Dec. 9, 1952 M. E. SANO 2,621,145

BONE MAT COMPOSITIONS

Filed Aug. 17, 1949

FIG. 1.

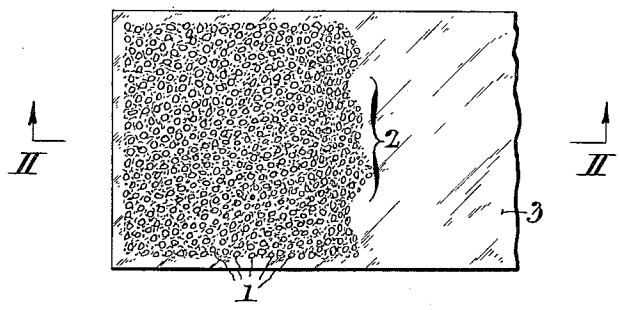


FIG. 2.

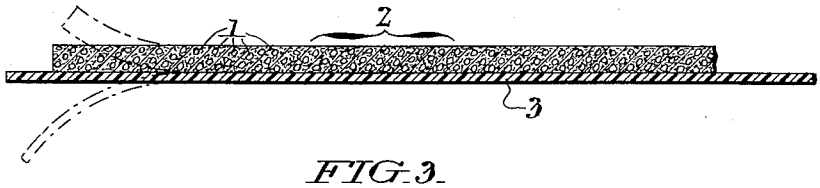


FIG. 3.

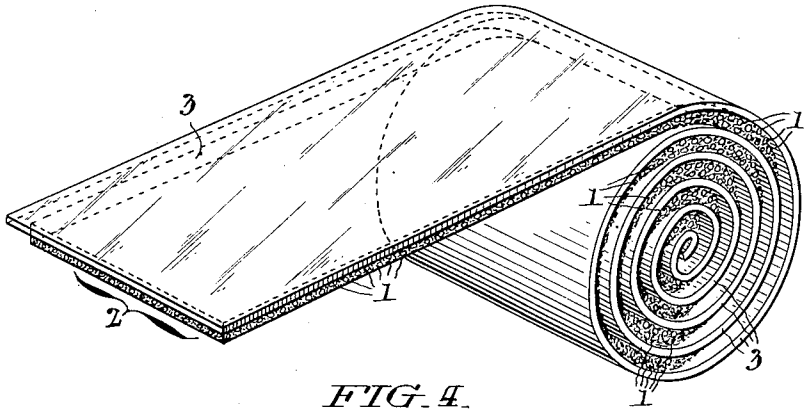
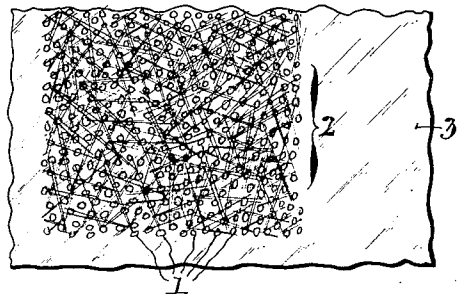


FIG. 4.



WITNESSES

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BONE MAT COMPOSITIONS

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5 Claims. (Cl. 167—84)

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This invention relates to the field of bone surgery and is directed particularly to the provision of a flexible strip comprising particles of bone held together by a fibrin network and sufficiently flexible to permit the formation of a rolled strip.

In the field of bone surgery it is frequently required to replace sections of bone or fragments thereof. The physiological replacement of large pieces of bone or fragments in the human or animal body requires time and in certain unfavorable instances will not take place. In order to bridge the gap and to thus facilitate the process of regrowth, the surgeon introduces a piece of bone which he may obtain from a bone bank or which he may remove from a healthy bone of the patient. Specially treated animal bones have also been used in this way. In any of these three instances the process is time consuming. One of the objections to the use of bone grafts of this kind is the accurate cutting and fitting which is time consuming. A further difficulty in the methods heretofore employed has been in readily obtaining bone grafts of the desired shapes and lengths.

The purpose of the present invention is to provide a composition of bone particles which will promote the assimilation of the bone by the host and which can be readily obtained and which will be easy to use. To further this object, the present invention provides a flexible mat comprising, in combination, a multiplicity of bone particles enmeshed in a fibrin network, the entire composition being adapted for use in certain fields of bone surgery in place of the bone grafts heretofore used.

A preferred process for preparing the composition which is the subject of the present invention is described hereinafter in detail, reference being had to the accompanying drawings in which

Fig. 1 is a plan view of a portion of flexible strip comprising bone particles enmeshed in a fibrin network on a cellophane carrier;

Fig. 2 is a cross section taken through the lines II—II of Fig. 1;

Fig. 3 is a perspective view showing the flexible strip of Fig. 1 in roll form and;

Fig. 4 is a semi-schematic plan view greatly enlarged of a portion of a flexible strip comprising bone dust particles enmeshed in a fibrin network.

In the drawings a multiplicity of bone particles 1 are shown enmeshed in a fibrin network 2. The bone mat thus formed is supported by

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a carrier strip 3 comprising a thin flexible plastic material such as cellophane. In preparing the bone particles 1, pieces of bone, including the cortex, are obtained under sterile conditions from animals but preferably from humans, and these bones are ground by means of a bone grinder. The sizes of bone particles may vary from bone dust where the particle size is of the order of $\frac{1}{10}$ mm. to particles which may be 4 mm. in diameter or more. It is preferable, however, to provide bone particles of substantially the same size for a given bone mat composition. I have found it advantageous to provide bone particles of the following sizes:

$\frac{1}{10}$ mm., or bone dust
1–2 mm. in diameter
2–4 mm. in diameter

This provides a selection in making up a given quantity of the bone mat composition of the present invention.

A sterile flexible strip made of a plastic material such as cellophane or the like, is placed in a sterile container or on a sterile glass plate. This strip for convenience may be about 5 cm. wide. The previously prepared bone particles are then sprinkled on the sterile strip in a thin layer leaving an unsprinkled edge free of bone particles from 2–3 mm. from each side and end of the flexible carrier strip. The container or glass plate is then shaken gently to provide an even layer. Citrated or heparinized plasma, either human or animal, is then sprayed or dripped on the thin layer of bone particles in sufficient quantity to wet the entire surface. This will vary according to the size of the bone particles but will be approximately ½ cc. of plasma per 2 square cm. of bone particle layer. The plasma should be sterile and not over 24 hours should elapse between the time of its collection and the time of its use.

Following the application of plasma, thromboplastin containing 500 units per cc. or more is sprayed over the bone and plasma layer, it being sufficient to use ¼ cc. of thromboplastin per 2 square cm. of surface. The treated layer with its mixture of plasma and thromboplastin is next gently pressed with the fleshy part of the forefinger or a small rubber cushion and the edges of the strip are gently patted inwards. The sterile container or glass plate is gently tilted for about 5 minutes to let the excess fluid drain and the drained layer is then gently pressed as in the previous pressing step. The bone mat thus formed supported by the cello-

phane carrier strip may now be rolled upon itself, placed in a sterile tin container and sealed air-tight or it may be stored in a glass container and sealed air-tight.

The procedure outlined above for preparing the bone mat composition of the present invention is applicable particularly in the case where human plasma is used. In the event that animal plasma is used, best results are obtained if the steps involving spraying with plasma and then with thromboplastin are repeated. It is also possible to form a thicker layer of bone mat by repeating the entire process a number of times and then building up a succession of layers.

The addition of the thromboplastin to the plasma, which contains fibrinogen, results in the formation of a fibrin network which enmeshes the bone particles and holds them together thus forming a bone mat.

It will be apparent that the flexible plastic carrier strip serves to support the bone particle layer during the treatment with plasma and thromboplastin and permits rolling so that the strip can be effectively stored. The bone mat comprising bone particles enmeshed in a fibrin network can be removed from the carrier strip by a roll-off operation as shown in Fig. 3 of the drawings.

The final bone mat composition of the present invention may be looked upon as the bone particle-fibrin network layer and it is possible to store this layer either flat or rolled. For convenience it is desirable to store the bone mat layer rolled and with the carrier strip affixed. At the time of ultimate use the bone particle-fibrin mat is removed from the carrier strip.

In using the composition of the present invention in bone surgery, the surgeon merely unrolls the slightly humid bone mat and removes it from the plastic carrier strip. A strip of bone mat prepared with 1–2 mm. bone particles which is 5 cm. wide and 10 cm. long can be rolled without the plastic carrier strip into a bone roll 5 cm. long and 1½ to 2 cm. in diameter which may be used in ways which will be apparent to the skilled surgeon.

In addition to being much easier to use and less time consuming, the bone mat of the present invention encourages a more rapid regrowth of bone by the body as compared to the rate of regrowth where the usual bone graft method is used.

In describing the present invention a specific preferred example has been given. However, it will be understood that various modifications may be employed without departing from the spirit of the present invention as set forth in the appended claims. Likewise if prepared on a large scale certain modifications will suggest themselves as being applicable to mass production methods.

Having thus described my invention, I claim:

1. A bone roll for use in bone surgery in promoting regrowth of bone comprising a rolled flexible strip consisting of a multiplicity of unboiled particles of ground whole bone enmeshed in a fibrin network and held together thereby.

2. A flexible strip for use in bone surgery in promoting regrowth of bone comprising a multiplicity of unboiled particles of ground whole bone enmeshed in fibrin in the form of a bone particle-fibrin network and a thin, flexible carrier strip support for said network.

3. The invention of claim 2 further characterized by the fact that the carrier strip consists of a sterile strip of cellophane.

4. A bone roll for use in bone surgery in promoting regrowth of bone comprising a rolled flexible strip consisting of a multiplicity of unboiled particles of ground whole bone held together by a fibrin network and supported on a thin, flexible carrier strip.

5. A flexible mat which can be rolled into any desired length, thickness and shape for use in bone surgery in promoting regrowth of bone comprising a strip consisting of a multiplicity of unboiled particles of ground whole bone enmeshed in a fibrin network and held together thereby.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,241,868	Reimann	May 13, 1941
2,398,077	Smith	Apr. 9, 1946
2,433,299	Seegers	Dec. 23, 1947
2,485,791	Tucker	Oct. 25, 1949
2,492,458	Bering	Dec. 27, 1949
2,517,772	Doub	Aug. 8, 1950

FOREIGN PATENTS

Number	Country	Date
18,601	Great Britain	A. D. 1897
474,093	Germany	Mar. 26, 1929

OTHER REFERENCES

Drug and Cosmetic Industry, May 1937, page 727, "Stimulating Bone Growth."

Blaine, "Experimental Observations . . ." Annals of Surgery, January 1947, pages 102 to 106, 108 to 114, especially at page 108.