United States Patent

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[54] **THERMALLY CONDUCTIVE SURGICAL DRESSING**
10 Claims, 11 Drawing Figs.

[52] **U.S. Cl.** **128/156,** 128/82.1, 128/268, 161/95
[51] **Int. Cl.** **A61l 15/00**
[50] **Field of Search** 128/155, 156, 284, 290, 296, 416, 268, 82.1; 161/93, 95

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ABSTRACT: Surgical dressings comprising a combination of conventional cotton gauze materials and thermally conductive elements interwoven or impregnated in the cotton gauze materials to provide a surgical dressing having an adequately high degree of absorbency and excellent thermal conductivity to facilitate cooling or heat treatment to body areas while bandaged.

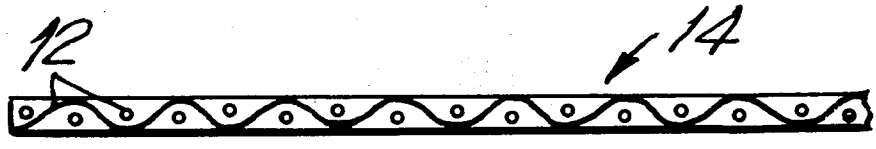


FIG. 1

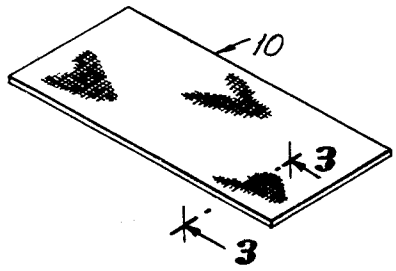


FIG. 3

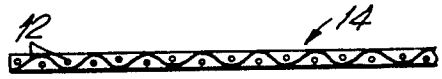


FIG. 5

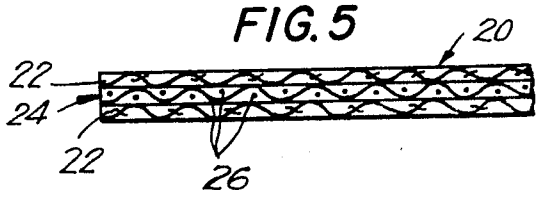


FIG. II

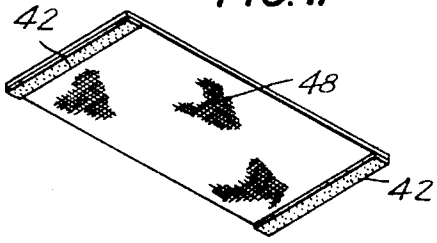


FIG. 8

FIG. 10

FIG. 2

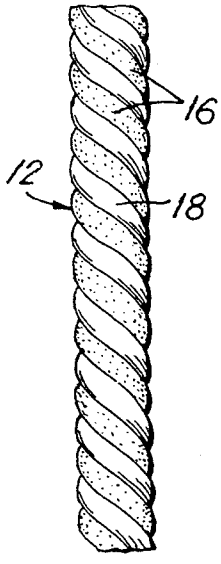


FIG. 4

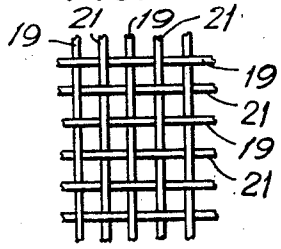


FIG. 6

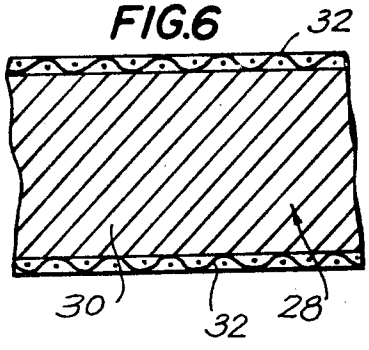


FIG. 7

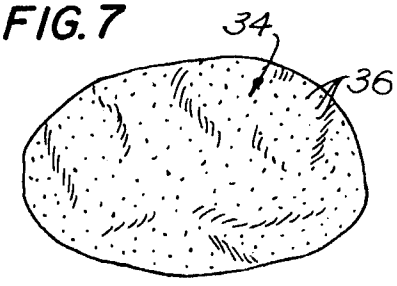
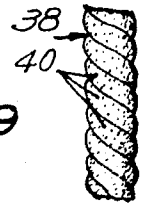


FIG. 9



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THERMALLY CONDUCTIVE SURGICAL DRESSING

The present invention relates to surgical dressings and more particularly to thermally conductive surgical dressings.

Presently known surgical dressing materials include cotton gauze strips, bandages, pads and cotton balls. The primary functions of such presently employed dressings are to provide sterile protection to the applied area and/or to absorb any fluids at the area of the wound or incision. In some cases the dressings provide a protective cushion to the affected area to minimize aggravation or pain which would otherwise be caused by pressure on the wound.

Although the aforementioned presently employed surgical dressings have been found satisfactory for the above purposes, in many instances, because of the inherent nature of the dressing materials, the aforementioned conventional dressings prevent the removal of heat from particular body areas, during surgical procedures and during the postoperative period. This is so because the aforementioned surgical dressings act as thermal insulators because the cotton material is itself a very poor conductor of heat and furthermore, because the small air pockets formed between the cotton threads of such dressings are excellent thermal insulators. In fact, materials very similar to the conventional surgical cotton padding is expressly employed for the purpose of providing thermal insulation in clothing.

Many instances of medical treatment require the direct application of cooling packs or instruments to specific body areas for purposes such as reduction of pain, retarding swelling or edema due to injury, and to check bleeding. Clearly, since the conventional surgical dressings are poor thermal conductors, where the affected body area must be bandaged, the transmission of heat from the body area is very slow and inefficient.

Conversely, in those instances where it is desirable to apply heat to a body area that must remain bandaged, it is very difficult to transmit heat efficiently and evenly through the bandages and to the desired body area due to the poor thermal transfer characteristics of such conventional surgical dressing materials.

In cases of patients with high fevers, it is common medical practice to apply a cold thermal pad or blanket to the patient's body in order to reduce the patient's temperature. In such cases, because of the thermal barrier presented by conventional sheets or common sterile materials, the thermal blanket is applied directly to the patient's body causing the thermal blanket itself to become soiled during this treatment. Accordingly, before use by another patient, the thermal blanket must be laundered and sterilized, a procedure which is time consuming and costly.

Furthermore, in the case of hydrotherapy treatments, since the patient must be in a disrobed condition for efficient application of cold, in order to maintain privacy the hydrotherapy apparatus is usable only in the presence of one patient at a time.

It is therefore an object of the present invention to provide a disposable surgical dressing having highly improved thermal conduction characteristics.

Another object of the present invention is the provision of a surgical dressing of the character described which provides an even distribution of heat transfer over the area thereof in contact with the body area.

In accordance with the principles of the present invention, there is provided a surgical dressing comprising high-absorbency fibrous material in combination with thermally conductive elements distributed throughout said fibrous material to provide a surgical dressing having a high absorbency and uniformly high thermal conductivity.

Additional objects and advantages of the present invention will become apparent during the course of the following specification when taken in connection with the accompanying drawings in which:

FIG. 1 is a perspective view of a surgical dressing pad made in accordance with the present invention.

FIG. 2 is an enlarged plan view of a single strand of yarn for making up the dressing pad of FIG. 1, comprising a fiber strand spun together with a thermally conductive metallic thread.

FIG. 3 is a sectional view taken along the line 3–3 of FIG. 1 showing a dressing pad made up of the yarn shown in FIG. 2.

FIG. 4 is an enlarged view of a modified form of dressing pad according to the present invention comprising alternate strands of metallic wire and fiber respectively interwoven to form a gauze pad.

FIG. 5 is a sectional view of another modified form of dressing pad in accordance with the present invention comprising a layer of thermally conductive metal gauze sandwiched between two layers of cotton gauze.

FIG. 6 is a sectional view of still another form of dressing pad in accordance with the present invention, comprising a thick wad of absorbent cotton having a thermally conductive metallic wire gauze layer on the top and bottom surfaces thereof.

FIG. 7 is a perspective view of an absorbent cotton ball impregnated with thermally conductive metallic particles in accordance with the present invention.

FIG. 8 is a sectional view of a dressing pad similar to that of FIG. 1, but comprising cotton gauze impregnated with thermally conductive metallic particles.

FIG. 9 is an enlarged plan view of an alternate type of yarn which may be used for making up the dressing pad of FIG. 1, the yarn comprising a plurality of fiber strands impregnated with thermally conductive metallic particles.

FIG. 10 is a sectional view through a strip of adhesive tape impregnated with thermally conductive metallic particles, and

FIG. 11 is a perspective view of a dressing pad similar to that of FIG. 1, but provided with strips of adhesive at opposite ends thereof to provide a self-retaining bandage.

Referring in detail to the drawings, and in particular to FIG. 1 thereof, there is shown a surgical dressing pad **10** made in accordance with the present invention, for application to the body area of a patient to provide even and efficient thermal transfer to and from the selected body area. As will hereinafter become clear, dressing pad **10** may comprise various combinations of conventional fibers such as cotton which provides the required absorbency, and fine metallic wire which provides thermal conductivity in order to facilitate the conduction of heat to or from the body area. Dressing pad **10** may comprise various combinations of cotton material and thermally conductive elements.

Referring to FIGS. **2** and **3**, in one embodiment, dressing pad **10** comprises yarns **12** cross-woven in the conventional pattern to form a gauze layer **14**, with each yarn **12** comprising at least one strand **16** of fiber material spun together with at least one strand of fine metallic wire **18**. FIG. **2** shows the intertwisting of one strand of fiber with one strand of metallic wire, however, it is understood that various combinations of different number of fiber strands **16** and metallic strands **18** may be spun together to form a yarn **12**, depending on the degree of absorbency and thermal conductivity desired in the dressing pad **14** to be formed thereby. In practice, pad **10** will usually comprise a plurality of gauze layers **14** in order to provide sufficient absorbency and/or cushion effect as needed.

Referring to FIG. **5**, in another embodiment of the present invention, a surgical dressing pad **20** in accordance with the present invention may comprise a pair of layers **22** of conventional fiber gauze having sandwiched therebetween at least one layer **24** of gauze made up of interwoven strands of fine metal wire **26**. It is understood that although FIG. **4** shows a single metallic layer **24** between two fiber layers **22**, it is understood that pad **20** may comprise various numbers of alternate layers **22** and **24** depending on the degree of absorbency and thermal conductivity desired in pad **20**.

In another embodiment of the present invention, as shown in FIG. **6**, a surgical dressing **28** may comprise a thick wad **30** of absorbent cotton having a layer **32** of metallic gauze on the top and bottom surfaces of the wad **30** for use in those cases where a high degree of absorbency is required while providing

greatly improved thermal conductivity characteristics over the conventional cotton wad.

Conventional cotton wadding such as in the form of balls are excellent means for absorbing body secretions and for serving to protect a wound area from impact or further injury. However, such known cotton balls serve to thermally insulate the body area to which they are applied, a condition which in some instances, as pointed out above, is deleterious to rapid healing of the wound and which interferes with treatment involving removal of heat from the affected area. Keeping in mind that in such cases, the wound must be dressed with high-absorbency bandages, in another embodiment of the present invention, as shown in FIG. 7, a wad of absorbent cotton in the form of a ball **34** is impregnated with thermally conductive metallic particles **36**. In this way, the thermally conductive metallic particles **36** serve to provide a thermal conduction path through cotton ball **34** to improve the thermal conductivity thereof while essentially maintaining its high-absorbency characteristics. In a similar fashion as shown in FIG. **8**, a cotton gauze pad **35** may be impregnated with thermally conductive metallic particles **37**.

The above-described principle of the present invention, i.e. impregnation of conventional absorbent cotton dressings with highly conductive particles to improve the thermal conductivity thereof, is implemented in yet another embodiment of the present invention, by impregnating individual cotton yarns **38** with thermally conductive particles **40** as depicted in FIG. **9**. The impregnated yarn **38** may be interwoven to form layers of gauze in the manner shown in FIG. **3**, and may be combined with other layers, for example with layers of gauze comprising either pure cotton such as layers **22** in FIG. **5**, or with layers of wire gauze such as the layers **24** in FIG. **5**, to provide a dressing having the desired degree of absorbency and heat transfer characteristics.

It is understood that in many cases, surgical dressings must be secured by means of adhesive tape or the like. However, conventional adhesive tapes used for such purposes have very poor heat transfer properties and serve to aggravate the problem of heat transfer to and from the body area. Accordingly, in a further embodiment of the present invention shown in FIG. **10**, there is provided a strip of adhesive tape **42** having fine thermally conductive metallic particles **44** impregnated therein. Such thermally conductive particles **44** do not materially interfere with the adhesive action of tape **42** yet provide improved thermal conduction through the tape **42**, and accordingly when the tape is used in conjunction with any of the other dressings of the present invention described above, it substantially improves and facilitates heat transfer to and from the body area during the course of heat or refrigeration treatment. By way of example, as shown in FIG. **11**, narrow strips of such thermally conductive adhesive tape **42** may be secured to opposite edges of a dressing pad **48** constructed in accordance with any of the embodiments of the present invention described herein.

In another embodiment of the dressing pad **10**, as shown in FIG. **4**, each gauze layer **14** may comprise alternate strands of fiber **19**, such as cotton, and fine metal wire **21** which strands are interwoven to form gauze layer **14** which retains an adequate measure of absorbency due to fiber strands **19** while providing a greatly increased thermal conductivity due to the high thermal conductivity of metallic strands **21**. Furthermore, the cross weave configurations of strands **19** and **21** insures an even thermal distribution throughout gauze layer **14**. Again it is understood that in many instances several layers of gauze **14** may be suitably arranged in a stack to form a pad **10** of suitable absorbency and thermal conductivity.

Further, the thermally conductive gauze materials described hereinabove in the form of sheet material, may be utilized to make various articles of clothing, such as gloves, pajamas, etc. to be worn by a patient undergoing physical therapy treatment such as hydrotherapy. In this way, the patient may be suitably covered or dressed with thermally conductive, absorbent, sterile and disposable individually available dressings thereby avoiding the awkwardness or embarrassment of exposure which would otherwise obtain as in the case of group hydrotherapy where several patients are present.

While preferred embodiments of the invention have been shown and described herein, it is obvious that numerous omissions, changes and additions may be made in such embodiments without departing from the spirit and scope of the invention.

What I claim is:

1. A thermally conductive surgical dressing comprising a body of fibrous material having high liquid absorbency, said body having a first surface and a second surface, a plurality of thermally conductive elements distributed throughout said high-absorbency fibrous material between said surfaces, said thermally conductive elements being arranged to establish a heat conductive path through said body between the inner and outer surfaces thereof, to thereby provide a surgical dressing having a high liquid absorbency and uniformly high thermal conductivity.

2. A surgical dressing according to claim **1** which includes yarns interwoven to form a layer of gauze, wherein each of said yarns comprises at least one strand of highly absorbent fibrous material and at least one strand of a high thermally conductive metal spun together to form said yarns.

3. A surgical dressing according to claim **1** which includes a least one layer of gauze formed of alternately interwoven yarns of highly absorbent fibrous material and yarns of thermally conductive fine metallic strands.

4. A surgical dressing according to claim **1** which includes at least one layer of gauze formed of interwoven fibrous yarns having a high degree of absorbency, and particles of thermally conductive particles impregnated in said yarns.

5. A surgical dressing according to claim **1** which includes alternate layers of thermally conductive fine wire mesh gauze and absorbent fibrous gauze.

6. A surgical dressing according to claim **1** which includes a wad of highly absorbent fibrous material impregnated with thermally conductive metallic particles.

7. A surgical dressing according to claim **1** which includes at least one adhesive strip secured to said surgical dressing, said adhesive strip including thermally conductive metallic particles impregnated therein.

8. A surgical dressing according to claim **1** which includes a thick layer of highly absorbent fibrous material and at least one layer of thermally conductive metallic gauze on each of the top and bottom surfaces of said layer of fibrous material.

9. A surgical dressing according to claim **1** wherein said fibrous material comprises cotton.

10. An article of clothing formed of the material comprising surgical dressing according to claim **1**.