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(54) AIR CONDITIONING CUSHION FOR WHEELCHAIR

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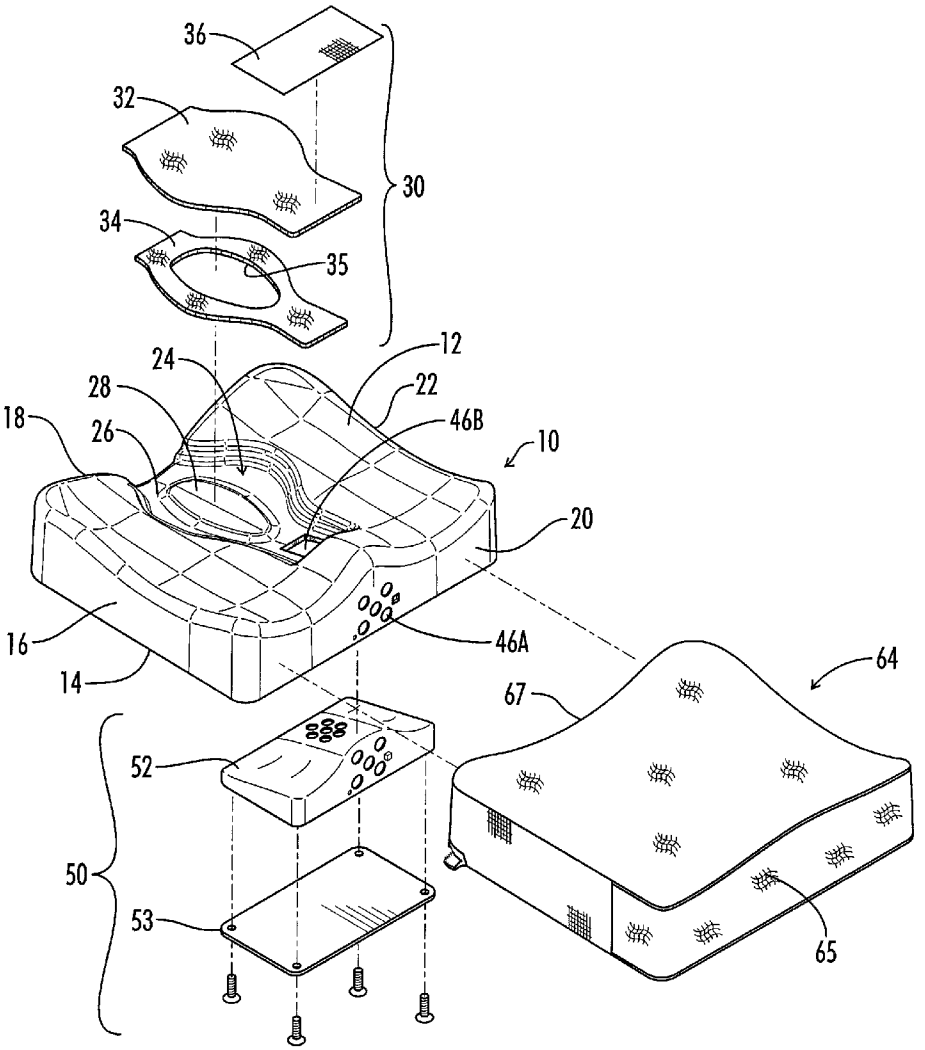
(57) **ABSTRACT**

A seat cushion for use in a wheel chair includes a foam pad contoured to the anatomy of a user positioned thereon and has an indentation in the middle thereof, which receives and drains incontinence fluid from the user. The foam pad encloses an air channel between the indentation and at least one side of the foam pad. A fan housed inside the pad pushes air through the air channel, into the indentation and onto the user. Alternatively, the seat cushion may house an air conditioner to circulate cooled air to the skin of the user.



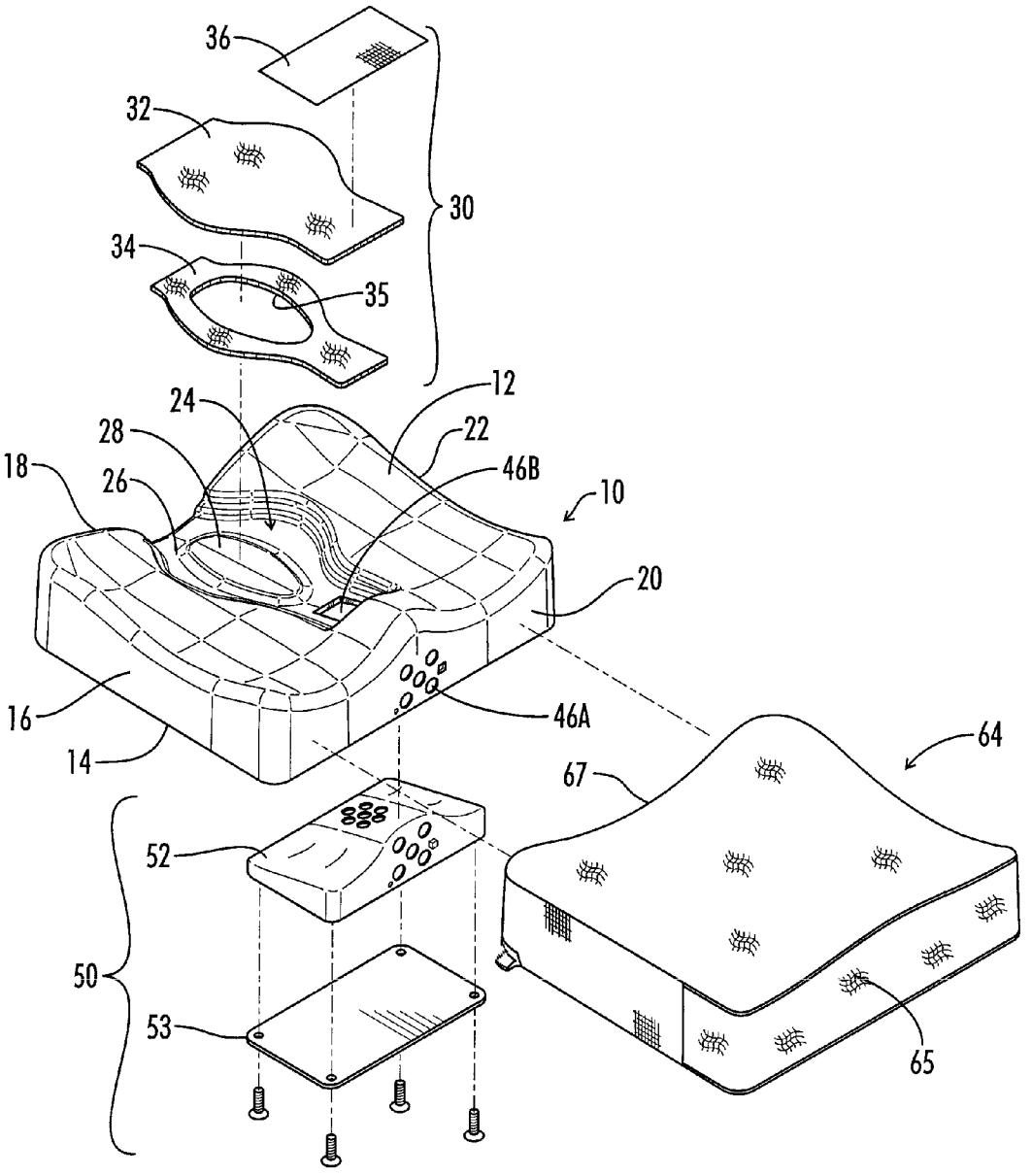


FIG. 1

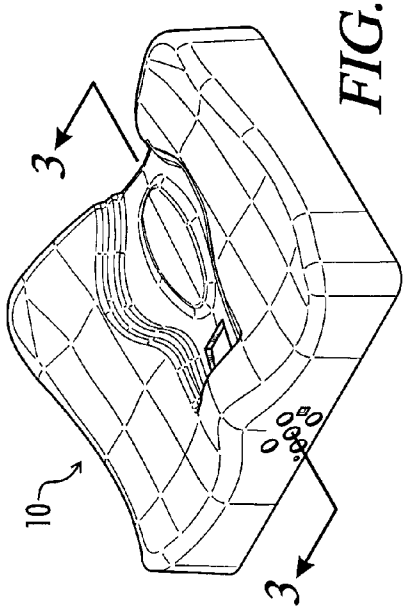


FIG. 2

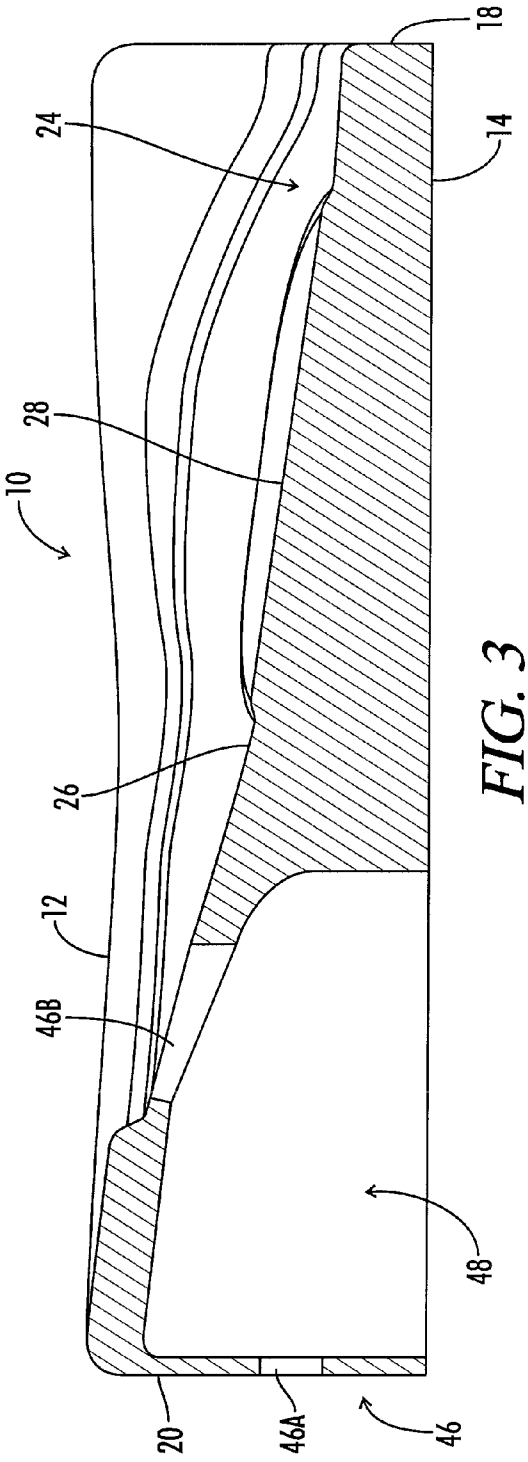


FIG. 3

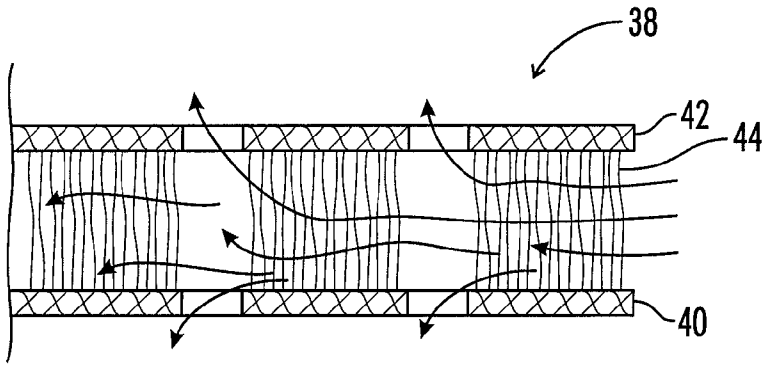


FIG. 4

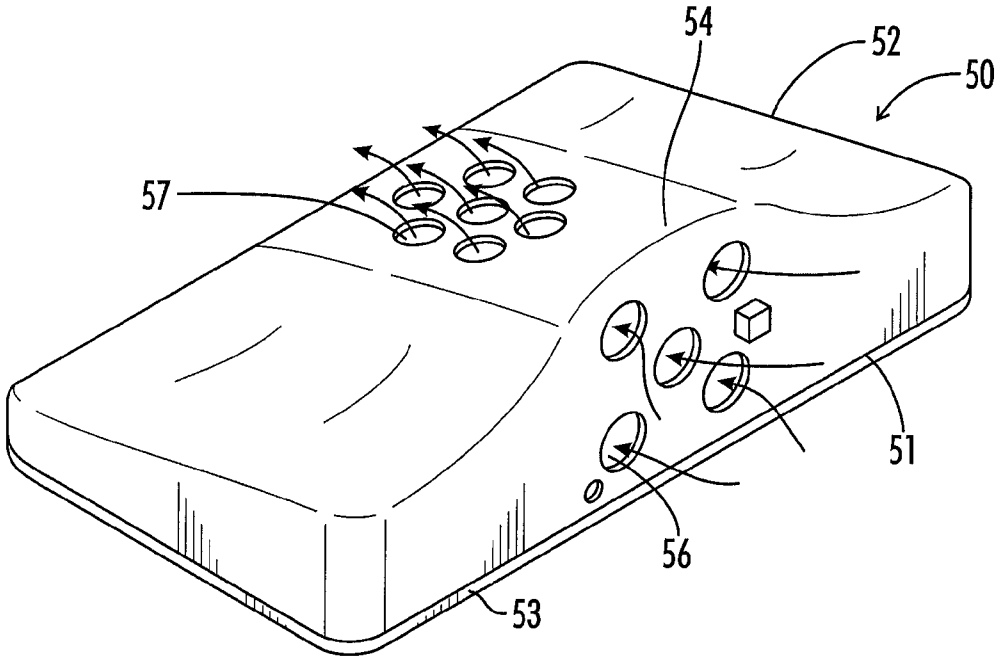


FIG. 5

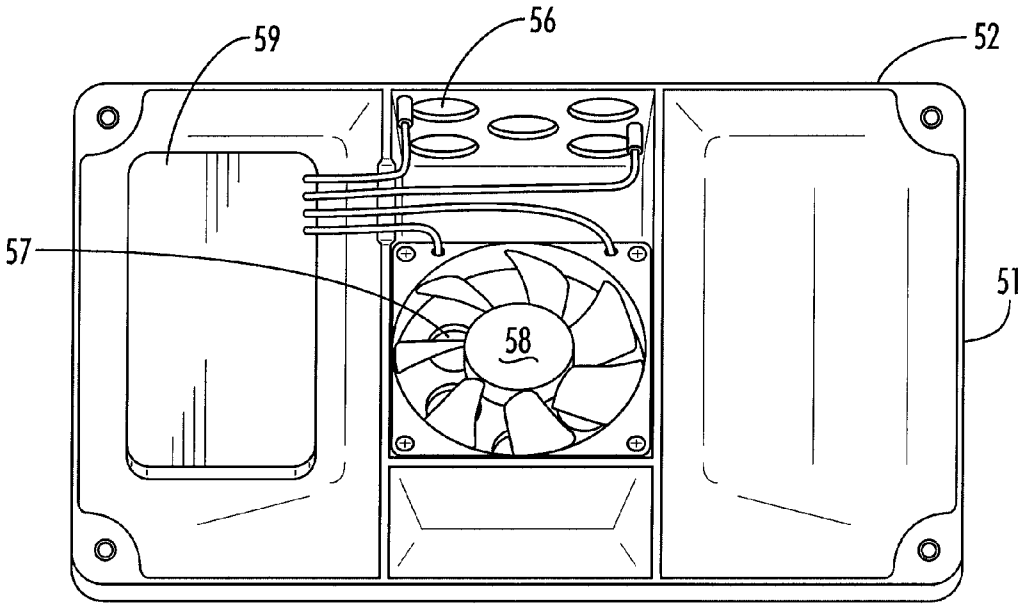


FIG. 6

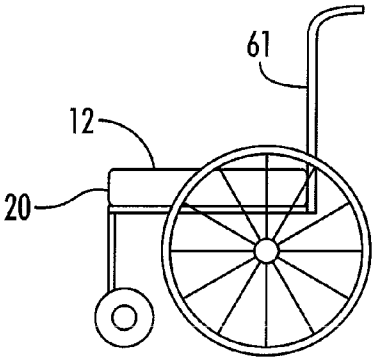


FIG. 7

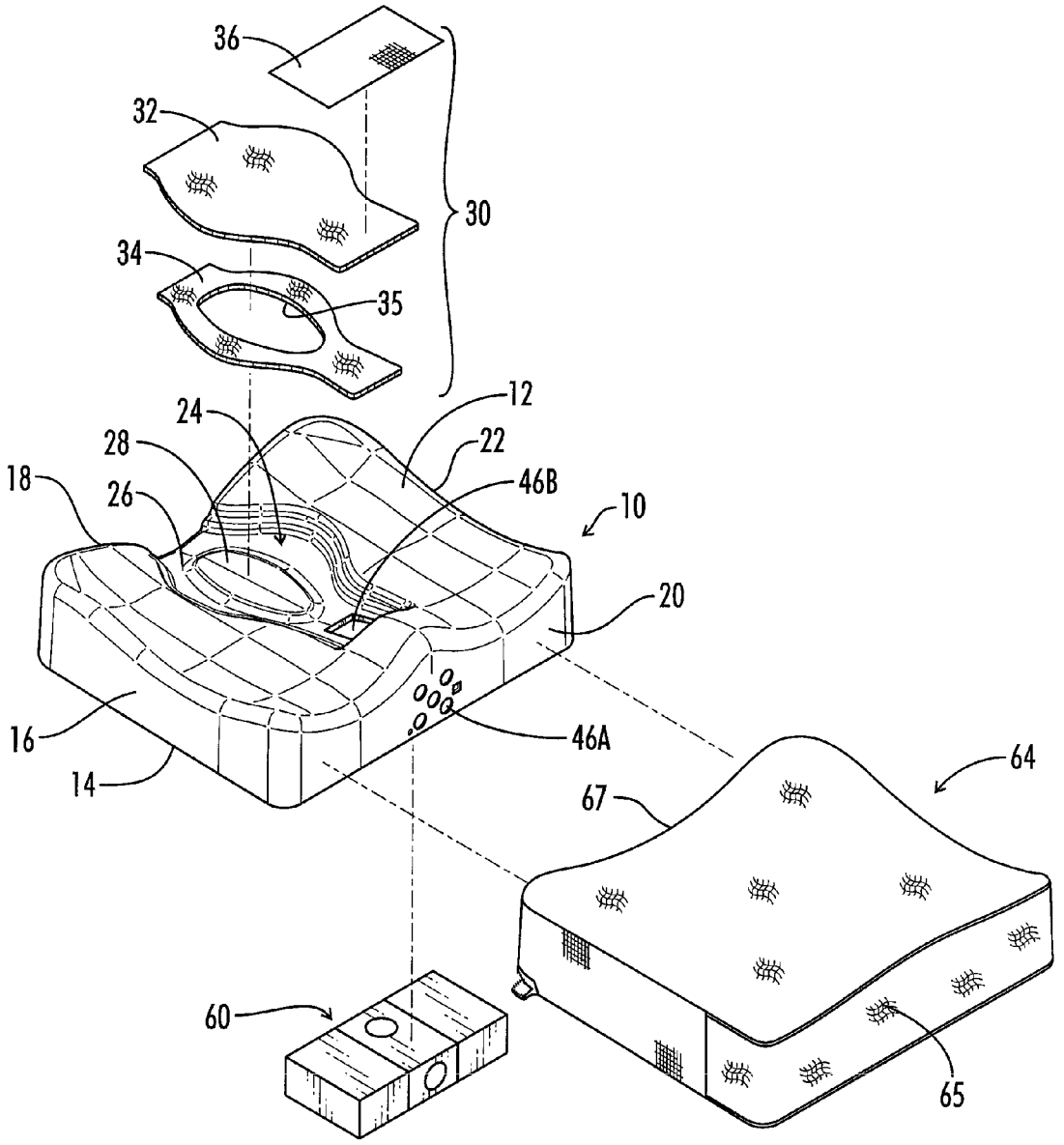


FIG. 8

AIR CONDITIONING CUSHION FOR WHEELCHAIR

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application is based on U.S. Provisional Patent Application Ser. No. 60/816,834, filed Jun. 27, 2006, and claims priority based on the earlier filed provisional patent application, the entire disclosure of which is incorporated herein by reference.

BACKGROUND

[0002] 1. Field of the Invention

[0003] This invention relates to a seat cushion; more specifically, a seat cushion that may be used in a wheelchair to drain incontinence fluid and deliver conditioned air to the skin of the user.

[0004] 2. Description of the Prior Art

[0005] U.S. Pat. No. 4,923,248 teaches a cooled seat cushion having a bottom and a back. Both the bottom and the back have a series of air passageways forming a plenum. This plenum is fed air from a Peltier unit which is attached to a DC power source, preferably a cigarette lighter in a car. The air passageways of the plenum are constructed of wound metallic coils; the passageways crisscross throughout the interior of both the seat bottom and back. The Peltier unit feeds the plenum air at the seat cushion's bottom, between the user's legs, or at the juncture between the bottom and the back, where it traverses the seat cushion and exits at the top of the seat back. The chilled air, in traversing the plenum, cools the seat cushion.

[0006] Seat constructions having a recessed region allowing incontinence fluids from a user to drain off are common to the field. Additionally, augmenting user comfort with an additional cushion in a chair is also common in the field.

[0007] However, the above described systems suffer from the drawbacks of an inability to combine functions of cooling and handling incontinence material, and utilization of an insufficient and weak cooling system; thus there is a need for a seat cushion that can convectively cool the skin of a user, receive and remove the byproducts of incontinence, and provide additional, comfortable support.

SUMMARY OF THE INVENTION

[0008] The present invention is directed to a seat cushion that delivers air to a user and removes moisture. In one embodiment of the invention, an indentation is formed into the center of the top of a foam pad and an air channel is formed through the foam pad, communicating between one of the sides of the foam pad and the indentation. In the air channel a cavity is formed and a chamber subassembly is inserted therein. This chamber subassembly has apertures on two of the sides and serves to maintain the viability of the channel after a user compresses the foam pad. Air naturally circulates through the air channel, through the chamber assembly, and into the indentation, which is filled with a permeable mesh. This permeable mesh insert allows the air to flow freely, while maintaining a comfortable level of support for the user, with the added benefit of allowing incontinence liquid to flow out through the insert drain through the indentation.

[0009] In another embodiment, the same configuration is used, except that the chamber subassembly includes an air circulating device, such as a fan, which forces room-temperature air into the indentation. In a third embodiment, an air conditioner or air cooling unit is integrated into the foam pad, in conjunction with the fan, with both preferably mounted inside the foam pad so that the air channel receives air conditioned by the air conditioner and distributes it into the indentation.

[0010] It is an object of this invention to augment the comfort and support of one sitting, especially one sitting for prolonged period in a wheelchair.

[0011] It is further an object of this invention to drain incontinence fluid released from a body of a user to avoid unsanitary and moist conditions on the skin of the user and to mitigate the risks of consequent skin breakdown.

[0012] It is another object of this invention to deliver conditioned air to the skin of the user to cool and dry the skin of the user to reduce the formation of skin ulcers and pressure sores.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] FIG. **1** is an exploded view of a seat cushion embodiment constructed in accordance with the present invention and including a chamber subassembly.

[0014] FIG. **2** is a perspective view of a foam pad shown in FIG. **1**.

[0015] FIG. **3** is a cross sectional view, taken along line **3-3** of FIG. **2**.

[0016] FIG. **4** is a side view of the permeable mesh, with the arrows representing the direction of the flow of air.

[0017] FIG. **5** is an elevated perspective view of the chamber subassembly shown in FIG. **1**, with the arrows representing the direction of the flow of air.

[0018] FIG. **6** is a perspective view of the bottom of the chamber subassembly with the mounting plate removed.

[0019] FIG. **7** is a perspective view of the seat cushion in a wheelchair application.

[0020] FIG. **8** is an exploded isometric view of the seat cushion embodiment that includes an integrated air conditioner.

DETAILED DESCRIPTION OF THE INVENTION

[0021] With reference to the drawings, FIG. **1** shows a seat cushion comprising a foam pad **10** formed with a metal mold; however, other molds or methods of construction could be used to achieve the shape and function of this foam pad **10**. The foam pad **10** is constructed of foam that gently compresses to comfortably support the user and is coated with a material that is substantially impervious to liquid. The foam pad **10** further has a top **12**, which is contoured to the anatomy of a user when the user is sitting on the seat cushion, a bottom **14**, a side **16**, a back side **18**, a front side **20**, and a side **22**.

[0022] Formed into the top **12** of the foam pad **10** is an indentation **24**, which, in the preferred embodiment, has a roughly concave surface **26**. However, alternatively shaped surfaces that comfortably support the user, which receive and drain incontinence fluids, will suffice. The indentation **24** is sloped away from the front side **20** and towards the back side **18**, such that fluids received into the indentation flow on the concave surface **26** towards the back side **18**, evacuating the fluids from the skin of the user. Formed in the

middle of the indentation **24**, protruding up from the concave surface **26**, is a support protrusion **28**.

[0023] An insert **30** having an outer layer **32**, inner layer **34**, and an air barrier **36**, fills the indentation **24**. The inner layer **34** has an opening **35** in the middle roughly the size of the support protrusion **28**. The inner layer **34** fits snugly around the support protrusion **28** and against the concave surface **26** of the indentation **24** such that the support protrusion **28** keeps the inner layer **34** in place. This arrangement ensures that the area around the support protrusion remains a viable region through which fluid may permeate towards the back side **18**.

[0024] The outer layer **32**, which rests along the top of the support protrusion **28** and the inner layer **34**, is dimensioned roughly the same as the indentation **24**. The outer layer **32** makes a top for the indentation **24**. To maintain the ability of the indentation **24** to receive incontinence fluid and circulate air, the outer layer **32** and the inner layer **34** of the insert are comprised of permeable mesh **38**, illustrated in FIG. **4**. The permeable mesh **38** has a first hide **40**, a second hide **42**, and a multiplicity of resilient fibers **44** in between that bias the first hide **40** and the second hide **42** apart. When in use, the fibers resiliently compress. Thus, when the permeable mesh **38** is compressed, the fibers **44** flex and provide a force to oppose the compression. There is space between the fibers **44** so that even when the fibers **44** are compressed, the space between them remains vacant, allowing air and fluid to permeate through in all directions. These fibers **44** also add stiffness to the insert **30**.

[0025] Constructing the insert **30** with the permeable mesh **38** ensures that the insert **30** provides support for the user in the indentation **24**, but does not become a sponge that holds the incontinence fluid and blocks air circulation. Instead, the permeable mesh **38** of the insert **30** allows the incontinence fluids to flow between the fibers **44** along the concave surface **26**, towards back side **18**, while not significantly impeding air circulation in the indentation **24**.

[0026] FIG. **3** exposes the interior of the foam pad **10** in a cross-section view, along line **3-3** from FIG. **2**. As shown in FIG. **3**, an air channel **46** is formed into the foam pad **10**. The air channel **46** has entrance holes **46**A formed into the front side **20** of the foam pad **10** and an exit **46**B formed into the concave surface **26** of the indentation **24**. Intersecting the air channel **46** is a cavity **48**. The cavity **48** is formed into the bottom **14** of the foam pad **10**; however, in alternative embodiments, the cavity **48** may be formed in one of the sides **16**, **18**, **20**, or **22**.

[0027] A chamber subassembly **50**, as shown in FIG. **1**, fits snugly inside the cavity **48**. The chamber subassembly **50**, as shown in FIG. **5**, has a preferably substantially rectangular base **51**, though alternative shapes are contemplated. The chamber subassembly **50** also includes a shell **52** preferably made of a sturdy but slightly flexible material such as certain plastics, thermoplastic olefins, or other composite materials, and a mounting plate **53** that fits on the rectangular base **51**. The mounting plate **53** attaches to the bottom **12** of the foam pad **10**, shown in FIG. **1**, holding the chamber subassembly **50** in place in the cavity **48** (the cavity **48** is shown in FIG. **3**). The shell **52** is shaped to have a bulge **54**, and there are apertures in the shell **52** on both sides of the bulge **54**. These are the intake apertures **56** and the outlet apertures **57**. The sturdiness of the plastic shell **52** ensures that neither the cavity **48** nor the air channel **46** collapse when a user sits on the foam pad **10**, while the shape of the shell **52** allows the top **12** of the foam pad **10** to remain shaped to the anatomy of the user when the user is seated on the seat cushion.

[0028] As shown in FIG. **6**, in one embodiment a fan **58** is mounted inside the shell **52** and powered by a battery pack **59** so that the fan **58** pulls air through the intake apertures **56** and pushes it out the outlet apertures **57**. Other embodiments may not require the addition of the fan **58**, relying on natural convection of air through the shell **52**, or an external method of pushing air through the chamber subassembly **50**.

[0029] The intake apertures **56** and outlet apertures **57** on the shell **52** of the chamber subassembly **50** are aligned with the air channel **46** and secured in place with the mounting plate **53**. The chamber subassembly **50** is inserted into the bottom **14** of the foam pad **10** as shown in FIG. **1**. The air, once pushed through the outlet apertures **56**, travels to the exit of the air channel **46**B. The stream of air then, instead of flowing as a condensed stream into the user, collides with the air barrier **36**, thus disbursing the air in the indentation **24**, throughout the insert **30**.

[0030] The majority of wheelchair use is done in-doors, where the air temperature and humidity are controlled by the building's air conditioning unit. The chamber subassembly **50**, when installed into the cavity **48** as depicted in FIG. **1**, delivers this conditioned ambient air to the skin of the user. Thus the relatively low humidity and low temperature ambient air is delivered to the indentation **24** to ventilate the skin of the user, convecting heat away and evaporating moisture. This promotes cool dry skin conditions adverse to the formation of skin ulcers.

[0031] Further, an air conditioner **60** may be used in addition to, or instead of, the chamber subassembly **50** as shown in FIG. **8**. The air conditioner **60** is described in U.S. Pat. No. 6,240,742, the details of which are incorporated herein by reference. The air conditioner **60** employs a method of evaporating and condensing a fluid to chill, with the option to heat, a fin arrangement (not shown) across which air is forced which is located in the path to the skin of the user; however, unlike other air chillers, this air conditioner **60** is small enough to be mounted inside the foam pad **10**. Further, the air conditioner **60** functions utilizing evaporative cooling between sealed low pressure chambers, combined with absorptive air pressure reduction technology, and thus does not require a bulky or heavy battery. It merely requires enough battery power to control the operation of a valve.

[0032] In the preferred embodiment, the air conditioner **60** fits snugly in the cavity **48**. Thus the air conditioner **60** chills or, if desirable, heats air, which then flows to the indentation **24** where it collides with the air barrier **36**, which disburses it throughout the insert **30**. At night, or when the seat cushion is not in use, the air conditioner **60** may be removed to recharge its evaporative cooling system (not shown).

[0033] As shown in FIG. **1**, a cover **64** envelops or fits over at least a portion of the foam pad **10** and preferably covers all of the foam pad **10**. The cover **64** is partially constructed of the permeable mesh **38**, illustrated in FIG. **4**. When the user sits on the cushion, the permeable mesh **38** of the cover **64** compresses, but remains air and liquid permeable because the multiplicity of resilient fibers **44** between the first hide **40** and the second hide **42** flex and exert reactionary force. Further, these fibers **44** add a pressure redistribution function to the cover **64**, increasing the support provided to the user. In one embodiment, the permeable mesh **38** comprises a side **65** of the cover **64**, which

fits over the back side **18** of the foam pad **10**, for allowing air to ventilate the indentation **24**. In other embodiments, the permeable mesh **38** could also comprise a portion **67** of the cover **64** over the front side **20** of the foam pad **10**, to allow increased flow of air to the chamber subassembly **50** or the air conditioner **60**; the permeable mesh **38** could also comprise the cover **64** in its entirety. Areas of the cover **64** not comprised of the permeable mesh **38** are preferably made of a breathable fabric suitable for comfortably supporting a user.

[0034] Thus, the cover **64** allows air to circulate into the air channel **46** into the chamber subassembly **50**, and/or air conditioner **60**, depending on the embodiment, and throughout the indentation **24**. Further, even when compressed by a user, the permeable mesh **38** of the cover **64** remains liquid permeable, allowing incontinence fluid flowing from out of the indentation **24** to traverse the cover and be evacuated from the seat cushion.

[0035] Illustrated in FIG. **7**, the preferred application of this seat cushion is in a wheelchair, to increase the health and welfare of a prolonged, continuous user.

[0036] Thus it is seen that the apparatus of the present invention readily achieves the ends and advantages mentioned, as well as those inherent therein. While certain preferred embodiments of the invention have been illustrated and described for purposes of the present disclosure, numerous changes in the arrangement and construction of parts and steps may be made by those skilled in the art, which changes are encompassed within the scope and spirit of the present invention as defined by the appended claims. Although there have been described particular embodiments of the present invention of a new and useful ventilated seat cushion, it is not intended that such references be construed as limitations upon the scope of this invention except as set forth in the appended claims.

1. A seat cushion comprising:
- a foam pad comprising a top upon which a user may sit, an opposed bottom, and a plurality of sides extending between the top and bottom;
- an indentation in the top of the foam pad and having a substantially concave surface for receiving incontinence fluid and circulating air; and
- an insert fitting in the indentation for supporting the user while the user sits on the seat cushion and allowing incontinence fluid to flow to the concave surface of the indentation.

2. The seat cushion of claim **1**, wherein the insert comprises a permeable mesh.

3. The seat cushion of claim **2**, wherein the permeable mesh comprises:
- a first hide;
- a second hide; and
- a multiplicity of fibers between the first hide and the second hide, so that the fibers resiliently compress between the first hide and second hide when the user sits on the seat cushion.

4. The seat cushion of claim **1**, wherein the foam pad further comprises:
- a support protrusion defined in the foam pad, located on the concave surface of the indentation, for supporting the insert.

5. The seat cushion of claim **4**, wherein the insert further comprises
- an outer layer supported by the support protrusion; and
- an inner layer attached to the outer layer, fitting between the outer layer and the concave surface of the indentation, and disposed about the support protrusion, for maintaining air circulation and reception of incontinence fluid in the indentation.

6. The seat cushion of claim **5**, wherein the insert further comprises a permeable mesh.

7. (canceled)

8. The seat cushion of claim **1**, further comprising:
- an air channel defined in the foam pad, having a first end communicated with the indentation, and a second end communicated with at least one of the plurality of sides.

9. The seat cushion of claim **8**, further comprising:
- a cavity defined in the foam pad, intersecting the air channel.

10. (canceled)

11. The seat cushion of claim **9**, further comprising:
- a chamber subassembly located in the cavity, the chamber subassembly comprising a shell having a plurality of apertures aligned with the air channel.

12. The seat cushion of claim **11**, wherein the chamber subassembly further comprises:
- a fan attached to the shell, for forcing air through the apertures.

13. The seat cushion of claim **11** further comprising:
- an air barrier attached to the insert where the air channel communicates with the indentation, for disbursing the air that comes through the air channel.

14. The seat cushion of claim **11**, further comprising:
- an air cooling unit comprising an outlet operationally connected to the chamber subassembly, for providing cooled air to the chamber subassembly.

15. The seat cushion of claim **1** further comprising:
- a cover fitting over at least a portion of the foam pad, the cover comprising a permeable mesh, for protecting the foam pad and allowing air and fluid to enter and exit the indentation.

16. The seat cushion of claim **15**, wherein the permeable mesh comprises:
- a first hide;
- a second hide; and
- a multiplicity of fibers located between the first hide and the second hide, so that the fibers resiliently bias the first hide and second hide apart for enhancing ventilation.

17. The seat cushion of claim **1** further comprising an air conditioner operatively attached to the foam pad to circulate conditioned air about at least a portion of the user who sits on the seat cushion.

18. An apparatus for ventilating a seat cushion, the apparatus comprising
- a shell having a plurality of apertures; and
- a fan operatively positioned inside the shell for forcing air through the apertures and throughout at least a portion of the seat cushion.

19. The apparatus of claim **18** further comprising
- an air cooling unit comprising an air outlet operationally connected to the shell for cooling the air the fan forces throughout at least a portion of the seat cushion.

20. A seat cushion for use with a wheelchair comprising:
- a foam pad having a top contoured to the anatomy of a user when the user is sitting on the foam pad, an opposed bottom, and a plurality of sides connecting the top and the bottom; and

an air circulating device integrated into at least a portion of the foam pad to circulate air to at least a portion of a user, when the user sits on the foam pad; and

an indentation comprising a surface defined in the foam pad for receiving incontinence fluids from the user and receiving air from the air circulating device.

21. (canceled)

22. The seat cushion of claim **20** further comprising:

an insert fitting in the indentation for supporting the user while allowing incontinence fluid to flow to the indentation.

23. (canceled)

24. The seat cushion of claim **22**, wherein the insert further comprises:

a mesh outer layer; and

a mesh inner layer attached to the mesh outer layer and fitting between the mesh outer layer and the surface of the indentation, the mesh inner layer being disposed about the support protrusion, for maintaining air circulation and reception of incontinence fluid in the indentation.

25. The seat cushion of claim **24** further comprising:

an air channel defined in the foam pad, having a first end in communication with the indentation and a second end in communication with at least one of the plurality of sides.

26. The seat cushion of claim **25** further comprising:

an air barrier attached to the mesh outer layer of the insert where the air channel communicates with the indentation, for disbursing the air received through the air channel; and

a cavity defined in the foam pad, having a mouth opening into the foam pad and formed such that air channel is in communication with the cavity, wherein the air circulating device is located in the cavity.

27. (canceled)

28. (canceled)

29. The seat cushion of claim **20**, wherein the air circulating device comprises a fan.

30. The seat cushion of claim **20**, wherein the air circulating device comprises an air conditioner.

31. The seat cushion of claim **20** further comprising:

a permeable mesh cover fitting over at least a portion of the foam pad.

32. (canceled)

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