United States Patent [19]

Williams

[11] **3,854,156**

[45] **Dec. 17, 1974**

[54] **PORTABLE BABY WARMING APPARATUS**

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[22] Filed: **Mar. 20, 1972**

[21] Appl. No.: **236,120**

[52] **U.S. Cl.** ..... **5/347,** 5/93 R, 5/284, 62/261, 62/372, 126/204, 126/206, 128/134

[51] **Int. Cl.** **A61f 7/00,** A61f 7/06, F75d 3/08

[58] **Field of Search** ..... 5/93, 94, 97, 284, 347; 44/3; 126/204, 205, 206, 263; 2/2.1 R, 69.5 X; 128/403, 134

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Primary Examiner—Casmir A. Nunberg
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[57] **ABSTRACT**

A combination for transporting an infant having a mattress, a hot pack for chemically generating heat, a heat retaining pack for absorbing the generated heat and releasing it at a generally constant temperature over an extended period of time, and an insulating bunting or blanket for swaddling the infant. These elements in combination provide the infant with heat from an external source and insulate him against the loss of his own heat, thereby enabling him to use his limited energy to sustain other vital body functions. The insulating bunting also has a novel construction since it includes means for retaining the infant in a fixed position on the mattress, means for supporting the head of the infant in a hyperextended position and means for visually monitoring the breathing and skin color of the infant.

25 Claims, 12 Drawing Figures

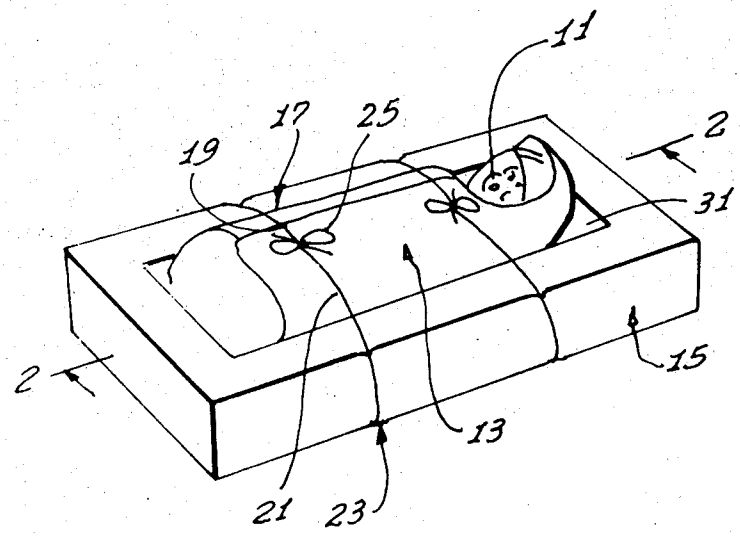


Fig. 1

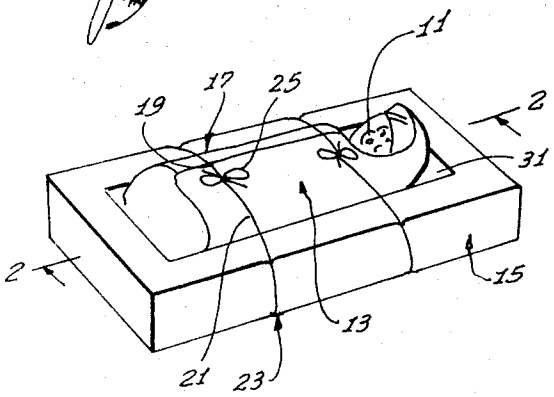


Fig. 2

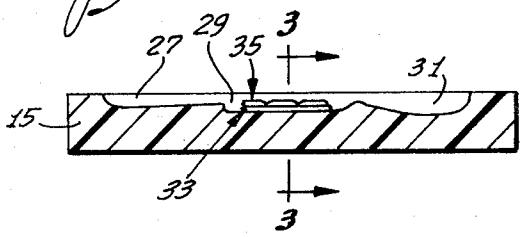


Fig. 3

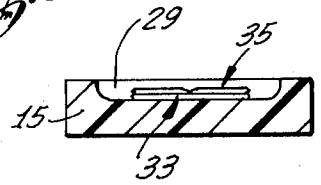


Fig. 4

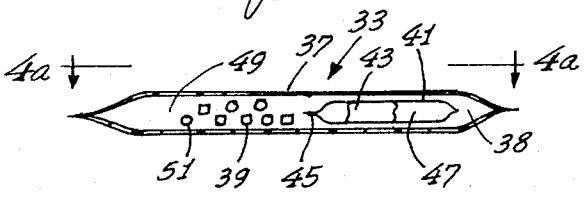


Fig. 4a

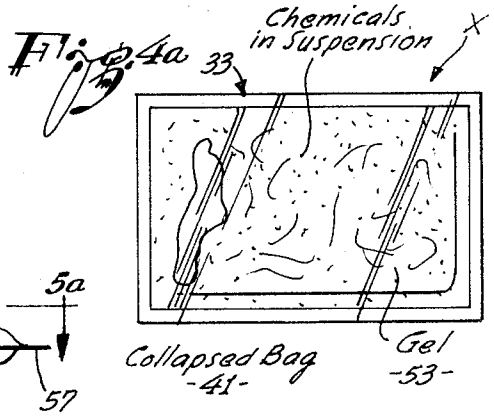


Fig. 5

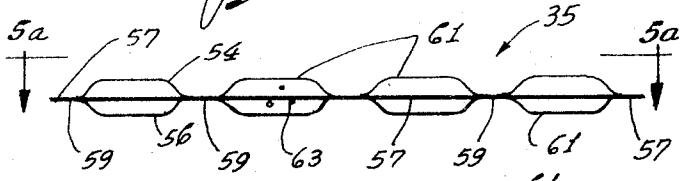


Fig. 5a

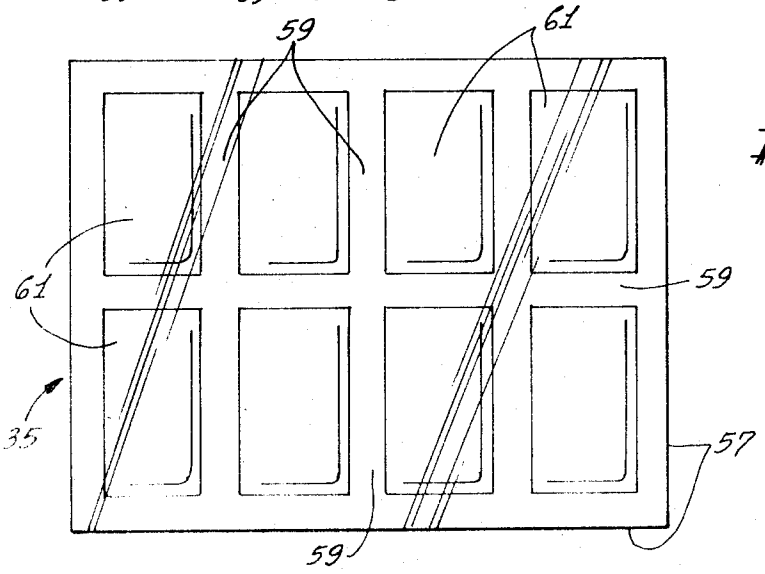


Fig. 6

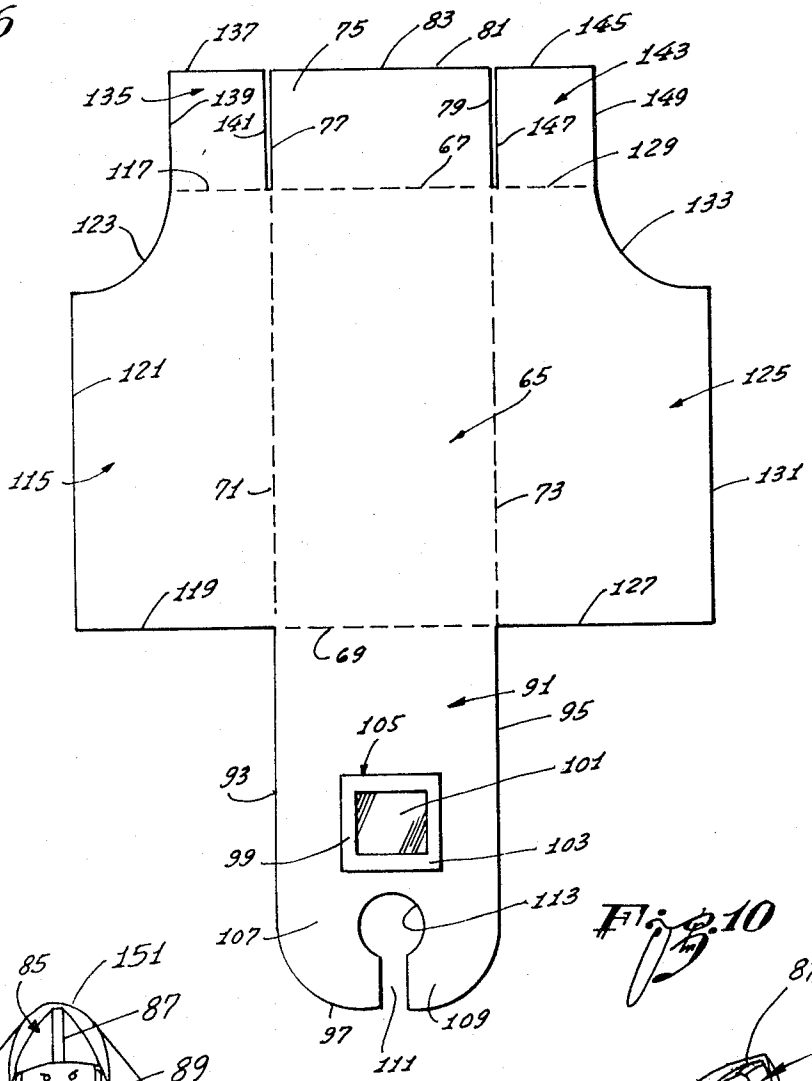


Fig. 9

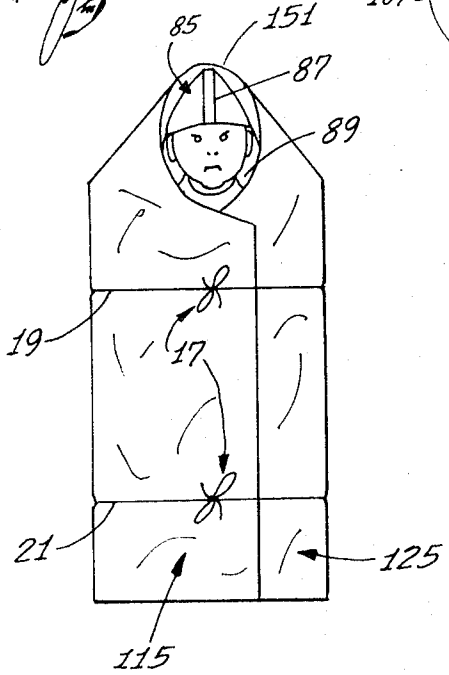


Fig. 10

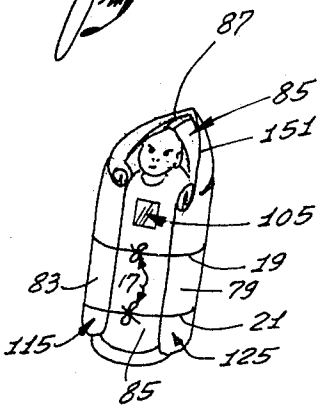


Fig. 7

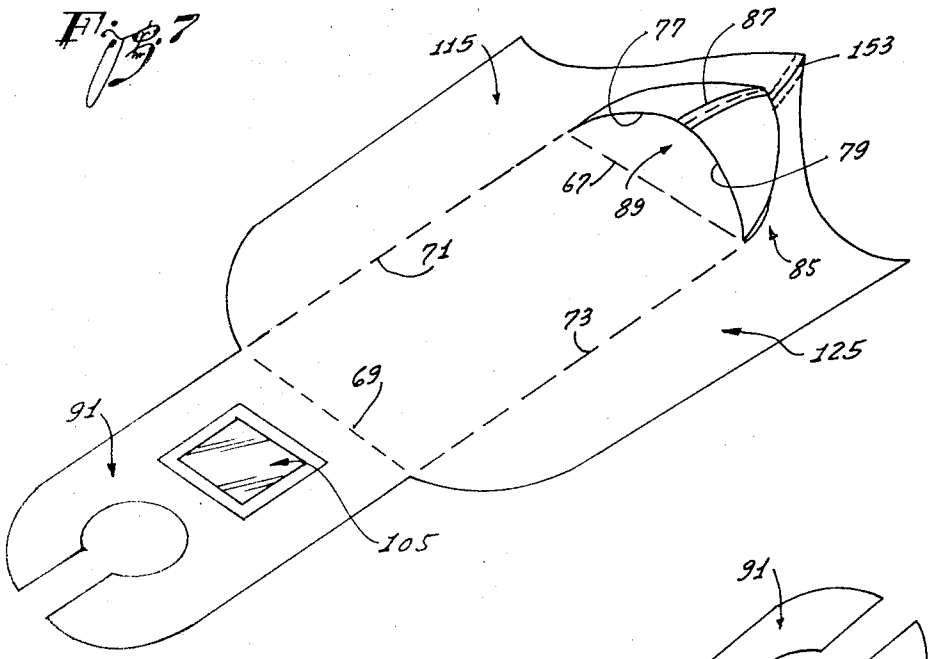
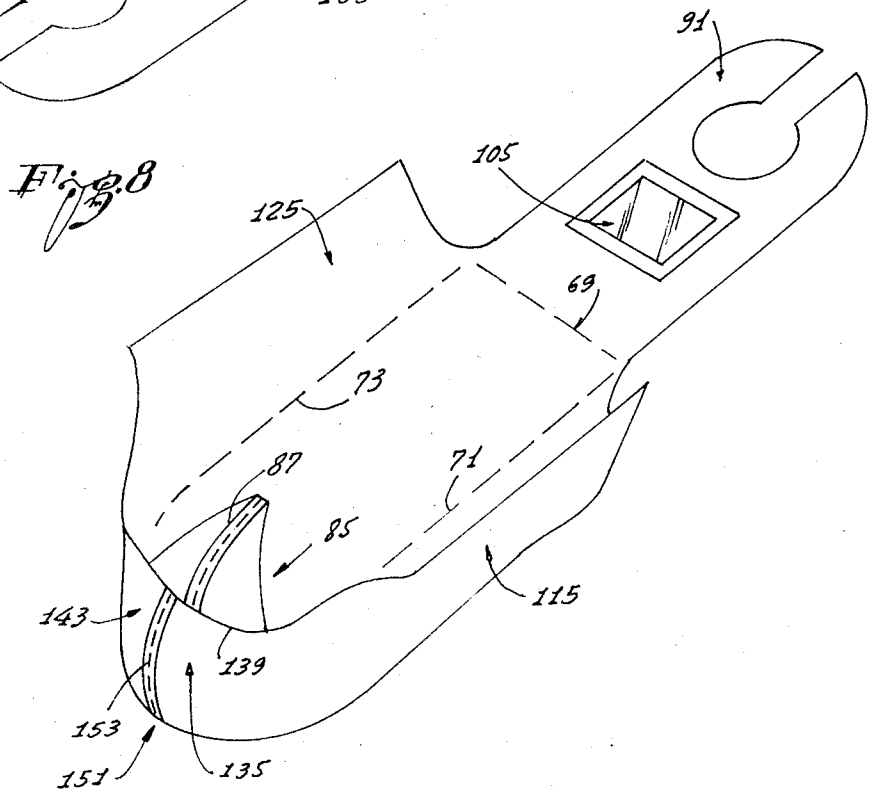

115
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Fig. 8


91
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151
135

PORTABLE BABY WARMING APPARATUS

BACKGROUND FIELD OF THE INVENTION

The fields of this invention comprise hooded infant apparel and portable apparatus for the generation of heat which can be imparted to an infant to aid in the stabilization of his or her body temperature.

DESCRIPTION OF THE PRIOR ART

It is well known that a baby experiences an abrupt drop in temperature when it first leave its mother's womb. Very few infants make this transition without having to devote a substantial amount of their available energy to the maintenance of body temperature. In the case of small, premature or sick babies, the absence of additional energy to devote to other vital body functions is often critical.

Various devices have been provided to conserve the precious heat of such a frail body. In many hospitals, the infant is immediately wrapped in a flannel bunting which has some insulating effect on the infant. However, this flannel wrap only aids in retaining the body heat of the infant. Furthermore, the retention of this heat is questionable in light of functional limitations on the thickness of the flannel and hence the bulkiness of the bunting.

Various attempts have been made to increase the insulating quality of the bunting. Significant among these is a plastic and aluminum laminate. The reflective surfaces and the polyester insulating layer have been found to retain heat more efficiently than the flannel bunting. However, a serious disadvantage of the foil laminate is the danger of overheating and suffocation. This danger of suffocation has typically required that the laminate only be used under the supervision of doctors and nurses.

In neither the flannel bunting nor the foil laminate has there been any provision for imparting heat to the frail infant. These wraps are intended only to retain the heat which the infant generates within himself or herself.

The prior art also includes electrical radiant heaters which are positioned above a table on which the infant lies. A thermistor is attached to the body of the infant for sensing his body temperature and controlling the amount of radiant energy which is emitted by the heater. As the temperature drops, additional radiant heat is directed onto the table.

Although the electrical radiant heaters attempt to impart heat to the infant, several functional drawbacks have been encountered. The most serious of these is the possibility that the thermistor may become detached from the infant. This is a frequent occurrence since the arms of the infant are typically unrestricted and therefore are free to interfere with devices within reach. With the thermistor detached, a temperature substantially lower than the normal body temperature of the infant is registered so that the radiant heater operates in a highly radiant and therefore dangerous state. This, of course, could result in overheating of the baby.

The temperature of the infant's environment varies considerably as the amount of radiant heat is increased and decreased in accordance with the operation of the thermistor. This is not desirable since a constant temperature is conducive to the preservation of the infant's vital energy.

The need to attach a thermistor to the body of the infant generally prohibits the successful wrapping of the infant so that he is typically exposed to the cool convective air currents which are present. These air currents tend to lower the body temperature of the infant so that the degree of radiant heat must be increased.

The radiant heaters are typically positioned over a table on which the infant is lying. Doctors and nurses attending the infant on the table necessarily come within the rays of the heater. This, of course, makes the doctors and nurses uncomfortable since they are exposed to heat that is intended for the infant. More importantly, perhaps, the infant is deprived of the heat which it needs. Therefore, the radiant heaters can be a source of discomfort to both the infant and the persons attending the infant.

The radiant heater is also disadvantageous because it is not portable. Portability of the heater is important because it allows a newly born infant to be carried about the hospital, such as from the nursery to the maternity ward, without changing the temperature of the infant. Attempts have been made to make the radiant heaters portable by incorporating large batteries to provide a source of electrical power. It is well known however, that a substantial electrical current is required by any heat generating apparatus. This in turn results in a large current drain on the batteries and requires that the batteries be recharged frequently. Thus maintenance of the batteries has been a considerable problem.

In addition to these disadvantages, the electrical radiant heaters are expensive to purchase and maintain. Furthermore, their high purchase price requires that the radiant heaters be non-disposable and therefore a considerable effort must be made to keep them free of germs.

SUMMARY OF THE INVENTION

The above-described problems have been solved by the apparatus of this invention, which provides for the novel combination of a small portable mattress having insulating qualities, means for chemically generating heat, means for absorbing the generated heat and releasing the heat at a substantially constant temperature over an extended period of time and means for wrapping an infant so that the dispersion of his body heat is inhibited. It will be appreciated that various subcombinations within the above combination are in themselves inventive and patentable.

The mattress is provided with cavities which readily accept the size and shape of the heat generating means and the heat absorbing means to define a recess in which the baby can be laid. The heat generating means is provided with a rupturable bag which, prior to its rupture, separates chemicals which are capable of reacting to generate heat. Since the heat generating reaction will not take place until the chemicals become mixed, the rupturable bag provides a means for controlling the time at which the reaction takes place.

The heat absorbing means absorbs the heat generated by the heat generating means and releases this heat over an extended period of time. During the time that the heat absorbing means is releasing this heat, it provides a substantially constant temperature. The capacity of the heat absorbing means to absorb heat is

preferably greater than the capacity of the heat generating means to generate heat so that the heat absorbing means will be able to operate at a constant temperature. The heat absorbing means may be compartmentalized so that the puncture of a single compartment will not result in a complete loss of the enclosed chemicals.

The bunting or baby-wrapping means includes provision for the support of the baby's head and the viewing of the baby's chest while he remains covered. Preferably the baby's head is supported in a hyperextended position to facilitate his breathing. Provision is made in the bunting or baby-wrapping means to view the baby's chest so that the breathing of the baby can be determined at any instant. Preferably the baby-wrapping means is formed from a single piece of material having insulating properties.

Means may also be provided in the bunting for pinning the baby's arms to his sides to limit the baby's movement. Limiting the baby's movement is desirable to insure that the baby's temperature will be maintained at a substantially constant value. A baby can easily breathe through the insulating material which comprises the baby-wrapping means so that any danger of suffocation is minimized.

The low cost and disposability of the combination of means constituting this invention also cause the invention to be significantly advantageous over the prior art. Furthermore, with the present invention each infant can be provided with his own individual unit. This individual unit can be used not only to transport the infant within the hospital, but also can provide an inexpensive and functional gift to the parents as they leave the hospital. In this manner, the infant can be carried from the hospital to his home at a substantially constant temperature. Since this is generally the infant's first exposure to an uncontrolled environment, this means for aiding him in the generation of body heat can be of particular importance at that time.

Even when the infant is older, the warming apparatus will provide an excellent means for transporting the infant during short trips to and from his home. By providing the infant with a source of heat at a substantially constant temperature and thus aiding him in retaining his body heat, the warming apparatus will make it possible for the infant to be taken from the comfortable environment of his home even sooner than would otherwise be possible. By contributing to the maintenance of the infant's body temperature, the warming apparatus makes it possible for the infant to use his limited energy to combat germs and sustain his other vital functions.

Further features of the invention will appear from the following description in which the preferred embodiments of the invention have been set forth in detail in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a frontal-side perspective view of the portable baby warming apparatus constituting one embodiment of this invention;

FIG. **2** is a sectional view taken substantially on the line 2—2 of FIG. **1**;

FIG. **3** is a sectional view taken substantially on the line 3—3 of FIG. **2**;

FIG. **4** is a cross-sectional view of heat generating means included in the embodiment of FIG. **1**;

FIG. **4***a* is a top view of the heat generating means shown in FIG. **4** and is taken substantially on line 4*a*—4*a* of FIG. **4**;

FIG. **5** is a cross-sectional view of heat absorption means included in the embodiment of FIG. **1**;

FIG. **5***a* is a top view of the heat absorption means shown in FIG. **5** and is taken substantially on line 5*a*—5*a* of FIG. **5**;

FIG. **6** is a top view of baby-wrapping means include in the embodiment of FIGS. **1** to **4**, inclusive, and constitutes another inventive feature of the combination, the baby-wrapping means being shown in the unfolded condition;

FIG. **7** is a perspective view of the baby-wrapping means shown in FIG. **6** with the baby-wrapping means in a partially operative or folded condition;

FIG. **8** is a perspective view of the baby-wrapping means shown in FIGS. **6** and **7** with the baby-wrapping means in a further operative or folded condition;

FIG. **9** is a top view of an infant wrapped in the baby-wrapping means; and

FIG. **10** is a perspective view of an infant wrapped in the baby-wrapping means.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIG. **1** an infant **11** is shown enclosed in a wrapping or swaddling means generally indicated at **13** and laid upon a mattress generally indicated at **15.** A securing means generally indicated at **17** is attached to the mattress **15** and tied around the wrapping means **13.** The securing means **17** is of particular advantage since it serves a dual purpose in insuring that the wrapping means **13** stays on the infant **11** and also that the infant **11** remains in contact with the mattress **15.** In this embodiment the securing means is composed of ties or cords **19** and **21** which are attached at one of their ends, such as end **23,** to the mattress **15** and are tied to each other at the bow **25.**

The mattress **15** is composed of a soft insulating material such as synthetic foam or latex. The mattress **15** is formed so that it generally defines three cavities, a body and foot cavity **27,** a heat cavity **29,** and a head cavity **31.** The head cavity **31** is relatively deep so that the head of the infant **11** will be lower than the spine of the infant when the infant is placed upon the mattress **15.** This relative position imparts a particular advantage to the combination since it contributes to the ease with which the infant **11** breathes.

A heat generating means generally indicated at **33** is disposed at the bottom of heat cavity **29** and an absorbing means generally indicated at **35** is disposed on the heat generating means **33.** The heat generating means **33** is shown in FIGS. **4** and **4***a*. It consists of a container bag **37** which can be constructed of a flexible plastic and heat-sealed to form an outer cavity **38.** At least one chemical **39** is disposed within the container **37.** When heat is to be generated, the chemical **39** may be calcium chloride. At least one other chemical **47** capable of reacting with the chemical **39** to generate heat can be enclosed within a rupturable bag **41** and disposed within the outer cavity **38.** When calcium chloride is chosen for the chemical **39,** water can be used for the chemical **47.**

The rupturable bag **41** preferably contains a weakened seal **45** which can be broken by striking the bag **41** whereby the chemical **47** is released into the outer

cavity 38 where it mixes and reacts with the chemical 39 to generate heat. The heat generating means 33 is disclosed in detail and claimed in co-pending application Ser. No. 809,870, filed by Cornwall and Lynch on Mar. 24, 1969, and assigned of record to the assignee of record of this application.

A gelling agent 51 may be enclosed in the outer cavity 38. A particular gelling agent 51 can be chosen which will react with the chemical 47 (such as water) to form a gel with the chemical 39. The effect of the gel will be to inhibit the conduction of heat within container 37 and to suspend some of the chemical 39, thereby prolonging the period during which effective heat generation can take place and maintaining the heat generation at a substantially constant temperature. The inclusion of a gelling agent 51 is also advantageous since it maintains the different chemicals in the container 37 in a fixed position. This will prevent the chemicals from running to the lowest portion of the container 37 when the mattress 15 is tilted. This is important in insuring that heat is generated over the full surface of the mattress 15 on which the baby lies. The use of starch as a gelling agent is disclosed in detail and claimed in co-pending application Ser. No. 169,328 filed by Vernon L. Williams on Aug. 5, 1971, and assigned of record to the assignee of record of this application.

Some gelling reactions require the generation of heat, particularly when starch is used as the gelling agent 51. This heat can be supplied by the heat generating reaction of the chemical 39 with tthe chemical 47. Under such circumstances, the temperature of the heat generating means 33 will rise significantly prior to the formation of the gel, thereby permitting the container 37 to achieve a therapeutic temperature prior to the formation of the inhibiting gel. This causes the starch to become cooked so that it can react with the water to form a paste for holding the material in a substantially fixed position within the container 37.

A top view of the heat generating means is shown in FIG. 4*a* with the rupturable bag 41 in its collapsed state and the chemical 39 suspended by the gel 53. The gel 53 has been formed by the chemicals 39 and 47 and the gelling agent 51.

The heat absorbing means 35 is shown in detail in FIGS. 5 and 5*a*. It is composed of a first layer of flexible plastic 54 and a second layer of flexible plastic 56 each having marginal regions 57 which are heat sealed. Heat seals 59 may also be provided which connected the marginal regions 57 to form a multiplicity of compartments 61.

At least one chemical 63 is enclosed within the compartments 61. The chemical 63 has the capability of absorbing heat from the heat generating means 33 and imparting that heat to the infant 11 at a substantially constant temperature over a relatively long period of time. The heat absorbing means 35 is particularly advantageous since it insures that any variations in the temperature of the heat generating means 33 are isolated from the infant 11 and that the infant 11 experiences a substantially constant temperature from the heat absorbing means 35. By absorbing heat from the heat generating means 33 at a faster rate than it imparts that heat to the infant 11, the heat absorbing means also provides the advantage of lengthening the period of time over which the combination can effectively warm the infant. Experimentation has shown that the heat absorbing means 35 can effectively impart heat to an infant for a period in excess of 5 hours.

A detailed description of the heat absorbing means 35 is provided in the co-pending application for a "Constant Temperature Device," Serial No. 223,966, filed by Walter B. Dandliker on Feb. 2, 1972 and assigned of record to the assignee of record to the present application. However, in one embodiment, the chemical 63 in the heat absorbing means 35 is calcium iodide herahydrate which has a melting temperature 42°C within a preferred range of melting temperature between 39°C to 43°C. The chemical 63 is originally in a solid form. As it receives heat from the heat generating means 33, it melts providing a fluid base on which the infant can be laid. The chemical 63 will continue to melt and maintain a substantially constant temperature as long as any of the chemical 63 remains in a solid state. Thus a sufficient amount of chemical 63 may be included in the heat absorbing means 35 so that some of the chemical 63 is still in the solid state when the heat generating means ceases to generate heat.

As is apparent from FIG. 6, the swaddling means 13 can be formed by joining several separate pieces of material but it is preferably stamped from a single sheet for ease of production. The single piece construction is of particular advantage to the combination since it permits the flexible insulating material to be stacked in layers so that several pieces can be cut at once. This substantially decreases the cost of manufacturing the swaddling means 13 and consequently results in a lower retail price.

The swaddling means 13 may be constructed from a soft flexible insulating material such as a plastic foam. For example, a relatively thin sheet of polyethylene foam can be used for the swaddling means 13. This material is particularly advantageous because of its light weight and high insulating qualities. This material flexes easily and is also adaptable to several means for binding the material to itself.

Polyethylene foam is also relatively easy to breathe through. This is particularly important for a material which is intended for use in swaddling an infant. It is well known that babies which are awake are in constant motion. This sometimes has resulted in blankets or other wrapping means falling across the infant's face and suffocating the infant. Even if the swaddling means 13 were to fall over the infant's face, the polyethylene foam material would not cut off his oxygen supply.

The swaddling means 13 is preferably formed from a single sheet of material which may include a back region 65 which is substantially defined by a rectangle comprising two imaginary short lines 67 and 69 and two imaginary long lines 71 and 73. In use, the back side of the infant typically will be laid upon the back region 65.

A hood region 75 extends from the imaginary short line 67 of the back region 65 and can be shaped in a substantially rectangular configuration. In this configuration the hood region 75 is defined by two short sides 77 and 79 which may be collinear with the long lines 71 and 73, respectively. The hood region 75 is also defined by a long side 81 and the imaginary short line 67. The long side 81 contains a center point 83 and defines one of the outer edges of the swaddling means 13.

A hood 85 can be formed by bending the long side 81 of the hood region 75 about its center point 83. The two corners formed by the long side 81 and the short

sides 77 and 79 are thus disposed in contiguous relationship to form a hood seam 87. The seam 87 can be bound by sewing or gluing but taping is preferred. The taping can be provided by disposing an adhesive on the polyethylene. It is apparent from the formation of the hood 85 that the dimensions of the long side 81 and the two short sides 77 and 79 should be such that the hood 85 is large enough to accept the head of the infant.

An opening 89 provides an entrance to the hood 85 and also a hole through which the face of the infant can be observed. The hood 85 substantially encloses the head of the infant with the exception of his face. This is particularly important since the surface area of the infant's head is large in comparison to the amount of circulation available for maintaining the temperature of his head. The infant's ears, which are notoriously susceptible to infection, are also covered by the hood 85.

A front region 91 extends beyond the imaginary short line 69 which defines the back region 65. The front region 91 is preferably capable of being folded over the feet of the infant and across his chest and shoulders. The front region 91 is shaped in a substantially rectangular configuration and defined by two long sides 93 and 95, a short side 97, and the imaginary short line 69. The long sides 93 and 95 and the short side 97 define outer edges of the swaddling means 13. The long sides 93 and 95 can be collinear with the imaginary lines 71 and 73 which define the back region 65.

The front region 91 contains means for monitoring the breathing of the infant. This monitoring means is shown generally as a window 105. The window 105 may be disposed in the front region 91 so that it will overlie the chest of the infant when the front region 91 is in place. The window 105 is formed by portions 99 of the front region 91 which define a hole 101. A piece of transparent material 103 can be connected to the portions 99 and across the hole 101 to cover the window 105. The piece of transparent material 103 is preferably a piece of flexible plastic such as cellophane but any other flexible and transparent material can be used.

The window 105 imparts significant advantages to the apparatus. When operably positioned over the chest of the infant, the window 105 provides a means for monitoring the breathing of the infant. The monitoring of the infant's breathing is especially critical in the first few hours after the infant's birth since this is the first time he is required to rely upon his own lungs to supply his body with oxygen. By thus embodying the window 105 in the swaddling means 13, the infant's chest can be observed without uncovering him. Thus, the advantages of the wrapping and the monitoring can be provided simultaneously.

A first shoulder strap 107 is provided in the front region 91 and includes the corner defined by the long side 93 and short side 97. A second shoulder strap 109 is also provided which includes the corner defined by the long side 95 and the short side 97. In the preferred embodiment these corners are rounded. The pair of shoulder straps 107 and 109 define a slot 111 which extends perpendicularly from the center of the short side 97 and terminates in a hole 113.

As the front region 91 is operably positioned, the neck of the infant is passed through the slot 111 to occupy the hole 113, and the shoulder straps 107 and 109 are folded around the respective shoulders of the infant. The pair of shoulder straps 107 and 109 provides a means for retaining the front region 91 in its operable position upon the chest of the infant. By thus retaining the front region 91 in its operable position, the shoulder straps 107 and 109 insure that the window 105 is also substantially secured over the chest of the infant to cover the infant and also provide for the continuous monitoring of the infant's breathing.

A first side region 115 extending from the imaginary long line 71 of the back region 65 can be provided to cover at least half of the infant's chest and one of his arms. The first side region 115 can be substantially defined by an imaginary short line 117, a short side 119, a long side 121, and the imaginary long line 71 arranged in a substantially rectangular configuration. The imaginary short line 117 can be collinear with the imaginary short line 67. The short side 119 and the long side 121 define outer edges of the swaddling means 13.

A portion of the first side region 115 can be removed from the corner defined by the long side 121 and the imaginary line 117. This piece can be substantially in the shape of a quarter section of a circle wherein the center of the circle is located at the point where the long side 121 and the imaginary short line 117 intersect. The removal of this piece provides the first side region 115 with an edge 123 which is curved in the direction of the hood region 75 with progressive displacements toward the back region 65.

A second side region 125 can extend from the imaginary long line 73 of the back region 65 and may be a mirror image of the first side region 115. In this configuration the second side region 125 is defined by a short side 127, an imaginary short line 129, a long side 131, and the imaginary long line 73. The short side 127 and the long side 131 define outer edges of the swaddling means 13. A piece substantially in the configuration of a quarter section of a circle can be removed from a portion of the second short side 125 where the imaginary side 129 and the long side 131 intersect to define the center of the circle. Thus an edge 133 is provided which curves in the direction of the hood region 75 with progressive displacements in the direction of the back region 65.

The curved edges 123 and 133 are operably positioned to extend along the sides of the infant's face. Thus these curved edges 123 and 133 cooperate to expose the face of the infant by defining the opening 89 in the hood 85. It can be appreciated that the curved edges 123 and 133 need not be circular but can be cut in any shape to provide an opening in close proximity to the infant's face.

When the first and second side regions 115 and 125 are folded over the arms of the infant, they provide a means for restricting his movement. This can be advantageous for several reasons. By restricting the movement of the infant, he will expend less energy, thereby conserving his energy to sustain other body functions. Also, by restricting the arms of the infant, his typically sharp fingernails will not be capable of scratching other regions of his body. Furthermore, without the use of his arms, the infant will be incapable of unwrapping the swaddling means 13 and thereby exposing his body to his environment.

As shown in FIG. 10, the first and second side regions 115 and 125 can be disposed in a second operable configuration to cooperate with the window 105 and to provide for the monitoring of the infant's breathing. In

this configuration, the first side region **115** can be folded around the right arm of the infant and tucked beneath the infant. Similarly, the second side region **125** can be folded around the left arm of the infant and tucked beneath the infant. In this manner the infant remains entirely covered since the tucking of the side regions **115** and **125** merely exposes the front region **91** which covers the front of the infant. In this manner, the window **105** is exposed and the chest of the infant can be viewed. In this configuration, the arms of the infant remain restricted by the first and second side regions **115** and **125.** In this manner the swaddling means **13** can provide simultaneously the advantages associated with covering an infant with an insulating material, restricting the movement of the infant's arms, and monitoring the breathing of the infant.

A first head support flap **135** extends from the first side region **115** in juxtaposition to the hood region **75.** The first head support flat **135** can be shaped in a substantially rectangular configuration and defined by the short side **137,** the imaginary short line **117,** and two long sides **139** and **141.** The short side **137** and the long side **139** define outer edges of the swaddling means **13.** The long edge **139** extends tangentially to the curved edge **123** at the point where the imaginary short line **117** and the curved edge **123** intersect. The long side **141** can be parallel to and coextensive with the short side **77** of the hood region **75.** In the preferred embodiment, the long side **141** also is closely disposed to the short side **77** so that it is also substantially collinear with the imaginary long line **71** of the back region **65.** The short side **137** can also be collinear with the long side **81** of the hood region **75.**

A second head support flap **143** extends from the second side region **125** in juxtaposition to the hood region **75.** The second head support flap **143** can be a nirror image of the first head support flap **135** whereby it is shaped in a rectangular configuration and defined by a short side **145,** a long side **147,** the imaginary short line **129,** and a long side **149.** The long side **149** can be in proximity to, parallel to, and coextensive with the short side **79** of the hood region **75.** The long side **147** can be tangential to the curved edge **133** and substantially perpendicular to the imaginary short line **129.** The short side **145** can be collinear with the long side **81** of the hood region **75.**

The short sides **137** and **145** of the first and second head support head flaps **135** and **143,** respectively, can be joined to form a head support flap **151** on the side of the hood opposite the opening **89.** The corner defined by the short side **137** and the long side **141** and the corner defined by the short side **145** and the long side **149** can be in contiguous relationship to define a head support seam **153.** The seam **153** can be retained by sewing or gluing but taping is preferred. This taping can be produced by providing a suitable adhesive on the polyethylene.

Thus, the first and second head support flaps **135** and **143** can be joined to define a head support means **151** which extends behind the head of the infant to aid in its support. Since the first and second head support flaps **135** and **143** are extensions of the first and second side regions **115** and **125,** the folding of the side regions over the chest of the infant operates to pull the head support means **151** in the direction of the hood **85.** In this manner, a continuous pressure is maintained on the back of the infant's head.

The head support means **151** is of particular importance to the swaddling means **13.** It is well known that an infant's head is quite heavy in relation to the size and strength of his neck. Thus, a means must be provided for aiding the infant in the support of his head to insure that an undue strain is not placed upon his neck. Typically, a person will carry an infant in a horizontal position with their arm beneath his head thereby providing the necessary head support. However, it is extremely difficult to maintain this support when the infant is carried in a vertical position on a person's shoulder. In the manner disclosed by this invention, the head support means **151** can be incorporated directly into the swaddling means **13** so that no additional head support may be needed. The head support means **151** can perform its function whether the infant is carried in a horizontal or in an upright position, such as shown in FIG. **10.**

The securing means **17** can comprise the plurality of ties **19** and **21** which can be folded around the swaddling means **13.** Buttons, zippers, and snaps can also be used for this purpose, but the ties **19** and **21** are preferable. The securing means **17** can also be used in combination with the mattress **15,** as shown in FIG. **1.**

As can be seen from the foregoing detailed description, the combination provides a means for aiding the infant in the maintenance of his body temperature so that his limited energy can be devoted to other vital body functions. This is particularly important in the period immediately after birth when the available energy of the infant is particularly limited. Heat can be chemically generated by the heat generating means and imparted to the infant through the constant temperature device so that the infant need not increase his circulation to adjust to his cooler environment. The constant temperature device can absorb the heat generated by the heat generating means and use that heat to melt the chemicals contained therein; thereby providing a fluid base on which the infant can be laid. The heat absorbed by the constant temperature device can be imparted to the infant at a substantially constant temperature so that the temperature of his environment does not fluctuate significantly.

The combination disclosed herein is portable and therefore can be used to transport the infant not only within the hospital, but also outside of the hospital. The combination is inexpensive to manufacture and therefore can be sold at a relatively low price. This low price can make the replacement of individual units inexpensive so that they can be disposable and, therefore, need not be maintained in a sterile condition.

The swaddling means provides a particularly novel apparatus capable of insulating the infant against the loss of heat. The head support means extends behind the head of the infant and aids in maintaining the neck of the infant in line with his spine. This is particularly important since the head of an infant is particularly heavy in comparison to the ability of his neck to support that weight.

A window is provided in the swaddling means for viewing the chest cavity of the infant so that his breathing can be monitored. In this manner the breathing of the infant can be observed without unwrapping him and thereby exposing him to his environment.

Although this application has been disclosed and illustrated with reference to particular applications, the principles involved are susceptible of numerous other applications which will be apparent to persons skilled

in the art. The invention is, therefore, to be limited only as indicated by the scope of the appended claims.

I claim:

1. In combination for maintaining an infant at a substantially constant temperature:

a portable mattress made from an insulating material;

first means disposed upon the mattress and having characteristics for chemically reacting to provide a substantially constant temperature for an extended period of time; and

second means disposed upon the first means for swaddling the infant and for permitting the transfer of heat from the first means to the infant at the substantially constant temperature and for facilitating the maintenance of the infant at the substantially constant temperature.

2. The combination set forth in claim **1** wherein:

the first means includes means for generating heat at a variable temperature and means responsive to the generation of the heat absorbing such heat at the variable temperature and for imparting the heat to the infant through the second means at the substantially constant temperature.

3. The combination set forth in claim **2** wherein,

the second means include means for retaining the head of the infant in a forward position and means for providing an indication of the breathing of the infant.

4. The combination set forth in claim **3** wherein,

the second means is constructed from a single piece of material having insulating properties and wherein the second means include means for retaining the arms of the infant in substantially fixed position.

5. The combination set forth in claim **4,** including:

means disposed in cooperative relationship with the mattress for retaining the swaddled infant and the first means in fixed relationship with the mattress.

6. A combination for imparting heat to and resisting dissipation of heat from an infant, comprising:

a portable mattress for supporting the infant with the head of the infant in a hyperextended position to facilitate the breathing of the infant, the mattress being formed from a material having characteristics for insulating against the loss of heat;

first means for generating heat at a substantially constant temperature, said first means being disposed in contiguous relationship with said mattress; and

second means for swaddling thhe infant, said second means being disposed in contiguous relationship with said first means on the side opposite said portable mattress, said second means substantially enclosing the infant so that the heat developed by and imparted to the infant by the first means is not readily dissipated.

7. The combination set forth in claim **6,** including:

third means for securing said infant within said second means and to said mattress.

8. A combination as defined in claim **7** wherein said first means comprises:

fourth means for chemically generating heat; and

fifth means in substantial contact with said fourth means and said second means for absorbing the heat generated by said fourth means and imparting the heat to the infant at the substantially constant temperature.

9. A combination as defined in claim **8,** wherein said fourth means comprises:

a sealed container;

a plurality of chemicals disposed within said container and being capable of reacting to generate heat;

sixth means having rupturable properties for releasably separating said chemicals to prevent said separated chemicals from reacting with each other prior to the rupture of the sixth means; and

whereby said sixth means can be ruptured by a force exterior to said sealed bag to release said chemicals into contact with each other, thereby initiating said heat generating reaction and developing a heat differential across the wall of said container.

10. A combination as defined in claim **9,** wherein said sixth means comprises:

a flexible rupturable bag enclosing at least one of said chemicals and having a weakened seal in its outer wall;

whereby said container can be struck to rupture said weakened seal so that said chemicals can mix and react to generate heat.

11. A combination for imparting heat to and resisting the dissipation of heat from an infant, comprising:

first means having characteristics for chemically reacting to provide a portable source of heat;

a mattress underlying said first means, said mattress being constructed to insulate heat and to provide support for the infant;

second means providing a wrapping for the infant with the infant disposed adjacent to said first means whereby the heat is imparted to the infant by the first means and said second means insulates against the dissipation of the heat;

third means for securing the infant to said mattress and for maintaining said second means in contact with the infant, and

fourth means disposed between said first means and said second means, said fourth means having characteristics for maintaining said heat at a substantially constant temperature.

12. A combination as defined in claim **11,** wherein said fourth means comprises:

a first sheet of material having the capability of readily transferring heat;

a second sheet of material having the capability of readily transferring heat wherein said second sheet is joined with said first sheet along the marginal region thereof to form an enclosure through which heat can be readily transferred in at least one direction;

at least one chemical contained within said enclosure, said chemical having the capability of readily absorbing heat from the first means at a substantially variable temperature and readily imparting that heat to the second means at a substantially constant temperature; and

whereby the heat generated by said first means is readily absorbed at a substantially variable temperature through said first sheet by said chemical and said heat is dissipated at a substantially constant temperature to said second means through said second sheet.

13. A combination for facilitating the maintenance of the body temperature of an infant, comprising:
first means for swaddling and substantially restricting the movement of said infant;
second means in substantial contact with said first means for providing a source of substantially constant temperature; and
a mattress supporting the infant in the first means and having a first cavity at one end thereof, said cavity having a depth permitting the head of said infant to tilt slightly backwards whereby the breathing passage of said infant is straightened to facilitate the breathing of said infant.

14. The combination recited in claim 13 wherein the second means comprises:
third means having a contiguous relationship with the mattress for chemically generating heat; and
chemical means having a contiguous relationship with the first means for receiving the heat from the third means and for imparting the heat to the infant through the first means at the substantially constant temperature.

15. The combination set forth in claim 13 wherein the first means is formed from a single piece of insulating material which defines a hole through which the chest of the infant can be viewed to monitor the breathing of the infant.

16. The combination as defined in claim 13, wherein said first means is formed from an insulating material and comprises:
a hood adapted to substantially enclose the head of said infant;
third means for enclosing and substantially restricting movement of the arms of said infant;
fourth means attached to said third means and in substantial contact with the back of said hood, said fourth means having properties for aiding in the support of the head of said infant;
fifth means for substantially covering the front region of said infant while permitting the observation of the breathing of said infant; and
a back portion in substantial contact with the back of said infant, said back portion connecting said hood, said third means and said fifth means; whereby
said infant can be placed on said back portion with the head of said infant substantially enclosed by said hood, said fifth means can be folded over the feet of said infant to substantially cover the front region of said infant, and said third means can be folded over the arms of the infant to restrict the arm movement of said infant.

17. The combination as defined in claim 16 wherein said fifth means includes:
first portions attached to said back portion on a side thereof opposite that of said hood;
second portions defining a hole through which the chest of the infant can be observed when the fifth means is operably positioned over the front region of said infant; and
third portions disposed on said fifth means at the end thereof opposite said first portions, said third portions having characteristics for engaging the neck of said infant to retain said fifth means in contact with the front of said infant.

18. A combination as defined in claim 17, wherein said third means comprises:
at least one side flap attached to said back portion on a side thereof substantially perpendicular to the side of the back portion to which said hood is attached; and
said side flap being of sufficient length to extend over both of the arms of said infant.

19. A combination as defined in claim 17, wherein:
said third means comprises at least a pair of side flaps attached to said back portion on opposite sides thereof and along lines substantially perpendicular to the line along which said hood is attached to said back portion, said side flaps being of sufficient length to permit overlapping of said side flaps across the front of the infant and also being of sufficient length to wrap around one of the arms of the infant; and
said fifth means comprises a front region having portions thereof which define a hole, said portions being disposed relative to said front region so that said portions are positioned over the chest of said infant when said front region is retained by said sixth means;
a transparent sheet material connected to said portions to provide a window in said front region, said transparent window permitting observation of the infant's chest while resisting the dissipation of heat from the body of said infant;
whereby said fifth means and said third means cooperate to maintain the heat ingegrity of said first means and restrict the movement of said infant while permitting the observation of the breathing of said infant through said transparent window.

20. A combination as defined in claim 19, wherein said first means is formed from a single piece of insulating material and said sixth means comprises a pair of shoulder straps which define a neck slot therebetween, said shoulder straps having characteristics for being of sufficient length to permit said straps to be folded between the back of said infant and said back portion.

21. A combination for facilitating the maintenance of the body temperature of an infant, comprising:
first means for swaddling and substantially restricting the movement of said infant;
second means in substantial contact with said first means for providing a source of substantially constant temperature and for supporting said infant in a manner which facilitates his breathing, said second means including a mattress made of insulating material and having a first cavity at one end thereof, said cavity being capable of permitting the head of said infant to tilt slightly backward whereby the breathing passage of said infant is straightened to facilitate his breathing;
a hood inluded in the first means and capable of substantially enclosing the head of said infant;
third means included in the first means and capable of enclosing and substantially restricting movement of the arms of said infant;
fourth means included in the first means and attached to said third means and in substantial contact with the back of said hood, said fourth means being capable of aiding in the support of the head of said infant;
fifth means included in the first means and capable of substantially covering the front of said infant and

permitting the observation of the breathing of said infant; and

a back portion included in the first means and in substantial contact with the back of said infant, said back portion connecting said hood, said third means and said fifth means; whereby

said infant can be placed on said back portion with his head substantially enclosed by said hood, said fifth means can be folded over the feet of said infant to substantially cover his front region, and said third means can be folded over the arms of said infant to restrict his arm movement.

22. The combination as defined in claim **21,** wherein said fifth means is attached to said back portion on a side thereof opposite to that of said hood wherein regions of said fifth means define a hole through which the breathing of said infant can be observed;

sixth means disposed on said fifth means opposite the attached end thereof, said sixth means being capable of retaining said fifth means in contact with the front of the infant;

whereby said fifth means can be folded over the front of said infant and said sixth means engaged, and the breathing of said infant can be observed through said hole.

23. A combination as defined in claim **22,** wherein said third means comprises:

at least one side flap attached to said back portion on a side thereof substantially perpendicular to the sides on which said hood and said fifth means are attached; and

said side flap being of sufficient length to extend over both arms of said infant.

24. A combination as defined in claim **22,** wherein said third means comprises:

at least a pair of side flaps attached on opposite sides of said back portion along lines substantially perpendicular to the lines on which said hood and said fifth means are attached, said side flaps being capable of overlapping each other across the front of the infant and also being of sufficient length to wrap around the respective arms of the infant and tuck between the back of said infant and said back portion; and

said fifth means comprises:

a front region having portions thereof which define a hole, said portions being disposed relative to said front region so that they are positioned over the chest of said infant when said front region is retained by said sixth means;

a transparent sheet material connected to said portions to provide a window in said front region, said transparent window permitting observation of the infant's chest while resisting the dissipation of heat from his body;

whereby said fifth means and said third means cooperate to maintain the heat integrity of said first means and restrict the movement of the infant while permitting the observation of his breathing through said transparent window.

25. A combination as defined in claim **24,** wherein said first means is formed from a single piece of insulating material and said sixth means comprises shoulder straps which define a neck slot therebetween, said shoulder straps having the capability of being folded between the back of said infant and said back portion.

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