Feb. 21, 1961 M. DEKER 2,972,350

SURGICAL SPONGE

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Fig. 1.

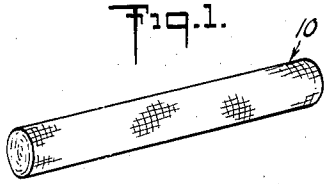


Fig. 2a.

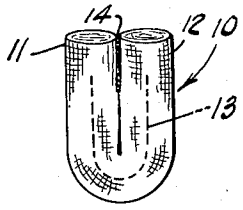


Fig. 2b.

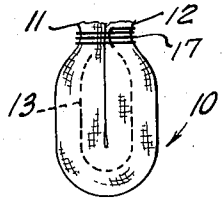


Fig. 2c.

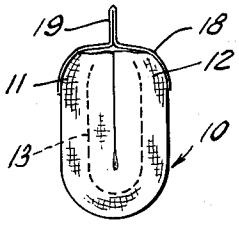


Fig. 2d.

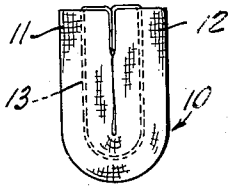


Fig. 2e.

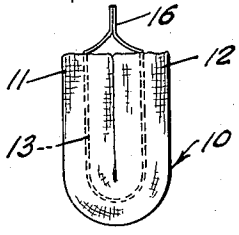


Fig. 3.

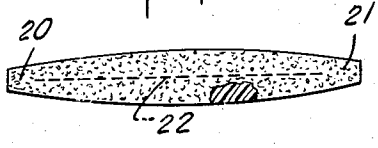
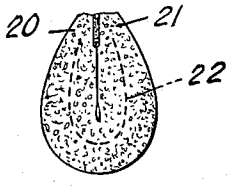


Fig. 4.



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SURGICAL SPONGE

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Fig. 6a.

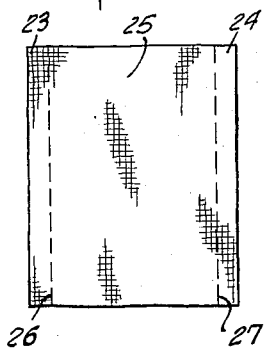


Fig. 6b.

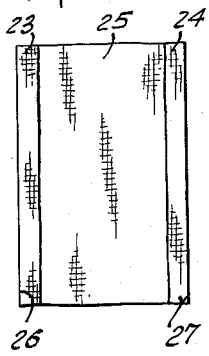


Fig. 6c.

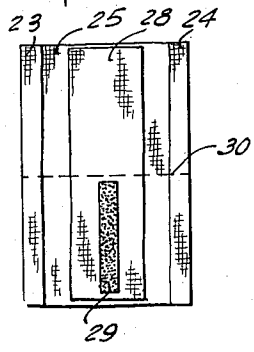


Fig. 6d.

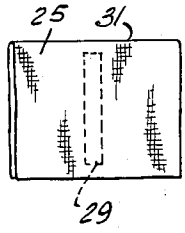


Fig. 6e.

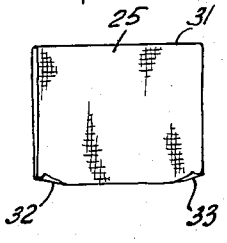


Fig. 6f.

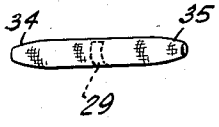


Fig. 6g.

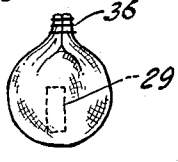
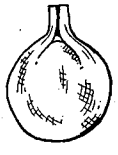


Fig. 5.



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2,972,350

SURGICAL SPONGE

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16 Claims. (Cl. 128—296)

The present invention relates to surgical sponges and more particularly to surgical sponges having a rounded contour and to a method of manufacturing the same.

In the surgical field, there is a demand for dressings adapted to be used within the body in surgical operations. These may be used for stanching the flow of blood, applying medication, separating or removing tissue, or other uses to which the surgeon may wish to put them. These dressings are generally referred to as surgical sponges.

Surgical sponges may be of various shapes and sizes. It is important, however, that the sponge contain no loose threads or fibers that may become detached from the sponge during its use.

Sponges having a rounded contour are especially useful for fitting into body cavities, the application of medication, or use as a blunt instrument for the separation of body tissues or removal, through friction, of tissue segments. For this latter use, a surgical sponge is preferred that is substantially harder and more dense than the surgical sponges used for stanching the flow of blood.

One of the objects of the present invention is to make surgical sponges of a design that can be readily adapted for the preparation of soft highly absorbent sponges or the preparation of relatively dense compact surgical sponges. A further object is to form rounded sponges of simple design so that they can be manufactured without the need of complex machinery.

These and other objects are accomplished by forming the sponge in a U-shape wherein a roll of absorbent material is first prepared and then the roll is bent on itself to bring the ends together. The ends are then secured by any suitable means, cementing, tying, stitching, etc.

The absorbent roll from which the sponges are made may be a preformed cellular rod such, for example, as rolls of synthetic cellular sponge material, such as polyurethane foam sponge, synthetic cellulose foam sponge or other preformed absorbent roll or may be specially prepared as hereinafter described.

It is generally highly desirable that surgical sponges have some X-ray opaque indicator so that the same may be readily detected if inadvertently left within the body. Although sponges are always counted both before and after an operation, the feature of X-ray detectability is very important and gives an excellent check, particularly where there may be some doubt as to the count. The sponges of the present invention are readily made X-ray detectable either by including within the roll a strip or thread of X-ray opaque material or by using an X-ray opaque cement when securing the ends of the sponge together.

In order to better understand the practice of the invention, attention is called to the drawings in which:

Figure 1 illustrates an absorbent roll or rod prior to forming into the sponge of Figure 2;

Figure 2 illustrates a sponge made from a roll of absorbent material wtih sub-figures (*a*) through (*e*) illustrating different ways of securing the ends together;

Figure 3 is a tapered absorbent roll or rod used for forming the sponge of Figure 4;

Figure 4 is a sponge made from a tapered roll;

Figure 5 is a sponge formed from a roll of folded gauze in which the center of the roll contains further absorbent material; and

Figure 6 (*a*) through (*g*), illustrates the steps in preparing a surgical sponge in accordance with the preferred practice of the present invention.

Referring to the drawings, the basic sponge construction of the present invention comprises a roll **10** of absorbent material bent into the form of a U and having its ends **11** and **12** secured together. The roll may be formed of any suitable absorbent material which does not have loose fibers. Materials found to be suitable are synthetic cellular sponge materials, cotton rolls, if the cotton is covered by a woven fabric or a non-woven fabric in which the fibers are sufficiently bonded so that they will not come loose in use, rolls of surgical fabric or rolls formed in the manner hereinafter described.

In order to make the sponge X-ray detectable, an X-ray opaque insert may be placed in the sponge. This may be in the form of a thread or strip **13** passed through the roll so as to be enclosed within the same. The ends of the sponge may be secured together by any suitable means, various manners of securing the ends **11** and **12** being illustrated in Figure 2, sub-figures (*a*) through (*e*). In Figure 2(*a*), the ends are secured by cementing as illustrated at **14**. In Figure 2(*d*), the X-ray opaque member **13** is of thermoplastic material. The ends of the X-ray opaque member extend beyond the ends **11** and **12** of the absorbent roll **10** and are bent over between the ends of the roll. Heat and pressure are then applied to melt the X-ray detectable material and fuse the ends **11** and **12** together.

In Figure 2(*e*), the ends **11** and **12** of the absorbent roll **10** are secured together by extending the ends of the X-ray opaque member **13** beyond the roll ends **11** and **12** and then securing the ends together at **16** either by tying or cementing or by fusing where the X-ray opaque member is formed of a thermoplastic material. If desired, a non-X-ray opaque thread or strip may be used in the manner of **13** in Figure 2(*e*) to bond the ends **11** and **12** of the sponge together. This may be combined with an X-ray opaque material, as by impregnating a portion of a non-X-ray opaque strip with an X-ray opaque substance. With such structure, the X-ray opaque portion would preferably be enclosed in the sponge body.

In Figure 2(*b*), the ends **11** and **12** of the absorbent roll are secured together by wrapping with thread **17**. Where the ends are secured by wrapping with thread, it is preferable to also use a cement to secure the thread to the sponge to assure its not coming loose while the sponge is being used. Since use of a relatively soft cement has certain advantages in that there is less chance for damage to body tissues, it is frequently desirable to use both the thread wrapping and cement together rather than to only cement the ends as done in Figure 2(*a*).

In Figure 2(*c*), a still further modification is shown in which the ends **11** and **12** of the absorbent roll **10** are taped together with an adhesive-coated tape **18**. In the embodiment shown, the tape is brought together above the end of the sponge, as illustrated at **19** to form a tab. The tab is preferably short where the sponge is of the hard or compact type. For the softer absorbent type sponge, the tab is preferably sufficiently long to facilitate holding.

Any cement may be used that is relatively insoluble in body fluids and non-irritating to body tissues under operating conditions. The cement should also be able to withstand sterilizing conditions. Among cements suitable for this purpose are the polyvinyl chloride and polyvinyl chloride copolymer latexes. Also, any X-ray opaque ele-

ment may be used that is not harmful to the body under the conditions of use. Suitable materials, for example, may be thermoplastic threads or strips of cellulose esters, vinyl chloride polymers, polymers of acrylic acid and polymers of acrylic acid esters and their derivatives which have dispersed through them very finely divided particles of an X-ray opaque material such as barium sulfate.

The sponge of Figure 4 is similar to that of Figure 2, the primary difference being that the sponge of Figure 4 is formed of a tapered absorbent roll having a configuration similar to that shown in Figure 3. The ends **20** and **21** of the roll can be bonded together in any of the manners described for the sponge of Figure 2. Also, the sponge of Figure 3 would preferably contain an X-ray opaque thread or strip **22**. This X-ray detectable member may be used for securing the ends **20** and **21** in the same manner as illustrated in Figure 2.

The preferred practice of the invention is illustrated by Figures 5 and 6, Figure 5 illustrating the formed sponge and Figure 6 illustrating the various steps of forming the same. When the surgical sponge is formed in this manner, a wide degree of control can be exercised to form sponges of high absorptive capacity or sponges which are relatively hard and dense, depending on the final use to which the surgical sponge is to be put.

The sponge of Figure 5 is formed as follows: Two opposed edges **23** and **24** of a piece of gauze **25** are folded over as indicated by dotted lines **26** and **27** to form the blank of Figure 6(*b*). An absorbent pad **28**, formed of any suitable absorbent material, such as folded gauze, non-woven fabrics, absorbent papers, etc., is then placed on the blank 6(*b*) between the folded edges **23** and **24**. The absorbent pad **28** is substantially narrower than the folded gauze sheet **25**. An X-ray opaque strip **29** is then laid on top of the pad **28** to form the assembly of Figure 6(*c*). The assembly of Figure 6(*c*) is folded over on itself along dotted line **28** with the gauge **25** on the outside into the form illustrated in Figure 6(*d*). If it is desired to have the strip of X-ray opaque material extend along the legs of the U, as illustrated in Figure 2, the X-ray opaque strip would be laid across the blank of Figure 6(*c*), the ends extending beyond the edges of the blank where it was desired to use the ends of the X-ray opaque strip to secure the ends of the sponge together. However, the preferred manner of inserting the X-ray opaque member is that illustrated in Figure 6(*c*). The folded blank 6(*d*) is then rolled, starting from the edge opposite the fold **31**, into the form illustrated in Figure 6(*f*). In forming the roll of Figure 6(*f*), care should be taken to first roll in the corners **32** and **33** as illustrated in Figure 6(*e*). It will be noted that the resulting roll, illustrated in Figure 6(*f*), has all edges of the gauze fabric folded within the roll. This avoids any possibility of loose threads. The roll of Figure 6(*f*) is then bent in the center into a U shape and the ends **34** and **35** secured together to form the completed sponge as illustrated in Figure 6(*g*). In the preferred modification, particularly for the absorbent type of sponge, the ends of the X-ray opaque material terminate within the roll and the ends of the U are held together both by cementing and by tying the ends **34** and **35**, as by wrapping with thread **36**. The tie, combined with the cement, is preferred particularly where a soft sponge is desired since in such cases a relatively soft cement is used. The cement, as previously stated with reference to Figure 2(*d*), should cover the tying threads so that the same cannot become detached during use of the sponge.

Where it is desired that the sponge have a highly absorbent character and be soft and pliable, the absorbent filling **26** is preferably made of relatively bulky absorbent materials, such as non-woven fabrics, cotton, cellulose wadding or macerated wood pulp, and the folded blank of Figure 6(*d*) loosely rolled. Also, the X-ray detectable material should preferably be in the form of a thread.

Where it is desired that the sponge have a compact, relatively hard structure, the filler **26** is preferably made of several folds of gauze and the blank of Figure 6(*d*) is tightly rolled. Also, the X-ray detectable element is in strip form. In this form it adds substantially to the compactness and relative hardness of the sponge. Where the X-ray opaque material is used in this manner to increase the compactness of the sponge body, the ends will, of course, not protrude nor will the X-ray opaque material be parallel to the length of the roll.

The sponge structures of the present invention are simple to manufacture and permit a wide degree of variation with respect to absorbency and compactness. They also can be made in varying sizes. Although applicants, in their specification, have described their preferred embodiment of the invention and several modifications thereof, further modifications will, of course, be apparent to one skilled in the art after reading the specification. The invention includes all such modifications and is to be limited only by the appended claims.

I claim:

1. A surgical sponge comprising an absorbent roll formed of a fabric wrapped around an absorbent body, the ends of said roll being joined together and all edges of said fabric running lengthwise of said roll being contained within said sponge.

2. A surgical sponge of claim 1 in which said absorbent roll contains therein a strip at least a portion of which is X-ray opaque.

3. A surgical sponge of claim 1 wherein the ends of the roll are tied together.

4. A surgical sponge of claim 1 wherein the ends of the roll are cemented together.

5. A surgical sponge of claim 3 wherein the ends of the sponge are tied together with a thread that is X-ray opaque.

6. A surgical sponge of claim 4 wherein the cement contains an X-ray opaque material.

7. A surgical sponge comprising a fabric folded over a filler and rolled into a roll with all fabric edges turned into the roll, the ends of the roll being joined together.

8. A U-shaped surgical sponge having an elongated absorbent body in the form of a roll, the roll containing therein a strip at least a portion of which is X-ray opaque, the ends of the strip extending beyond the ends of the roll and serving to secure the ends of the roll together.

9. A U-shaped surgical sponge having an elongated absorbent body in the form of a roll, the roll containing therein a strip at least a portion of which is formed of a thermoplastic X-ray opaque material which extends beyond the ends of the roll, the ends of the roll being secured together by fusing the extending ends of the thermoplastic X-ray opaque strip.

10. A surgical sponge of claim 7 in which the portion of the roll intermediate its ends is relatively hard and compact.

11. A surgical sponge of claim 7 in which the portion of the roll intermediate its ends is relatively soft and bulky.

12. The method of making a surgical sponge comprising taking a piece of absorbent fabric, folding over two opposing edges of said fabric, laying an absorbent filler between the folded edges of said fabric, folding said fabric and filler at right angles to said initial folded edges, rolling said composite of fabric and filler by starting at the edge opposite the fold in said composite so as to form a roll in which all fabric edges are turned in, bending said roll in the middle and securing the ends of said roll together.

13. The method of claim 12 wherein an X-ray opaque element is inserted within the surgical sponge.

14. The method of claim 12 wherein a flexible, elongated X-ray opaque element is inserted between the fold-

ed halves of said composite of fabric and absorbent filler at an angle to the line of fold of said composite.

15. The method of claim 14 wherein the ends of the roll of said composite of fabric and filler are cemented and tied together.

16. A U-shaped surgical sponge having an elongated body in the form of a roll, the middle portion of said roll being bulkier than its ends and the ends being secured together, said roll containing an absorbent filler rolled within an absorbent fabric, the absorbent fabric being substantially wider than the absorbent filler so as to form a roll the center portion of which has substantially more mass than the ends.

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