

[54] NON-SLIP INSTRUMENT PAD

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[51] Int. Cl. **A61f 13/00**

[58] Field of Search 128/132 R, 132 D, 128/155, 156, 292; 161/39, 190; 206/2.5

[56] **References Cited**

UNITED STATES PATENTS

3,215,647 12/1965 Dunn 260/2.5

[57]

ABSTRACT

A non-slip instrument pad is disclosed, which is composed of a synthetic polymer foam material applied to a substrate. The foam material is highly absorbent, has a high coefficient of friction and a low surface resistivity. The polymers used in making the foam are either styrene butadiene polymers or carboxylated styrene butadiene polymers. The foamed polymer contains an anti-static agent.

11 Claims, 5 Drawing Figures

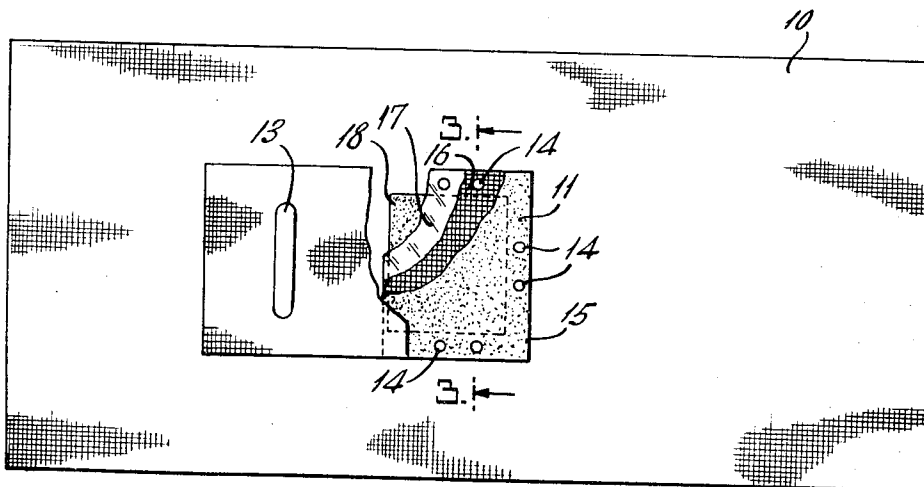


Fig. 1.

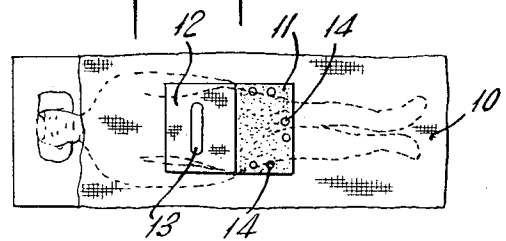


Fig. 2.

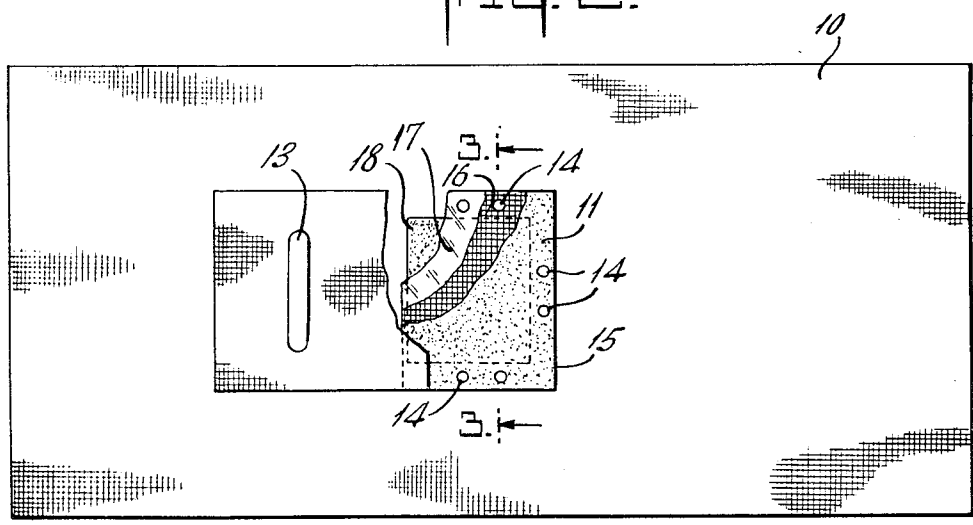


Fig. 3.

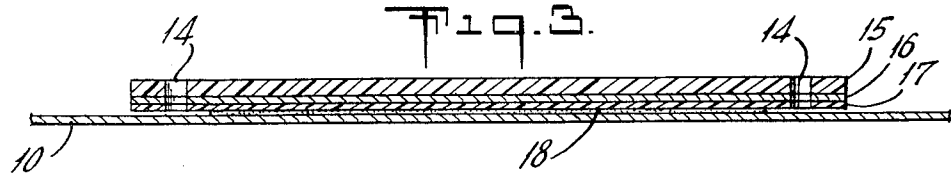


Fig. 4.

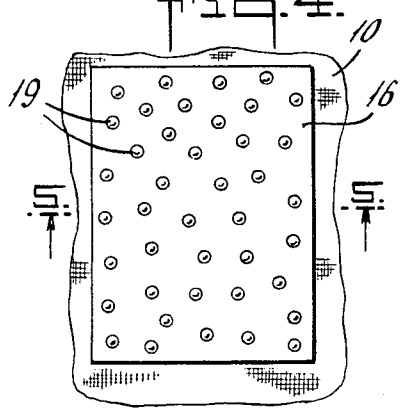
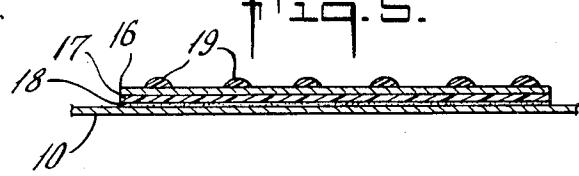


Fig. 5.



NON-SLIP INSTRUMENT PAD

BACKGROUND OF THE INVENTION

The present invention relates to an instrument pad which may be used in the operating room to provide a surface upon which surgical instruments and other implements normally used in the operating room may be securely placed during surgical procedures.

It is relatively common practice during surgical or obstetrical procedures for a surgeon or an obstetrician to place instruments and other implements, to be used during the procedure, on the surface of the drape which is used to cover the patient. The surface of commonly used linen or disposable paper drapes are not adequate to retain the instruments in the position in which they are placed. The surfaces of these linen or paper drapes are too smooth to positively hold an instrument in place. The problem is sometimes magnified by the tendency of individual surgeons to drop instruments onto the drape. The linen and disposable paper drapes, being too smooth, do not provide an adequate gripping or holding surface to insure that these instruments will stay in the position in which they are placed. The instruments, therefore, may fall from the drape onto the floor of the operating room or may fall into the operative field.

It has been suggested that magnets be incorporated into both linen and disposable surgical drapes to provide a positive holding action of surgical instruments. However, the placement of the magnets in the drape also requires that the instrument be positioned on a magnet before it would remain in place which is a time consuming and distracting procedure under the conditions existing in the operating room. In addition, some of the stainless steels used in surgical instruments do not have adequate magnetic properties to insure that the instruments will stay in place on the magnets. It has also been suggested that a portion of the drape be provided with a roughened surface which would be sufficient to hold instruments in place. The roughened surface, in the case of a disposable drape, would be obtained by heavily embossing the paper from which said drapes are constructed. An embossed paper surface has been found to be inadequate to provide the holding characteristics that are necessary for an instrument.

Another prior art attempt to solve the problem has been the use of a thin layer of a polyurethane foam. The polyurethane foam does not provide the surface characteristics necessary to hold an instrument in place and has also failed to provide any additional benefits.

In addition to the deficiencies in the surface characteristics pointed out above, the prior art instrument pads or drapes suffered from a lack of absorbency. The instruments that are placed on an instrument pad or drape are often wet with body fluids, water or other liquids commonly used in an operating room such as sterilizing or disinfecting solutions. The wet instrument placed on a linen drape can cause an immediate strike-through of the liquid to the patient, thereby causing possible contamination of the patient by any bacteria which might be present on the instrument. The previously used polyurethane foam pad also did not have sufficient absorbency to adequately absorb the liquids that might be on the instrument. If the liquid was present in sufficient quantity, it would have a tendency to pool on the surface of the foam before it could be ab-

sorbed and present the danger that the liquid could run off the foam and onto the patient or the surgeon.

An additional problem with polyurethane foams was the high surface resistivity of the foam. In order to be acceptable for use in an operating room, the electrical resistivity of a surgical drape or instrument pad must be below 5×10^{11} ohm/unit². The surface structure of the polyurethane or its chemical composition has been found to be such that it is extremely difficult to add presently available anti-static agents to the foam in order to obtain the desired surface resistivity.

THE INVENTION

The non-slip instrument pad provided by the present invention has a combination of the desirable characteristics of having a high coefficient of friction, is highly absorbent, has a low surface resistivity and has additional properties to provide a significantly improved non-slip instrument pad that is suitable for use under the conditions found in an operating room. We have discovered that these characteristics can be achieved by the use of foam made from a synthetic rubbery polymer such as a styrene-butadiene polymer or a carboxylated styrene-butadiene polymer. Using foams made of these rubbery polymers, it is possible to incorporate an effective antistatic agent into the foam which will eliminate the static electricity problems found in polyurethane foams. In addition, the rubbery polymer foams are more absorbent, and have a higher coefficient of friction and a greater capability of retaining instruments than found in polyurethane foams.

These rubbery polymer foams also offer an advantage in that they are more esthetically pleasing in appearance than the polyurethane foams. The polyurethane foams have a relatively rough course surface when compared to the smooth surface of the present rubbery polymer foams. Although it would be expected that the rough surface of the polyurethane foams would produce a high coefficient of friction when compared to the smooth rubbery polymer foams, the reverse has been found to be true. The smooth rubbery polymer foams have a higher coefficient of friction than the polyurethane foams.

The foams that we employ may be made with either a styrene-butadiene polymer or a carboxylated styrene-butadiene polymer such as that disclosed in Dunn U.S. Pat. No. 3,215,647. The carboxylated butadiene-styrene polymer foams offer an additional advantage over the styrene-butadiene polymer foams in that they can be made with a non-discoloring vulcanizing system and the color of the finished product can be more accurately controlled. The actual color of the instrument pad is of some significance as it is necessary that the surfaces used on the drapes covering the patient should not reflect excessive light into the eyes of the surgeon.

In addition to the characteristics pointed out above, the rubbery polymer foams also offer an advantage in that they are readily compressible and act to cushion any instrument on the body of the patient. This aids in providing the positive placement of the instrument on the drape as well as allowing the instrument to be readily lifted from the drape when reuse is required.

As previously stated, the instrument pad must have a low surface resistivity in order to be used in an operating room. The requirement is that the surface resistivity be less than 5×10^{11} ohms/unit square. The rubbery polymer foams of the present invention do not inher-

ently possess a low enough surface resistivity. It has been found to be necessary to modify the resistivity characteristics of the foam by incorporating an antistatic agent into the foam composition. Of the many antistatic agents commercially available, we have discovered only one antistat that will give the desired surface resistivity to the rubbery polymer foams. This antistat is the reaction product of a polyalkoxylated polyamine with epichlorohydrin and is marketed under the name STANAX. The antistat is present in the foam composition in an amount of from 0.05 to 0.25 percent by weight based on the dry weight of the foam.

There are a substantial number of commercially available rubbery styrene butadiene and carboxylated styrene-butadiene polymer latices that can be employed in the practice of the present invention. Generally, any rubbery polymer latex normally used to make general purpose foams may be employed to make the foam employed in the present invention. These latices may be compounded with the standard fillers, thickeners, curatives and other compounding ingredients normally employed by those skilled in the art. However, the foam composition and the ingredients employed therein must be capable of accepting the antistat without reacting with the antistat or otherwise reducing its effect as an antistatic agent in the cured foam.

A typical formulation of a carboxylated styrene-butadiene polymer foam composition is as follows:

	Parts by Weight
Carboxylated styrene butadiene polymer (37.5% solids)	174.0
Frothing Aid (30% solids of sodium lauryl sulfate)	8.3
Lubricant	1.0
Ammonium hydroxide (28% active)	1.0
Filler (CaCo ₃)	80.0
Froth stabilizer (2.5% solids)	10.0
Melamine formaldehyde curing agents (55% solids)	11.25
Water	2.0
Sodium bicarbonate	0.009
Antistat (STANAX)* (50% solids)	0.4
Dyes	Variable

*Reaction product of a polyalkoxylated polyamine with epichlorohydrin.

The above ingredients were foamed in a commercially available foamer and spread on a gauzed substrate and leveled with a doctor blade and cured at a temperature of 300° to 350° F. for 5 to 11 minutes. The foam had the following properties as compared with a polyurethane foam.

TABLE I

	Polyurethane	Carboxylated Polymer
Coefficient of friction	0.60	2.75
Time to wet (seconds) (1 drop of fluid)	120	10
Surface Resistivity	1.63×10^{11} ohms/square	5.9×10^9 ohms/square

It has also been determined that the thickness of the rubbery polymer foam layer is particularly significant in the ability of the instrument drape to retain instruments. If the instrument drape is too thin, of a thickness of less than 20 mils, the instrument will not adhere to the drape. If the foam layer is too thick, i.e., greater than 150 mils, there is a tendency of the instrument to bounce off the instrument drape. It is therefore desirable that the foam layer of the instrument drape be between 40 and 150 mils in thickness.

A test was devised to determine the instrument holding efficiencies of foam materials. A piece of the foam to be tested 5½ inches by 12 inches was mounted on a wooden board set at a 40° angle horizontal. Various instruments were lobbed on the foam from a distance of approximately 2 feet. The instruments were lobbed onto the foam so that they would fall flat on the foam and not hit the foam on the side or end of the instrument. The holding ability of the foam was considered adequate if it would retain an instrument in 3 of 5 lobbs. The results were as follows:

Instrument — 7½ inch scissors weighing 105 grams

Thickness of Foam	Pass (P) or Fail (F)
13 mils	F
15 mils	F
25 mils	P
32 mils	P
55 mils	P

A polyurethane foam of 123 mils in thickness failed the same test.

The relationship of the pad to the surgical drape will be better understood with reference to the following drawings in which:

FIG. 1 is a top view of a draped patient showing the instrument pad on the present invention in place on the surface of a drape.

FIG. 2 is an enlarged view of the drape of FIG. 1 showing a fragmentary view of the various components of the instrument pad.

FIG. 3 is a cross sectional view along the lines 3—3 of FIG. 2.

FIG. 4 is an alternate form of the instrument pad of the present invention.

FIG. 5 is a cross sectional view of the instrument pad with FIG. 4 along lines 5—5.

FIG. 1 shows a surgical drape in a normal position over a surgical patient.

The main portion of the drape 10 has secured thereto the instrument pad 11 of the present invention. The main drape 10 also has a reinforced area 12 in the drape through which there is a fenestration 13 which extends through the drape and through which the surgeon will perform the surgical procedure.

The instrument pad of the present invention is composed of a rubbery polymer foam layer 15 which has been cast or applied on a substrate 16. The substrate may be gauze or any other open mesh woven or non-woven fabric. The rubbery polymer foam tends to penetrate into the interstices of the fabric and when cured is securely affined to the fabric substrate. To prevent liquid from penetrating through the instrument pad and onto the main drape, there may be provided a thin impervious film 17 between the instrument pad and the main drape. This film may be polyethylene, polypropylene, vinyl chloride or other similar plastic. In an alternate construction of the pad, the rubbery polymer foam may be cast directly on the surface of the impervious film. The rubbery polymer foam may also be cast on a release coated surface, cured, removed from the coated surface and adhesively bonded to the impervious film. The preferred construction is that shown in cross section in FIG. 3 in which the foam is cast on an open mesh fabric.

The instrument pad may be secured to the main body of the drape 10 by overall glueing as indicated by FIG. 18 in FIG. 3, or it may be secured by any pattern of line glueing as will be readily apparent to one skilled in the

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art. The glue lines shown in FIG. 3 and in the dotted lines in FIG. 2 are inward of the outer edge of the instrument pad. This allows the instrument pad to be lifted and the apertures 14 in the pad utilized to hold tubing, that would be used in the surgical procedure, in position. The tubing could be suction tubing, which is employed to remove fluids from the operative site, or tubing carrying gases or other fluids used during the surgical procedure.

FIG. 4 shows an alternate construction of the drape in which a discontinuous surface of the rubbery polymer foam is employed rather than a continuous sheet of the foam. The foam may be printed on the substrate in the form of bumps or protuberances which are shown by number 19 in FIG. 5. The rubbery polymer foam would be the same composition as previously described but would be printed in a discontinuous pattern on the surface of the substrate 16. Although the form of the protuberances 19 in FIG. 4 and FIG. 5 are shown as mounds in a circular form, it would be readily apparent to one skilled in the art that they could also be printed as squares, triangles, or in any other pattern. When such a printed pattern of foam is employed, it should be present and cover at least 10 percent and preferably about 25 percent of the total surface area of one surface of the instrument pad.

The drape in FIG. 1 is shown in what is called a transverse laparotomy position. It should be understood that drapes employed in other procedures have other configurations and the instrument pad could be placed in another area on the surface of the drape. It is, however, desirable that the instrument pad drape not be placed immediately adjacent the fenestration.

It is common practice in the manufacture of disposable surgical drapes to reinforce the fenestration or opening through which the surgeon operates. Such a reinforcement is shown as element 12 in FIGS. 1 and 2. When the instrument pad of the present invention is placed adjacent the reinforcement area of the main body of the drape, it is preferred that the reinforced area overlap the instrument drape. This will prevent any liquid which might be present on the instrument pad from flowing into the reinforcement area of the main drape and through the fenestration and possibly contaminating the patient.

What is claimed is:

1. An instrument receiving pad which is capable of holding surgical instruments placed thereon and which is highly absorbent, has a coefficient of friction greater than 1, and has a surface resistivity of less than 5×10^{11} ohms/unit square, said pad comprising a surface of a

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foam formed from a rubbery polymer selected from the group consisting of polymers of butadiene and styrene and polymers of butadiene, styrene and an ethylenically unsaturated carboxylic acid, said foam containing from 0.05 to 0.25 percent, based on the weight of the foam, of an antistatic agent, said antistatic agent comprising the reaction product of a polyalkoxylated polyamine with epichlorohydrine.

2. The instrument pad of claim 1 in which the foam is adhered to an open mesh fibrous substrate.

3. The instrument pad of claim 2 in which there is an impervious film underlying the fibrous substrate.

4. The instrument pad of claim 3 in which the foam surface is a discontinuous series of circular mounds on the substrate, said circular mounds covering between 10 and 25 percent of the total surface area of the upper surface of said pad.

5. The instrument pad of claim 3 in which the foam surface is a continuous sheet.

6. A surgical drape having secured to the upper surface thereon an instrument receiving pad which is capable of holding surgical instruments placed thereon and which is highly absorbent, has a coefficient of friction greater than 1, and has a surface resistivity of less than 5×10^{11} ohms/unit square, said pad comprising a surface of a foam formed from a polymer selected from the group consisting of polymers of butadiene and styrene and polymers of butadiene, styrene and an ethylenically unsaturated carboxylic acid, said sheet containing from 0.05 to 0.25 percent, based on the weight of the foam, of an antistatic agent, said antistatic agent comprising the reaction product of a polyalkoxylated polyamine with epichlorohydrine.

7. The surgical drape of claim 6 in which the foam surface is adhered to an open mesh fibrous substrate.

8. The instrument pad of claim 6 in which there is an impervious film underlying the fibrous substrate.

9. The surgical drape of claim 8 in which the foam surface of said instrument pad is a discontinuous series of circular mounds on the substrate, said circular mounds covering between 10 and 25 percent of the total surface area of the upper surface of said pad.

10. The surgical drape of claim 8 in which the foam surface is a continuous sheet.

11. The surgical drape of claim 8 in which the instrument pad is secured to the drape with an adhesive which is applied inward of the outer edges of said pad, and in which said pad has apertures through the pad which lie between the point where the pad is adhesively secured to said drapes and the outer edge of said pad.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,738,359 Dated June 12, 1973

Inventor(s) Julius A. Lindquist et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In Column 2, line 35, "course" should read --- coarse ---.

In Column 4, line 51, "affined" should read --- affixed ---.

In Column 5, line 28, "lapatoromy" should read --- laparotomy ---.

In Column 6, line 8, "epichlorohydrine" should read --- epichlorohydrin --

In Column 6, line 33, "epichlorohydrine" should read ---epichlorohydrin ---.

In Column 6, line 36, "The instrument pad of claim 6 in which there is an impervious film underlying the fibrous substrate" should read
--- The surgical drape of claim 6 wherein the instrument pad includes an impervious film underlying the fibrous substrate ---.

Signed and sealed this 2nd day of April 1974.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents