June 2, 1964 O. B. BILLINGS ETAL 3,135,258

BANDAGE

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Fig. 1.

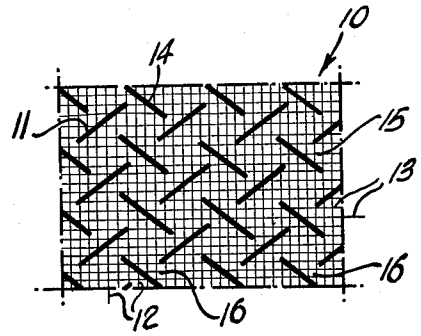


Fig. 2.

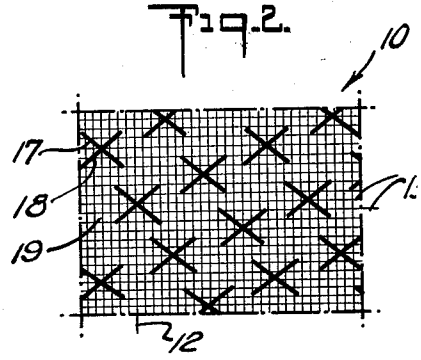
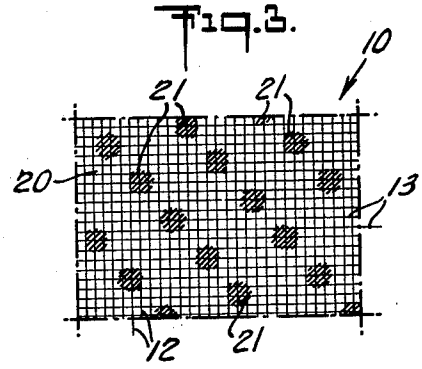


Fig. 3.



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BANDAGE

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The present invention relates to surgical cast-forming materials and, more particularly, to plaster bandages from which plaster casts of improved appearance can be made.

Plaster of Paris bandages for use in forming surgical plaster casts are made by coating or impregnating a relatively loose-weave fabric with plaster of Paris in a non-activated state. The plaster of Paris generally contains a binder for holding it onto the fabric carrier, the binder being incorporated in the slurry of plaster of Paris prior to application of the same to the fabric carrier.

In use the bandage roll is wetted, generally by complete immersion in water, and the roll then removed and squeezed to remove excess water. The wetted bandage is then wrapped around the injured limb. The wetting of the plaster not only activates the same, but gives it a fluid or pasty consistency so that the plaster of Paris in adjacent wraps or convolutions tends to flow together to give the wrap a strong, uniform structure. It is the practice, during application of such bandages, to smooth the bandage down as it is applied on the injured member and to rub the hand over the cast surface while the plaster is still in a fluid state so as to smooth out the plaster and thus improve the uniformity and the appearance of the cast. As the fabric which acts as the carrier for the plaster of Paris is generally of a loose-weave material, edge threads become detached from the bandage due to raveling after the bandage has been wetted and during application. This raveling of edge threads during bandage application interferes with obtaining a smooth and uniform wrap and also results in a cast that is generally unsightly and unattractive.

In order to overcome this problem some manufacturers have used lino-weave fabrics as the carrier fabric, as these fabrics have a greater resistance to raveling than conventional weaves. Lino-weave fabrics, however, are substantially more expensive and add appreciably to the final cost of the product. Also, the lino-weave does not entirely solve the problem, some edge threads still raveling during bandage application. Another approach to this problem has been to use serrated knives when slitting the plaster of Paris impregnated fabric to the desired bandage width, so as to form on the edge of the bandage a serrated rather than a straight edge. This serration of the bandage edge prevents raveling of long threads so that there is no difficulty encountered in applying the resulting plaster of Paris bandage. However, short threads come loose from the serrated edge and these, together with the tufts of threads remaining, make it extremely difficult to obtain a smooth and attractive looking cast. As a result the cast generally has a rough appearance, particularly at the edge of each convolution of the bandage wrap.

It has now been discovered that plaster of Paris bandages can be prepared from relatively loose-weave fabrics of conventional weave and having straight slit edges which can be formed into smooth and attractive appearing casts, the bandages being free from raveling during bandage application and free from loose threads and tufts which detract from the appearance of the cast after the same has been formed. These improved plaster of Paris bandages are obtained by stabilizing the threads of the fabric at some of the intersections with an adhesive material that is compatible with the plaster of Paris composition.

The manner of bonding the intersecting threads of the base fabric is important with respect to obtaining a satisfactory product, as hereinafter more fully described.

The base fabric must maintain its flexibility and its ability to satisfactorily hold the plaster of Paris both in the dry and in the wet state. It has been found that overall bonding, wherein all of the intersecting threads are bonded, produces an unsatisfactory product in that the bandage is not sufficiently conforming. Accordingly, the bonding must be intermittent. The best results are obtained where the pattern of bonding is such that there are no continuous areas of bonding, such, for example, as continuous lines wherein all intersecting threads in the areas of the lines are bonded. The bonding of intersecting threads should rather be in an intermittent pattern with areas of bonded intersecting threads preferably each surrounded by areas of unbonded intersecting threads.

It is also important that the bonding agent used in treating the base fabric be one that is compatible with the plaster of Paris composition so as not to interfere with the bonding of the plaster of Paris composition to the base fabric in either the wet or the dry state.

The base fabric may be any loose-weave fabric generally used in preparing plaster of Paris bandages, such fabrics generally having 20 to 40 warp and 16 to 36 weft threads per inch. The bonding agent used should be compatible with the bonding agent used in the plaster of Paris composition for bonding the plaster of Paris to the fabric and is preferably the same as the bonding composition used in the plaster of Paris.

Since in the application of plaster of Paris bandages the problem of raveling is encountered primarily after the bandage roll has been wetted and during application of the bandage, any material used in bonding the crossing threads of the base fabric must be sufficiently resistant to water so that it will maintain its bonding action throughout the period of application after the same has been wetted.

In the preferred practice of the present invention, nonswellable adhesives of the type described in Eberl et al. Patent No. 2,655,148 are used both for bonding the crossing threads of the base fabric and as the adhesive material used in the plaster of Paris composition for bonding the same to the fabric base. The same adhesive may not necessarily be used in the plaster of Paris composition as used for bonding the fabric as long as the two adhesives used are compatible. These adhesive materials, in the absence of a better name, can be referred to as "nonswellable" adhesives, and they may be either insoluble in water or so slowly soluble in water as not to swell during the period of wicking the bandage and application of the wet bandage. Among materials in this category which may be used in practicing the present invention are the water insoluble polymers and copolymers of vinyl acetate and methacrylate or acrylate esters; water insoluble cellulosic ethers and esters; natural and synthetic rubbers; coumarone indene resins; rosins; and those derivatives of rosin which are water insoluble.

The bonding pattern of the adhesive material may be printed on the base fabric with the fabric either in a dry state or with the fabric in a pre-wetted condition. It is generally preferred to print the adhesive pattern onto the fabric while it is in a wet state to avoid the extra handling and drying, the adhesive in such case being applied after the fabric has been boiled and bleached and prior to drying. The adhesive is preferably applied in the form of an aqueous emulsion or latex and is applied by printing onto the fabric base. Although printing in the wet state is preferred for the reasons given, it is found that when casts are prepared from bandage materials in which the fabric is wet when printed the surface of the cast formed of such bandages contains numerous small

hills and valleys which tend to detract from the appearance of the cast, particularly after a cast has been worn for some time, as the peaks of these hills tend to get dirty prior to the remainder of the cast giving the cast a somewhat mottled appearance. This is a phenomenon which is not nearly as apparent with bandages that have been prepared using a base fabric in which the adhesive has been printed while the fabric is dry. It is found, however, that this undesirable effect can be avoided by blending in with the plaster of Paris composition a small amount of a wetting agent, the wetting agent generally being present in amounts of 0.01 to 0.5 percent based on the weight of the plaster composition. Among wetting agents suitable for this purpose are included the alkyl aryl sulfonates, sulfonated esters of fatty alcohols, and quaternary ammonium compounds, although the invention is not restricted thereto. Care should be taken, however, not to use a wetting agent that is irritating to the human skin.

In the preferred practice of the present invention, the plaster of Paris is applied from an aqueous slurry to the base fabric. A manner of applying such plaster of Paris compositions is described, for example, in Eberl Patent No. 2,557,083 of June 19, 1951.

In the preferred practice of the present invention, polyvinyl acetate is used as the bonding material in the plaster of Paris composition as well as the bonding material in stabilizing the threads of the base fabric.

The bonding material should preferably be applied to the base fabric in such manner as to avoid filling too many of the interstices of the base fabric in the area of application, as the plaster of Paris composition must be free to flow through the fabric so as to give a continuous plaster mass in the final cast. It is generally preferred to use only sufficient of the bonding material to firmly anchor crossing threads at the point where the bonding material is applied, although some of the interstices may be filled during application. Where polyvinyl acetate is used as the bonding material for the base fabric, it is preferably applied in amounts of about 1.0 to 6.0 grams on a solid basis per square yard of the fabric being treated.

An intermittent pattern of bonding is preferably used wherein bonded areas are completely enclosed by unbonded areas. This is best illustrated by reference to the drawings wherein are set forth by way of illustration and example certain patterns of bonding.

Referring to the drawings,

FIG. 1 illustrates the preferred pattern of bonding;

FIG. 2 illustrates a different pattern of bonding; and

FIG. 3 illustrates yet a different pattern of bonding.

Referring to FIG. 1, the base fabric **10** is printed with a bonding agent, such as polyvinyl acetate. The bonding material is imprinted in spaced intermittent lines, line segments **11** extending in one direction which cuts across both the warp and weft threads of the woven fabric end and line segments **14**, extending in a direction apparently at right angles to line segments **11**, also cutting across both the warp and weft threads **12** and **13**. Each line segment **11** and **14** covers several intersections **15** of the woven threads **12** and **13** anchoring the threads at these intersecting points. Around each line segment of bonding material is an area **16** which is free of any bonding agent. The line segments **11** and **14** of bonding material should preferably not exceed about 1.0 inch in length and about ¼ inch in width.

In the bonding pattern illustrated in FIG. 2, the bonding material is placed on the fabric in the form of intersecting lines **17** and **18**. These intersecting line segments of bonded material are each surrounded by an area **19** where the intersecting warp and weft threads **12** and **13** are free of any bonding material. The line segments **17** and **18** should be of approximately the same size as the line segments **11** and **14** of FIG. 1.

In FIG. 3 still another pattern of bonding is illustrated. In the particular pattern the bonding material is placed in the form of dots which are spaced with respect to each other so that each dot is surrounded by an area which is free of any bonding material, but there is no thread of the fabric which is not bonded at at least some of its intersecting point. The dots of bonding material should preferably not exceed about ½ inch in diameter. Also, as previously stated, care should be taken that the bonding material be applied only in sufficient concentration to bond the intersecting threads where the bonding material is applied without filling the interstices of the fabric between adjacent threads to more than about 20 percent of the interstices area involved. Although, as indicated, various patterns of bonding can be used, the pattern employed is preferably one that will leave no thread unbonded near the edge of the bandage for a length of more than about 2 inches. As it is only at the edge of the bandage that the problem of raveling is encountered, the center portion of the bandage can be left free of adhesive, and the intermittent pattern of adhesive can be applied only in the sections of the fabric that on slitting will be adjacent to and will become the edges of the bandage after slitting.

The invenion is further illustrated by the following example which is for the purpose of illustration only, the invention not being limited thereto.

Example

A loose-weave gauze fabric having 32 warp and 22 weft threads per inch is used as the starting material. The fabric is boiled and bleached in the conventional manner for treating such fabrics and then while still wet, after having been passed through a mangle to remove excess moisture, is passed under a print roll containing the pattern in which it is desired to print the adhesive. The printing apparatus is of conventional type for printing fabrics. The pattern in the particular example is that of FIG. 1, the lines on the print roll being ¼ inch long and having a width of 1/16 inch. The adhesive applied to the print roll is a water emulsion or latex of polyvinyl acetate containing about 50 percent solids. The polyvinyl acetate has an intrinsic viscosity of 1.6 in acetone at a temperature of 30° C. The polyvinyl acetate is an emulsion concentrate of about 5.5 percent by weight solids. It is used as plasticized with 6 parts by weight of butyl benzyl phthalate plasticizer per 100 parts by weight, on a wet weight basis, of resin.

After the polyvinyl acetate is printed onto the fabric base, the printed fabric is tentered and dried while tentering. The wet printed pattern contains line segments of about ⅜ inch length and ⅛ inch width due to slight migration of the vinyl acetate during printing. This fabric is then coated with the following composition:

	Parts by weight
Plaster of Paris	100
Boric acid	0.4
Ammonia water (30%)	0.8
Polyvinyl acetate emulsion	1.0
Water	50.0
Alkanol "B" (sodium alkyl naphthalene sulfonate)	0.05

The composition is applied as a pasty material in the form of a thin porous coating by means of a knife coater in the conventional manner. The composition is applied at a solids weight of about 1 pound per square yard. The coated material is then dried for about 3 minutes at a temperature of about 310° F.

The plaster-coated fabric is then passed through a knife slitter and the plaster-coated fabric cut into bandage strips of 3 inch width, the plaster-impregnated fabric being slit by the knives in a straight line extending substantially parallel with the warp threads.

A cast is prepared by taking a roll of this plaster bandage material, immersing the same in water for 2 to 3 seconds, removing, squeezing out of the excess water, and applying in the conventional manner of applying plaster of Paris bandage wraps. As the bandage is applied, the hand is passed over the wrapped convolutions smoothing

out the plaster at the edges of each convolution and assuring that intimacy of contact is obtained. After wrapping is completed the whole cast is smoothed by rubbing the hand over the surface of the same. The cast is then permitted to dry and set. The finished cast has a smooth and attractive appearance.

Having thus described our invention, we claim:

1. A settable dry plaster of Paris bandage comprising an adhesive bonded, loose-weave fabric containing a first adhesive, said fabric being coated with a plaster of Paris mix containing a second adhesive bonding the plaster of Paris to said fabric, said first adhesive and said second adhesive being compatible one with respect to the other so that said plaster of Paris is bonded to said loose-weave fabric in the areas containing said first adhesive, said first adhesive being intermittently spaced on said loose-weave fabric to provide intermittent adhesive-containing and nonadhesive-containing areas near to and at the side edges of said bandage, said first adhesive in adhesive-containing areas anchoring together crossing threads of said fabric when said bandage is in a wet condition during use.

2. A plaster of Paris bandage of claim 1 in which said first and second adhesives are of the group consisting of

water insoluble polymers and copolymers of vinyl acetate, methacrylate and acrylate esters, water insoluble cellulosic ethers and cellulosic esters, natural and synthetic rubbers, coumarone indene resins, rosin, and water insoluble rosin derivatives.

3. A plaster of Paris bandage of claim 2 in which said first adhesive and second adhesive are the same.

4. A plaster of Paris bandage of claim 3 in which said first and second adhesive are polyvinyl acetate.

5. A plaster of Paris bandage of claim 2 in which said plaster of Paris contains 0.01 to 0.5 percent by weight of a wetting agent based on the weight of the plaster composition.

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