first member and a rigid second member, means for slideably mounting the second member in telescoping relationship with respect to the first member, means for attaching the base to the first member, and means for attaching the dome to the second member.

35. The incubator of claim **34** further comprising means for counterweighting the second member and components connected thereto to hold the dome in any

selected position relative to the base between the open and closed positions unless forcibly moved.

36. A comprehensive infant care system comprising a supporting structure having a chassis portion with internally wired compartments, an incubator chamber mounted on the supporting structure, modular electronic units, each modular unit designed to monitor or control specific parameters within the chamber, and each of which modular units is adapted to plug into a selected compartment, each compartment being wired to monitor or control specific parameters in conjunction with its associated modular unit independently of the other compartments and units, whereby one or more units may be used as desired, and means for automatically electrically connecting the modular units to the chassis wiring upon plugging the units into the compartments.

37. The system of claim **36** wherein the support structure further includes a lower cabinet portion containing storage compartments for instruments and medicants for attending the infant, the cabinet portion having a top surface, the support structure further comprising a pedestal portion between the top of the cabinet portion and the chassis portion, which pedestal portion is substantially narrower than the cabinet and chassis portions, to thereby space the chassis portion above the cabinet portion such that portions of the cabinet top extend under the chassis portion to effectively increase the working surface on top of the cabinet.

38. The system of claim **37** including a sunken tray mounted in the cabinet top for placing small instruments and the like.

39. The system of claim **36** including compartment means in the support structure adapted for receiving an oxygen tank.

40. The system of claim **36** wherein the modular units have front panels with indicators mounted thereon, and including means for mounting the modular units within the chassis compartments such that the indicators are tilted upward for easy visibility.

41. The system of claim **36** including a surgical tray mounted for selective accessibility in the supporting structure, the tray being for the placement of instruments in performing minor operations on the infant with the infant in the incubator.

42. The system of claim **36** wherein the incubator chamber further comprises a base mounted on the supporting structure, a cover for the base, and means for moving the cover into and out of covering relationship with respect to the base.

43. The system of claim **42** further comprising means for tilting the base, cover, and cover-moving means relative to the supporting structure.

44. The system of claim **43** wherein the moving means includes a first column member rigidly connected to the base, a second column member rigidly connected to the cover, and sliding track means between the first and second columns to slide the second column with respect to the first and thereby move the cover with respect to the base.

45. The system of claim **36** wherein the incubator chamber is releasably mounted on the supporting structure for quick removal therefrom.

46. An incubator for infants comprising a base on which the infant lies, a dome adapted to fit over the base and to define with the base an environmental chamber for the infant, means for controlling the infant's environment within the chamber, a first column member secured near its bottom end to the base at one side of the dome and base, a second column member mounted for sliding movement relative to the first column, an arm member, means for mounting one end of the arm member to the second column for movement therewith, and means for rigidly mounting the dome to the other end of the arm member with the dome in alignment with the base, whereby movement of the second column relative to the first moves the dome relative to the base between a closed position in contact with the base and an open position.

47. The incubator of claim **46** further comprising a supporting structure, a carriage assembly, means for mounting the carriage assembly on the supporting structure for tilting movement of the carriage assembly with respect to the supporting structure, means for locking the carriage assembly in a selected tilt position, and means for mounting the dome base on the carriage assembly.

48. The incubator of claimi **47** including means for mounting the base onto the carriage assembly for easy installation and removal of the base.

49. The incubator of claim **46** wherein the means for mounting the dome to the end of the arm member includes handle brackets which stay with the dome when removed from the arm member for convenience in carrying the dome.

50. The incubator of claim **46** including means for counterbalancing the cumulative weight of the second column and those components supported thereby to hold the second column in any slide position relative to the first column between the fully closed and open positions, and hence the dome in any position relative to the base between fully open and closed positions.

51. The incubator of claim **50** wherein the counterbalancing means further comprises spring means, one end of the spring means connected to the top of the first column and its other end connected to the bottom of the second column, the tension in the spring means being such as to urge the second column away from the first.

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