April 22, 1947. S. P. LOVELL 2,419,358

SPLINT AND THE LIKE

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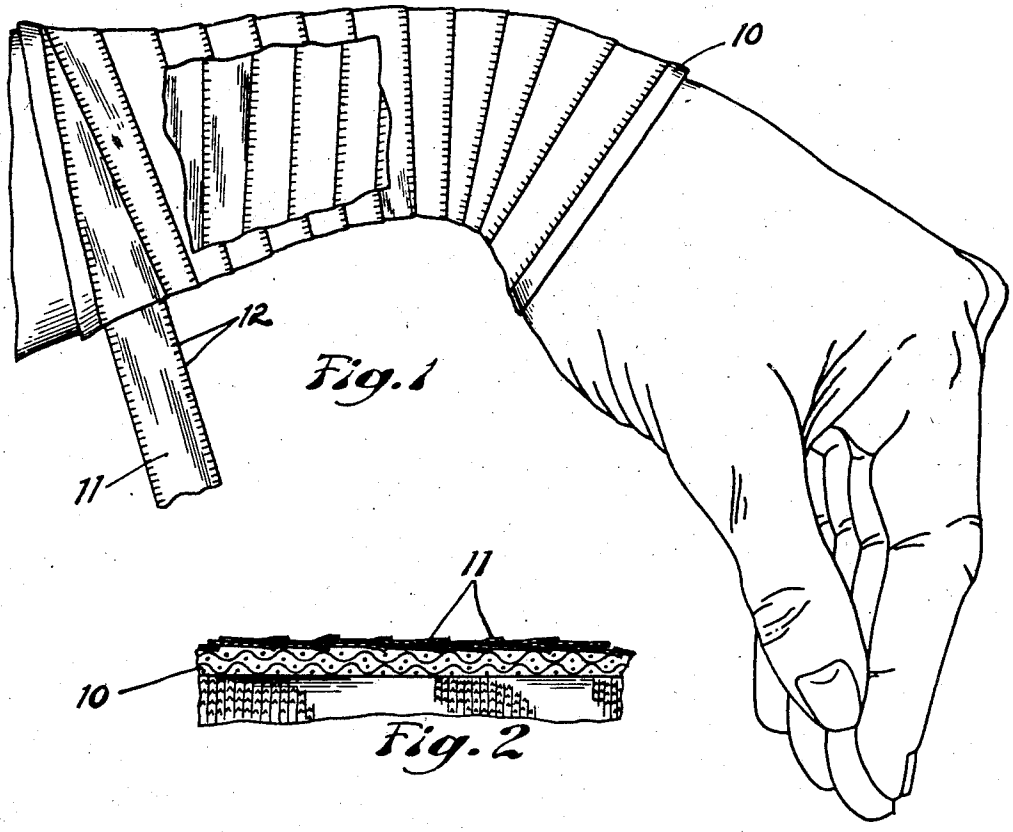


Fig. 1

Fig. 2

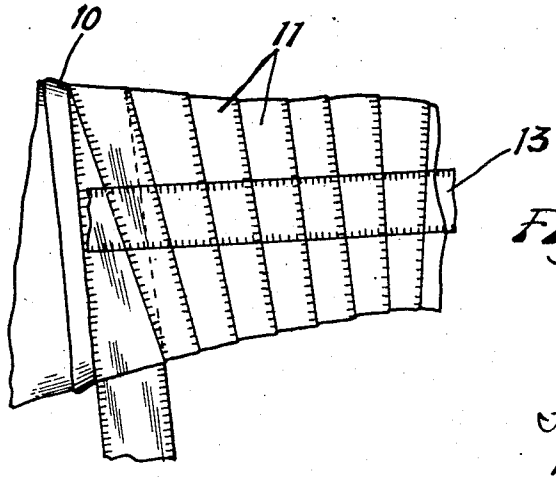


Fig. 3

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SPLINT AND THE LIKE

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This invention relates to the construction and formation of rigid bandages, confining casts, splints and the like, such as are useful in the practice of the retention of set bones in surgery or orthopedics.

Calcined gypsum (plaster of Paris) has long been used for this purpose, either alone or with a reinforcement of fibre and fabric. More recently the obvious deficiencies of plaster casts, such as weight, destruction when wetted and impermeability to X-ray, have led to the use of fabric tapes impregnated with solvent-softened waterproof stiffening compounds, especially nitrocellulose. While such products have obviated the weight and X-ray opacity of plaster, they prove to have two undesirable characteristics: the necessity for exposing the patient to prolonged skin and lung contact with organic solvents, and a relatively slow rate of achieving hardness. Thus, for example, whereas a patient with a Colles wrist fracture may be safely discharged where plaster is used in fifteen or twenty minutes, the organic-solvent type of rigid bandage necessitates the attendance of the physician for almost an hour. Since this is impractical in out-patient departments of hospitals, the use of such otherwise desirable bandages is prescribed and limited to private patients.

After repeated attempts to produce a bandage or cast material capable of satisfactory immobilization, yet light in weight, easy to apply, permeable to X-ray and almost instantaneous in its total rigidity, I have discovered a new and improved composite bandage and a method of applying it which solves the problem.

A film of flexible, homogeneous, substantially non-stretchable material is selected as my raw material for one constituent of the novel bandage or splint. Its suppleness will depend upon the use to which it is to be adapted: for example a splinting material may be a film of cellulose acetate or aceto-butyrate, Celluloid (containing fire retardant) ethyl cellulose, polyethylene, tetrafluoroethylene, vinylidine dichloride, polymeric styrene, regenerated cellulose or the like materials having the same characteristics and having a thickness of say ten thousandths of an inch. For arm and leg rigid bandages, hip spicas, body encasements and the like I select a film of say one-and-one-half thousandths of an inch thickness.

Regardless of the thickness of the base film or the chemical composition of it, I now coat one side of the material with an adhesive coating of the pressure-sensitive type. My preferred coating is a natural rubber latex but I have successfully used dispersions of crude rubber, polymeric styrene, the co-polymer of butadiene and styrene known as G. R. S., polymerized isoprene known as neoprene and the like. When dried on one face of the film and aggregated into a roll, the resulting film or strip must be capable of unwinding without "blocking" and of subsequent adhesion in situ without the application of heat.

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The features and advantages of my invention will be best understood and appreciated from the following description of a preferred embodiment thereof, selected for purposes of illustration and shown in the accompanying drawings, in which—

Fig. 1 is a view in perspective showing a rigid bandage applied to a patient's wrist.

Fig. 2 is a fragmentary view in longitudinal section and on an enlarged scale.

Fig. 3 is a fragmentary view suggesting a modified construction.

In the immobilization of a skeletal fracture, I first cover the site of injury with cotton wadding, knitted or woven fabric or other cushioning material, after the injury has been treated and the bones set in proper place. I now apply in strip form my film after the strip material has been unwound from its roll so as to expose the face which has been pre-treated for adhesion.

Assuming that it is desired to immobilize the patient's wrist in substantially the position shown in Fig. 1, I first apply a cushion layer of textile fabric to the area of the fracture. As herein shown this comprises a double layer of knitted stockinet 10. I now proceed to wind spirally upon the cushion thus provided strip or ribbon material 11 of thin, tough, pressure-sensitive adhesive material. The strip is wound in cold condition, each turn adhering to the underlying turn while presenting at all times a smooth non-tacky outer surface. As above suggested, one satisfactory material for this purpose is cellulose acetate treated on one face with natural rubber latex. I thus provide a transparent non-fibrous, smooth, dense, flexible strip, resistant to the effects of moisture and high humidity and capable of being readily built up into a shell which constitutes an inextensible structure that cannot be distorted from within. Preferably and as herein shown, the edges of the strip material are provided with short transverse slashes 12. These facilitate close winding of the strip material and cause its edges to conform to the general contour of the resulting shell.

In Fig. 2, I have shown two or three layers of the strip material 11 wound in overlapping or

spiral manner over the cushion, but it will be understood that in some cases many more layers will be employed in constructing the shell portion of the bandage or splint. It is adhesive to the underlay or cushion and each ply or superimposed integument is self-adhesive to that layer of the partially formed bandage already in place. By this means the practitioner can readily and rapidly build into the bandage whatever degree of rigidity the particular case requires. From strip film of greater thickness (e. g., ten one thousandths of an inch) he may inlay between spiral plies reinforcing and supplemental units, or he may lay his spiral winding in multiple plies one directly on top of the other in the line of desired extra strength. A longitudinal reinforcing unit 13 is shown in Fig. 3.

The strip or ribbon material 11 is wound about the cushion 10 in such a manner as to form a shell of less area than the cushion. For example, as shown in Fig. 1 the shell terminates at both ends of the bandage within the length of the cushion and does not therefore come into contact with any part of the flesh of the patient.

Since the treated films have little or no extensibility, the finished cast, rigid bandage or splinting has the unique feature of being non-distortable from within, yet flexible, light and comfortable. It is waterproof and suited for use with incontinent patients or with hydro-therapy. It is completely permeable to X-ray and thus knitting of bone structure may be followed without removal of the restraining bandage.

There is no shrinkage, crystallization or evaporation involved in the application of my novel splint to retard the instant discharge of the patient. Since the cast so formed will not warp or distort and since its weight is approximately only 10% that of an equivalent plaster cast, malpositioning of the bone structure is greatly reduced, if not eliminated. This would indicate freedom from re-fracture and re-setting by the orthopedic surgeon.

A particularly valuable characteristic of the bandage of my invention is that it may be applied cold, no heating whatever being required to render the strip material adhesive. Thus the practitioner requires no heating equipment whatever, the range of application of the bandage or splint is greatly widened and it may be used with full advantage in the field wherever an accident has occurred and when the bandage has been completed it presents a very smooth non-tacky exterior surface.

It will thus be seen that the present invention provides a rigid bandage forming a practically instantaneous encasement of the injured part. Included in it is not only the continuous laminar structure of the spiral strip but also compatible supporting material giving the bandage strength in direct relation to the severity of the injury. The longitudinal strip 13 shown in Fig. 3 might well be .025'' in thickness in some cases.

Having thus disclosed my invention and described in detail an illustrative embodiment thereof, I claim as new and desire to secure by Letters Patent:

1. A splint or the like comprising an inner flexible cushion layer of textile fabric in contact with the body of the patient, and an outer shell of less area than said cushion layer and comprising a multiplicity of laminations of thin, flexible, tough, pressure-sensitive adhesive non-fibrous homogeneous strip material selected from the following group, viz, cellulose acetate or aceto-butyrate, Celluloid, ethyl cellulose, polyethylene, tetrafluoroethylene, vinylidine, dichloride, polymeric styrene and regenerated cellulose, the strip material being flexible and being adhesive on one side only when cool and the said shell constituting an inextensible structure which is non-distortable from the inside, waterproof and permeable to X-rays and presenting a hard smooth exterior surface.

2. A splint or the like comprising a soft yieldable cushion lining in contact with the body of the patient, and an outer shell of less area than said lining and comprising pressure-sensitive adhesive substantially non-stretchable cellulosic material in strip form, flexible when cool and also adhesive on one side only when cool, wound in a multiplicity of overlapping adherent turns and including a longitudinal strip of the same material and constituting a waterproof structure, inextensible and non-distortable from the inside, permeable to X-rays and presenting a hard smooth non-tacky exterior surface.

3. A splint or the like comprising an inner lining of multi-ply stockinet, and an outer shell covering the major portion of the lining and comprising a multiplicity of turns of spirally wound pressure-sensitive adhesive, substantially non-stretchable cellulosic material, approximately ten thousandths of an inch in thickness, flexible in strip form when cool and adhesive on one side only when cool, and having transversely slashed marginal edges, the said wound strip material constituting a light-weight water-resistant inextensible structure which is non-distortable from the inside and which presents a hard smooth exterior surface.

4. A rigid bandage comprising an inner cushion lining in contact with the body of the patient, and an outer encasement comprising self-adherent substantially non-stretchable cellulosic strip material, flexible in strip form when cool and being also adhesive on one side only when cool and being wound continuously in laminations, and interleaved strips of compatible pressure-sensitive adhesive reinforcing material, the encasement thus provided being of light weight, moisture-resistant and non-distortable from the inside, and presenting a hard smooth non-tacky exterior surface.

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