United States Patent

[11] **3,587,583**

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[54] **SURGICAL SPONGE WITH MAGNETIZED MEANS**
8 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **128/296**
[51] **Int. Cl.** **A61f 13/00**
[50] **Field of Search** 128/296

[56] **References Cited**

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ABSTRACT: A surgical sponge having magnetized means associated therewith, preferably in the form of a flexible thread having magnetized particles therein, which is readily detectable during a checkout procedure prior to the termination of surgery. The checkout procedure employs a means for detecting and locating the sponge by its magnetized means as well as surgical instruments which have a magnetized material embedded therein, and which detection means may be interconnected with a recording apparatus so that a permanent record of the checkout may be retained.

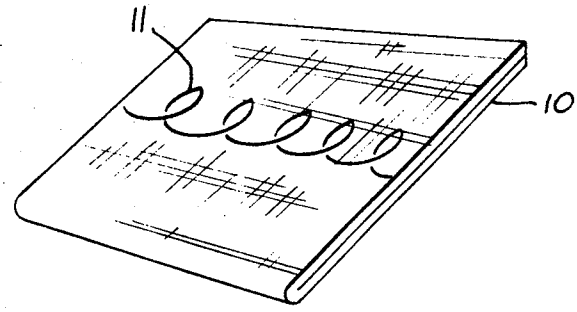


Fig. 1.

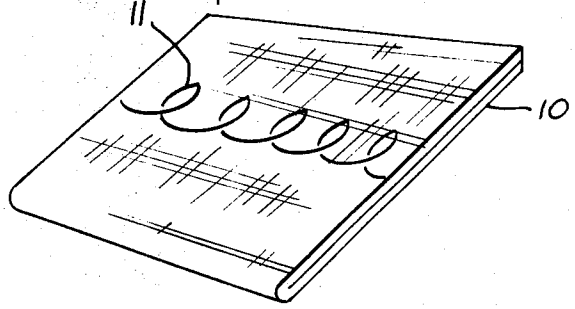


Fig. 2.

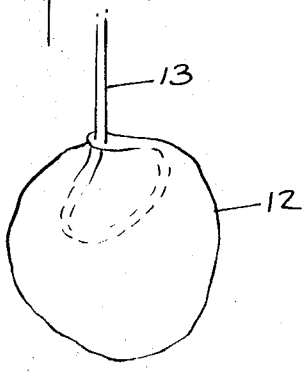


Fig. 3.

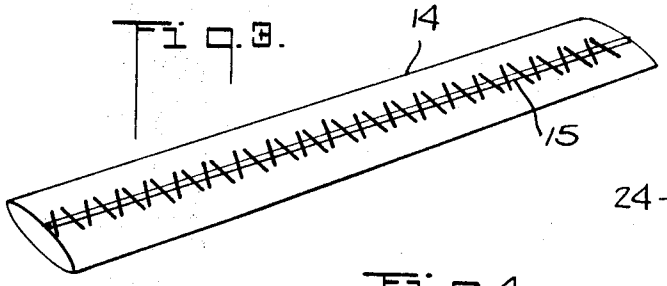


Fig. 6.

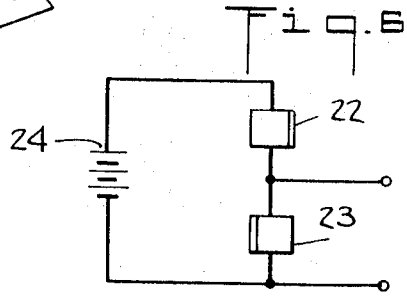
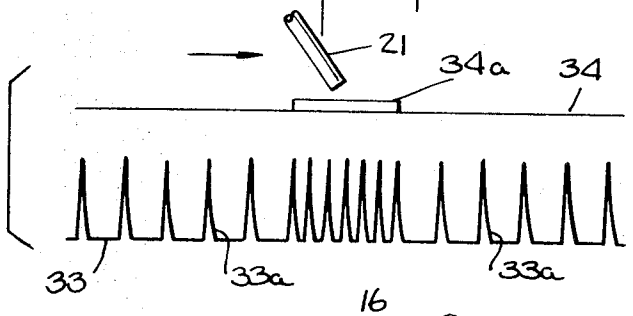


Fig. 4.



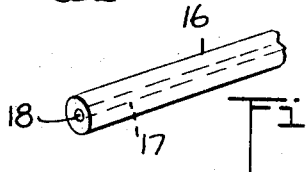


Fig. 7.

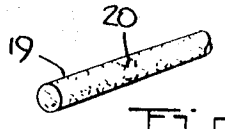


Fig. 8.

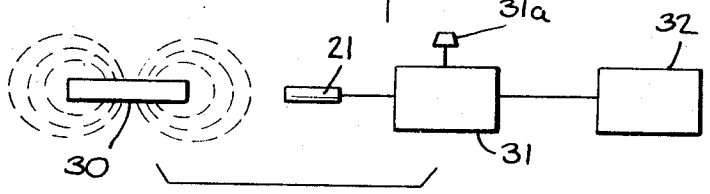


Fig. 5.

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SURGICAL SPONGE WITH MAGNETIZED MEANS

BACKGROUND OF THE INVENTION

This invention relates generally to surgical sponges, and more particularly to one containing an amount of magnetized material which is readily detected by a magnetic detection means during a surgical checkout procedure.

Once a surgical operation on a patient has been completed, but prior to closing the incision, in order to insure that foreign objects are not left within the surgical cavity, the surgeon and other personnel generally perform a count of the sponges and instruments utilized during the operation. Such a manual count has, from time to time, been erroneous, with the consequence that the incision may be closed and the patient may leave the operating room having a foreign object left within the surgical cavity. This manual counting procedure is particularly disadvantageous because of the danger that human error may occur, and also because of the time consumed by the counting procedure while the patient must remain in the operating room with the incision still open. Manual counting is further complicated in that the sponges utilized are of varying sizes and difficult to locate since they have absorbed body fluids and are not readily identified.

In order to improve upon the manual counting procedure, it has been proposed that a radio opaque material be inserted or attached to the sponge so that it may be located once the surgery has been completed. During the postsurgical checkout, a manual count is again performed and, if one or more of the sponges have not been recovered, the surgeon then closes the incision and the patient is removed for an X-ray examination. This X-ray examination is generally conducted in a different part of the hospital and requires that the patient be subjected to a subsequent operation for removal of the sponge. This provides a great inconvenience and subjects the patient to an unnecessary additional surgical operation. The postsurgical X-ray examination frequently must be accomplished with the incision already closed since the nonsterile nature of the equipment would seriously increase the chance of infection if performed in the operating room while the incision is open. Another disadvantage of the radio opaque system is that, even if the X-ray examination indicates a foreign object within the patient, it is difficult and time-consuming to precisely locate the object.

It has also been proposed to employ radioactive materials within the sponge in order to alleviate the disadvantages of the manual counting and radio opaque detection methods. However, the use of radioactive materials presents serious disadvantages, particularly due to the nature of their limited shelf life and the storage problems associated therewith. Furthermore, radioactive materials present a danger both to the patient and, more particularly, to the attendants handling the material on a day-to-day basis.

More recently it has been proposed to employ a pair of tuned coils to produce an electromagnetic field which is changed when in the presence of a metallic object capable of being magnetized. The metallic object contained in the sponge produces a change in the electromagnetic field when brought into contact therewith. This type of system contains inherent limitations since numerous other metallic articles are used in the operating room, all of which interfere with the function of this type of detection system. For instance, in order to provide an electromagnetic field devoid of metal objects, this type of metal detection postsurgical checkout cannot be conducted while the patient is on a normally metal operating table, nor may the checkout be conducted in the presence of metal retractors, clamps or the like, all of which are conventional to a surgical operation. By utilization of the means disclosed herein, the deficiencies and disadvantages of the heretofore proposed systems is overcome.

SUMMARY OF THE INVENTION

Briefly stated, a surgical sponge is provided which has associated therewith magnetized particles. The sponge provides a magnetic field thereabout and, if inadvertently left within the surgical cavity, is readily detectable by probing the cavity with a magnetic detection means.

In a preferred form, the sponge is provided with a flexible magnetized thread which is of a plastic material and has embedded therein a plurality of barium ferrite particles. Alternatively, the magnetized thread may be provided with an internal or external layer of magnetized material.

Employing the principles disclosed herein, the surgical sponges used during an operation contain magnetized means associated therewith. Further, the surgical instruments may also be provided with a small amount of magnetized material associated therewith. The surgeon performs the required operation in a normal manner and, prior to closing the incision, conducts a probing of the surgical cavity. A magnetic detection means is employed which generates an electrical signal which is modified in the presence of a magnetic field. The signal may be converted into the form of an audio, visual or other like display so that the surgeon may be assured that no foreign objects are left within the patient upon completion of the probing. Once the surgeon is satisfied that no foreign objects remain, the incision may be closed and the patient removed from the operating room. No further testing for foreign objects need be conducted in areas outside the operating room.

Accordingly, it is a primary object of this invention to provide a simplified and reliable means for conducting a check for foreign objects prior to closing the incision.

It is a further object of this invention to provide a surgical sponge having a readily detectable magnetized means associated therewith.

These and other objects, advantages and features of the invention will become more apparent from the following description taken in conjunction with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a perspective view of a surgical sponge having a magnetized thread looped therethrough;

FIG. **2** is a perspective view of a surgical sponge having a length of magnetized thread tied thereto;

FIG. **3** is a perspective view of still another type of surgical sponge having a magnetized thread inserted therein;

FIG. **4** is a schematic view of the magnetic detection head being passed across a surgical sponge containing a magnetized means thereon and the type of signal thereby produced;

FIG. **5** is a schematic view of the magnetic detection and locating system;

FIG. **6** is a schematic view of the magnetodiode circuit;

FIG. **7** is a perspective view of a flexible thread having the magnetized material placed within the central core thereof; and

FIG. **8** is a perspective view of a flexible thread having magnetized particles disposed throughout the length thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to the drawings, FIGS. **1—3** illustrate some of the different types of sponges used during surgical procedures and which have attached thereto a magnetized thread. Today's surgical procedures necessitate the usage of various sizes and types of surgical sponges. In FIG. **1** is illustrated one type of a laminated gauze sponge **10**, which has the magnetized thread **11** looped therethrough so that it may readily be detected and located by means to be more fully described below. FIG. **2** illustrates a bulbous sponge **12** which has a length of detectable magnetized thread **13** looped and tied thereto. This embodiment further illustrates the manner in which the thread **13** may extend a substantial distance from the sponge to facilitate handling and recovery thereof. In FIG. **3**, an elongated absorbent sponge **14** is illustrated with the magnetized thread **15** being stitched therein.

The magnetized thread associated with each of the various types of sponges is preferably a nylon or other similar material which is both flexible and capable of carrying magnetized particles such as barium ferrite therein. These types of magnetized threads are particularly advantageous since they will withstand elevated temperatures such as exist during autoclaving and will not allow any alteration or loss of magnetic properties. In FIG. 7, the nylon thread **16** is provided with a hollow core **17** into which magnetized particles **18** may be placed. Another form of flexible thread is illustrated in FIG. 8 wherein the flexible nylon thread **19** contains a plurality of minute magnetized particles **20** embedded throughout the length thereof. Usage of these types of surgical sponges, each of which has the normal absorbent characteristics necessary to enable the absorption of body fluids, is conducted in the conventional manner. Although the preferred form of the invention includes magnetized particles within a flexible thread attached to the absorbent sponge portion, it is noted that magnetized particles or magnets in the form of inserts may otherwise be attached or impregnated into the absorbent portion and remain within the scope of the present invention.

Once the surgical procedure has been completed, the surgeon then probes the surgical cavity with a magnetic detection head. The magnetic detection head **21** preferably employs magnetodiodes connected in a manner illustrated in FIG. **6**. The magnetodiode is of the type manufactured by Sony Corporation, Tokyo, Japan, although other equivalent means may be substituted. The magnetodiodes **22** and **23** are arranged in matched pairs and have a voltage source **24** applied thereto. The magnetodiode is particularly well adapted for this system, because it only responds to the presence of a magnet and not to the presence of a metal or magnetizable unmagnetic material. In addition, the response of the magnetodiode varies directly with the strength of the magnetic field. The surgeon may then accordingly move the detector head **21** in the appropriate direction so that the sponge or other object having a magnetic field may be precisely located.

The magnetodiode is temperature sensitive and, therefore, the matched pair configuration of FIG. **6** is preferred. When a constant voltage is applied across the matched pair of magnetodiodes, the voltage potential across the center leg is substantially one-half of the applied voltage for any given temperature. Employing this configuration, as a given magnetic field is encountered, the resistance of one of the magnetodiodes will increase while that of the other will decrease thereby imbalancing the bridge circuit and producing a different signal. The magnet **30** of FIG. **5**, which is illustrative of the surgical sponge having the magnetized thread therein, provides a means for altering the signal generated by the pair of magnetodiodes within the detector head **21**. The signal generated by the magnetodiodes is of a substantially constant value until contacted by a magnetic field such as that which exists in the vicinity of the surgical sponge having the magnetized thread associated therewith. The detector head **21**, which is probed in and about the surgical cavity, generates the signal which is then amplified at **31**. Amplifier **31** further contains controls at **31***a* which are operated in conjunction therewith. The amplified signal generated by the magnetodiode is then either displayed visually or in the nature of audio signal at **32**. Audio signals may be in the form of a constant frequency with a change thereof being indicated once the probe enters the magnetic field of the surgical sponge. In one of the preferred forms, in addition to an audio signal, a visual display is provided which is recorded as illustrated in FIG. **4** at **33**, so that a permanent record of the surgical checkout may be retained. FIG. **4** indicates the detector head **21** being passed across a layer of sponge material **34** which contains a piece of magnetized material **34***a* therein. As the detector head **21** is brought closer to the magnetic field of the material **34***a*, the frequency of signals **33***a* is greatly increased and clearly indicates that the magnetized material is encountered. Each of the signals **33***a* may also be produced in an audio fashion, such as a click, thereby producing both types of signals to aid the surgeon in the probing procedure. The detection systems described herein may also readily be used to locate metallic or nonmetallic instruments which have a small amount of magnetized material attached or embedded therein.

As is readily apparent, utilization of the system described herein overcomes the deficiencies of the radio opaque, radioactive and metal detection systems of the prior art. The magnetic detection system of this invention is simple, compact, portable and may be readily utilized in the operating room prior to the closing of the incision. This eliminates the necessity of removing the patient to an external checkout room with possible additional surgery necessary to remove any subsequently located foreign objects. The system is furthermore inexpensive and may be employed in small hospitals where expensive X-ray equipment is not available. The system provides further advantage in that the magnetized particles do no emit any dangerous radioactive rays which may be detrimental to both the patient and the attendants.

Although the above description is directed to a preferred embodiment of the invention, it is noted that other variations and modifications will be readily apparent to those skilled in the art and, therefore, may be made without departing from the spirit and scope of the present disclosure.

I claim:

1. A detectable surgical sponge for use in absorbing fluids during surgical procedures which comprises a pad of absorbent surgical sponge material for absorbing the fluids, and a magnetized means attached to said sponge material, said magnetized means containing therein a sufficient quantity of magnetized material so that said sponge material and magnetized material may be readily located by a magnetic sensitive detection means.

2. A surgical sponge in accordance with claim **1** wherein said magnetized means includes a flexible thread containing therein said quantity of magnetized material.

3. A surgical sponge in accordance with claim **2** wherein said flexible thread comprises a plastic material having embedded in at least a portion thereof a plurality of magnetized particles.

4. A surgical sponge in accordance with claim **2** wherein said flexible thread is a tubular plastic material having a hollow core in the center thereof, and said magnetized material is housed in said core.

5. A method of performing a surgical procedure and conducting a surgical checkout which comprises the steps of:

a. utilizing surgical sponges having magnetized means associated therewith during the surgical procedure;
b. performing the necessary surgical procedure on the patient;
c. probing the surgical cavity with a magnetic sensitive detector upon completion of the surgical procedure and prior to the closing of the incision to determine if any surgical sponges remain therein;
d. generating a signal from the magnetic sensitive detector, said signal being adapted to be modified in the presence of a magnetic field associated with the surgical sponge having magnetized means associated therewith;
e. observing the signal to determine if any surgical sponges having magnetized means associated therewith remain within the surgical cavity; and
f. closing the incision upon completion of the aforementioned steps.

6. The method of claim **5** which includes the additional step of removing all surgical sponges from the incision prior to the closing thereof.

7. The method of claim **6** which includes the additional step of recording the signal generated by the magnetic sensitive detector so that a permanent record of the surgical checkout procedure may be retained.

8. The method of claim **5** which includes the additional step of utilizing surgical instruments which have magnetized means associated therewith.