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DERMATOME AND METHOD OF EXCISING SKIN

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FIG. 1

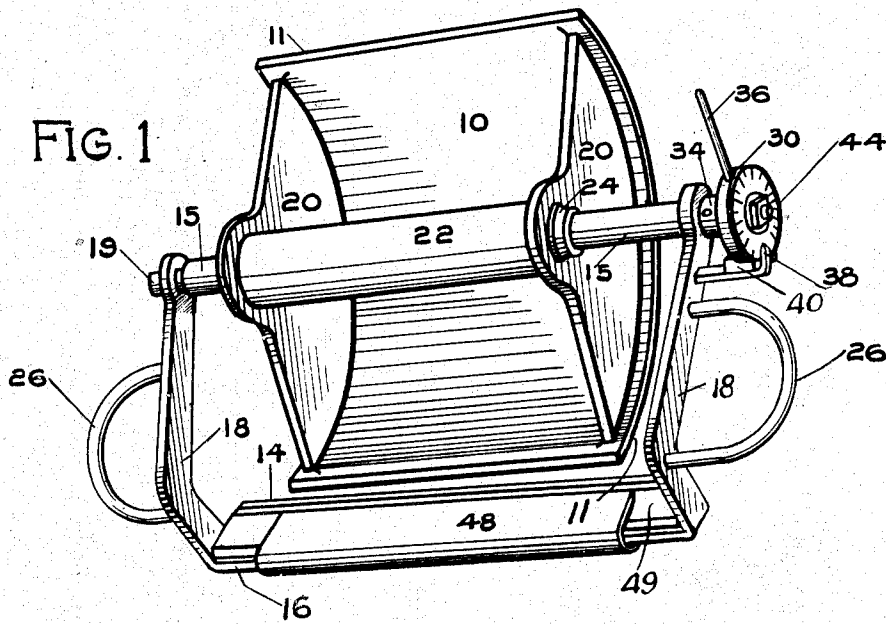


FIG. 2

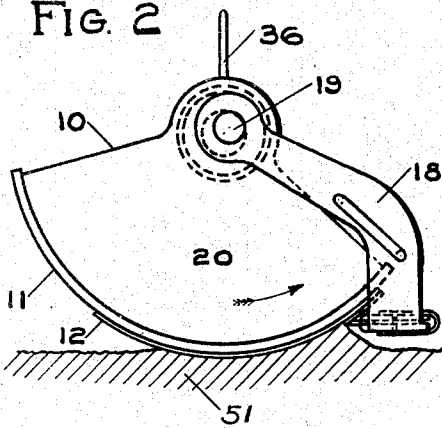


FIG. 3

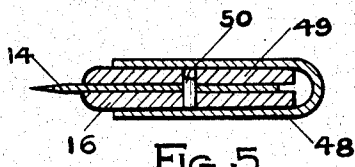
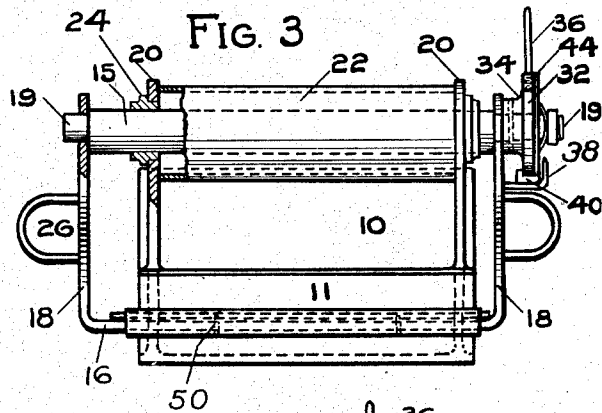


FIG. 5

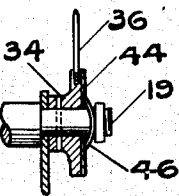


FIG. 6

FIG. 7

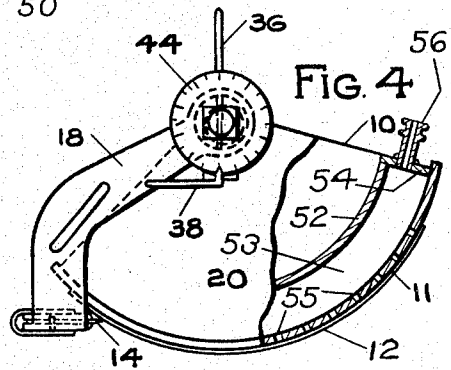
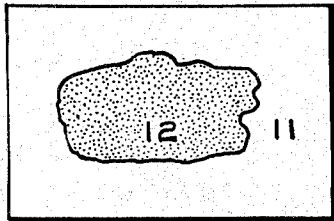


FIG. 4

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DERMATOME AND METHOD OF EXCISING SKIN

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16 Claims. (Cl. 128—305)

This invention relates to a dermatome and a method of cutting a skin graft.

Skin cutting devices have been proposed heretofore which have either injured the skin as by perforating the same, or have not succeeded in cutting skin grafts of uniform thickness and a predetermined area. It is desirable that the patient be subjected to the least possible injury and that the skin removed be no larger than required for the operation. Also, the skin graft should be properly handled and protected during the cutting operation so that it will satisfy the exact requirements of the surgeon.

The primary objects of this invention are to provide a method of cutting a skin graft and to furnish a device therefor which has the above specified qualifications and which is simple in construction, easily operated and may be efficiently and safely used, and which in particular will cut an exact shape and area of skin graft of a required and controllable thickness. Further objects will be apparent in the following disclosure.

Referring to the drawing which illustrates a device capable of satisfying the above objects:

Fig. 1 is a perspective view of the dermatome;

Fig. 2 shows in vertical elevation the left hand end of the device in position for cutting a graft;

Fig. 3 is a front elevation, partly broken away, to show details of the construction;

Fig. 4 shows in elevation, partly broken away, the right hand end of the device of Fig. 3, but modified for the application of suction to aid in lifting the skin;

Fig. 5 is a sectional view through the knife holder;

Fig. 6 is a detail in section showing the friction head and index plate; and

Fig. 7 is a plan of the under side of the cylinder carrying an adhesive coating thereon ready for a skin grafting operation.

My method of cutting a skin graft comprises the steps of lifting the skin of the patient's body by means of adhesive and cutting a thin section with a knife. The adhesive is preferably shaped to lift the exact predetermined area of skin required to be transferred. The operation is best accomplished by means of a cylinder having an adhesive surface, such as a coating of rubber cement, which is arranged to roll over the patient's body and progressively lift the skin while the operator cuts it. This cutting operation may be accomplished by means of a knife held in the hand but preferably by a knife which is mechani-

cally supported and reciprocated at a correct distance from the adhesive.

The dermatome which best carries out this method comprises a holder having an extensive surface as large as the skin graft to be cut, which is provided with an adhesive coating that will adhere to and lift the skin into position where it may be cut by a movable knife. The holder preferably comprises a cylindrical surface, which may be either a complete cylinder or a partial cylinder, that is mounted to roll over the body of the patient and to lift the skin by means of its adhesive coating just in advance of a reciprocable knife. The distance between the knife and the cylinder's surface is adjusted so as to give a desired thickness of graft; and the knife and the skin holder are so arranged that, irrespective of the movement of the holder along the body, the knife will remain at an exact distance from its surface and thus cut a graft of uniform thickness.

As illustrated, the dermatome comprises a holder 10 having a cylindrical surface 11 which in the present embodiment is a partial cylindrical surface of sufficient extent to roll over the patient's body and support as large a graft as will ordinarily be needed. The holder 10 is adapted to have an adhesive coating 12 applied thereto, which is preferably of the exact shape and area required for the skin graft. This adhesive is intended to stick to the skin of the body and lift it as the holder is rolled over the surface just in advance of the sharp edge of the knife blade 14. These parts are so mounted that the knife blade may be reciprocated, either by power mechanism or manually, parallel with the axis of the cylindrical surface 11 and the axial support of the holder, while the holder is itself forced to move steadily over the body surface. As the cutting operation proceeds, the cut portion of the skin adheres to the adhesive 12, and at the end all of the skin graft remains on the holder in a protected condition and ready for removal and its subsequent use by the surgeon.

In the preferred construction, the cylinder 10 is mounted on a shaft 15 in such a manner that the shaft may be rotated and reciprocated axially relative to the cylinder. This shaft pivotally supports a U-shaped frame 16, adapted to carry the knife, which has spaced arms 18 provided with holes through their upper ends arranged to form bearings rotatably fitting on reduced ends 19 of the shaft 15. The shaft 15 is much longer than the width of the cylindrical holder 10, so that the shaft 15 may be reciprocated through

the bearings or bushings of the holder. The skin holder 10 is mounted on two spaced arcuate side plates 20 rigidly secured thereto and further connected by a cylindrical member 22 of sufficient size to serve as a hand hold. That is, the member 22 may be 3 to 6 inches long and the dimensions of the other parts of corresponding size, so that the operator's hand may readily grasp the cylinder 22 and fit within the hollow cylindrical casing. Each of these end plates 20 is provided with a bushing 24 located axially of the cylindrical surface 11, and the central cylindrical portion of the shaft 15 is rotatably and slidably fitted within these bushings, so that the shaft and the knife supporting frame 16 may be moved endwise by means of one of the handles 26 secured on the upright arms 18 of the frame. At the same time, the operator may roll the surface 11 over the patient's body by means of the hand hold 22 and thus lift the skin in advance of the reciprocating knife 14 and cause it to be cut as it adheres to the adhesive layer 12.

In order to vary the thickness of the graft, I provide means for moving the knife edge and the holder surface 11 relatively towards and from each other, and for holding the parts in the desired relationship. To this end, the reduced ends 19 of the shaft 15 are arranged eccentric to the axis of the main portion of the shaft 15 and the cylindrical surface 11; so that when the frame 16 is rotated about the shaft, the holder 10 and the knife 14 may be moved towards or from each other. Mounted on and near the end of shaft 15 is a sleeve or head 30 having a cylindrical surface 32 and a reduced portion 34. The reduced portion 34 fits onto the eccentric 19 and these parts are suitably pinned together to hold them in a fixed relationship. A handle 36 aids in rotating the head 30 and the shaft 15 relative to the frame.

Relative rotation between the frame and the shaft may be normally prevented by a friction device. For this purpose, an arm 38 projects laterally from the right hand frame member 18, on which is mounted a block of rubber 40 or other suitable friction material having an arcuate surface shaped and arranged to fit snugly against the cylindrical surface 32 of the head 30 and thereby provide sufficient friction to hold the head 30 from being turned easily and unless a considerable force is applied through the lever 36. The outer end of this arm 38 is upturned to form an index pointer. An index disk 44 is rotatably mounted upon the extreme right hand end of the shaft 15, which is suitably graduated and provided with a zero point so that the parts may be properly set. This disk is held frictionally against the flat end face of the head 30 by means of a spring washer 46 held in place by a nut. Hence, the index disk and the head 30 will normally rotate together but may be relatively adjusted to set the index.

By means of this construction, the operator may turn the head 30 and shaft 15 against the friction of block 40 by means of the handle 36 and thus move the off-center axis of the shaft up or down as desired. The index plate 44 may be first moved relative to the head 30 until a zero mark thereon is opposite the pointer when the knife 14 touches the adhesive surface 12. Then, by rotating the head 30 and shaft 15 within the eccentric bearing in the frame ends 18, the operator may move the knife 14 away from the holder 10 and its adhesive and thus determine that thickness of the skin graft to

be cut. In normal use of the device, the friction of the rubber 40 on the head 30 causes the knife supporting frame and the shaft 15 to remain fixedly connected as they are reciprocated relative to the rotating cylinder 10; hence the graft thickness will not be varied.

The knife may be suitably mounted on the supporting frame 16, as shown particularly in Figs. 1 and 5. The knife 14 comprises a thin piece of sheet metal of a length as great as or greater than the width of the cylinder 10. A U-shaped spring metal clip 48 projects over the bottom portion of the U-shaped frame 16, and a spacing block 49 is located above the knife blade. Two pins 50 in aligned holes in the blade, the frame 16, and the spacer 49 serve to hold these parts together so that the knife cannot move relative to its support. Pins 50 are fixed to and extend upwardly from that part of frame 16 underlying blade 14 to receive the blade and block 14 and 49 respectively. It will thus be seen that the parts are readily removable and replaceable, since it is merely necessary to pull the clip 48 off sideways and thus release the blade from its clamping block and so permit it to be sharpened or renewed.

The operation of the device and the method of cutting skin from a patient's body involves placing a coating of adhesive on the outer cylindrical face 11 of the partial cylinder 10. This adhesive may be a suitable material, such as rubber cement, applied directly to the smooth surface 11 of the cylinder as indicated in Fig. 7. Likewise, rubber cement may be applied to the skin of the patient in the area to be cut. A satisfactory adhesive comprises a rubber sheet of proper size and shape which is coated on both sides with a soft adhesive rubber compound of suitable adhesive properties. This material may be of that type which has cloth covering both adhesive faces, so that by removing the cloth from one face the rubber strip may be pressed securely and firmly against the cylindrical surface 11 and thus be made to adhere thereto. When the device is to be used, the cloth coating on the outer face of the rubber adhesive strip is removed. The surface of the cylinder 10 may be made of a suitable material, such as wood, metal, resinoid or other substance that is appropriate for the purpose.

It is ordinarily desirable that the skin be cut to an exact area and dimension as well as thickness. Hence, the rubber adhesive strip may be previously cut to match the correct area of the skin graft to be made as indicated in Fig. 7. Then this rubber strip 12 is placed on the surface 11 of the cylinder in a predetermined and correct position and secured firmly thereto. The cylinder will now be adjusted so that the zero setting on the index plate is such that the sharp edge of the knife 14 just touches the outer surface of the rubber strip. Then by means of the handle 36 and the graduations on the plate, the eccentrically mounted shaft may be moved until the rubber adhesive is now at a predetermined distance away from the knife edge which represents the thickness of the graft to be cut. With the parts thus assembled and with the outer protective covering removed from the rubber adhesive, the instrument is placed on the patient's body 51 with the forward edge of the adhesive ready to contact with the body. Then the operator grasps the handle 22 with one hand and one of the handles 26 with the other to position the parts, after which he carefully rolls the

cylindrical surface 11 across the body of the patient, around shaft 15 in the direction of the arrow in Fig. 2 and at the same time reciprocates the knife 15 back and forth by so moving frame 18 and thus cuts into the skin. The adhesive 12 tends to pull the skin up into the position shown in Fig. 2, so that as the knife is reciprocated the skin will be readily cut and it will adhere to the adhesive on the cylinder. The operator will later remove the skin from the adhesive and make such use as is necessary in the surgical operation.

Various modifications of this method may be adopted. For example, the entire surface of cylinder 10 may be coated with adhesive and then a non-adhesive powder, such as talcum, placed on that surface in the areas where it is not to stick to the skin. This may be easily accomplished by mixing the talcum with ether and then applying the same to the cylinder by means of a brush. The ether evaporates and leaves the talcum adhering to the rubber strip. One may also cut out a paper mask which will be secured to the cement around the skin graft area and thus prevent adhesion of the rubber adhesive to such portions of the patient's body.

The surgeon may find it desirable to leave the skin graft adhering to the rubber and strip them together from the cylinder and thus apply the graft to the patient's body before the rubber adhesive is removed. This serves to protect the skin graft and particularly prevents it from shrinking or otherwise getting out of shape. To expedite this method, I may utilize the construction shown in Fig. 4, wherein a suction box is provided for holding a strip of rubber adhesive in position. In this construction, an inner wall 52, side walls 53 and end walls 54 are suitably secured in position between the end walls 20 on the inside of and spaced from the cylinder 10 and the parts are so constructed as to form a closed space. The effective area of the wall 11 is provided with small closely spaced holes 55 therethrough, so that suction may be applied to a rubber sheet 12 and thus hold it against the outer face 11 of the cylinder. A tube 56 passing through an end wall 54 connects with this inner space and is constructed to make a tight fit with a flexible hose pipe through which the air may be exhausted by a suitable pump. The rubber sheet has adhesive applied on only its outer face for engagement with the skin. By this construction, the rubber sheet may be held in position solely by the partial vacuum within the suction box formed by walls 10, 20, 52, 53 and 54, so that as soon as the skin graft has been cut, the rubber sheet 12 may be quickly removed by admitting air to the vacuum chamber and the graft applied in its new location without delay. It will also be appreciated that numerous other modifications may be made in the construction within the scope of the appended claims.

I claim:

1. A dermatome comprising a skin holder having an extensive surface, adhesive thereon to support and lift a skin graft, a shaft, a bearing for the shaft supported by said holder and permitting rotation thereof, a knife blade, a frame supporting the knife blade close to the holder for cutting the lifted skin which is pivotally secured to said shaft eccentrically of the shaft axis and means for rotating the shaft relative to the frame and thereby varying the distance of the knife blade from the skin holder.

2. A dermatome comprising a skin holder hav-

ing an extensive cylindrical surface and bearings arranged axially thereof, a shaft mounted in the bearings for relative rotation and reciprocation of the shaft and holder, a frame having bearing members spaced from the holder bearings which bearing members are mounted eccentrically of the shaft for rotation thereon, a knife on said frame for reciprocation therewith having its edge located close to the surface of the holder, means securing the frame and shaft in a desired eccentric position and thereby adjusting the distance of the blade edge from the holder and an index member on the shaft to indicate said distance.

3. A dermatome comprising a skin holder having a cylindrical surface, a shaft, means for rotatably supporting the holder on the shaft which permits reciprocation of the shaft relative thereto, a knife blade, a frame supporting the blade which has spaced bearings eccentrically mounted on the shaft, and a friction member on the frame and an index plate on the shaft which are arranged for rotating the shaft relative to the frame and thereby varying the distance of the knife blade from the skin holder and frictionally holding the same in said adjusted position.

4. A dermatome comprising a suction box having an extensive perforated surface, a removable strip having an adhesive coating on its outer side arranged to adhere to the patient's skin and covering the perforations in said box, means through which the air may be exhausted from the box so as to hold the strip in place, a knife mounted adjacent to the box, and means for reciprocably supporting the knife with its edge movable in proximity to the adhesive coating for cutting the skin adhering thereto.

5. A dermatome comprising a member having an extensive, perforated, convex surface rockable over the patient's body, means associated therewith which forms a box for applying suction to the perforated surface, a knife mounted adjacent to the box having its edge located close to said surface, and means for reciprocably supporting the knife with its edge movable in a line substantially perpendicular to the direction of rocking movement of said surface.

6. A dermatome comprising a movable holder having an extensive convex surface rockable on a patient's body and provided with an adhesive coating to progressively lift an area of skin by adhesion thereto, a knife blade, and means for supporting said blade close to the holder for a cutting movement so that it may cut a graft progressively as the skin is lifted.

7. A dermatome comprising a skin holder having an extensive convex surface rockable on the patient's body, an adhesive coating for causing a predetermined area of skin to adhere to and be lifted by said holder as it is rocked, a knife blade, and means supporting the knife blade for a cutting movement close to the holder so that it may progressively cut a graft of the skin as it is lifted.

8. A dermatome comprising a skin holder having an extensive convex surface rockable on the patient's body, an adhesive arranged to adhere to the holder surface and only that area of the skin of the patient which is to be cut so that the skin will be progressively lifted as the holder is rocked, a knife blade and means for reciprocably supporting the blade on the holder so that it may be moved relative to the holder and caused to cut a graft from the skin lifted thereby.

9. A dermatome comprising a skin holder having a convex surface rockable over the patient's

body, and an adhesive coating for causing a predetermined area of skin to adhere to and be lifted by said holder, a knife blade, means for supporting the knife blade for reciprocation close to the holder as the latter moves so as to cut the skin lifted thereby, and means for varying the relative distance between the knife edge and the skin holder so as to cut grafts of variable thickness.

10. A dermatome comprising a holder having a convex surface rockable over the patient's body, means associated therewith to lift the skin progressively as the holder rocks, a shaft, a bearing for the shaft supported by the holder, said shaft being arranged for axial reciprocation relative to the holder and bearing, a frame carried by said shaft, and a knife mounted on said frame close to the holder, said frame being arranged to be reciprocated with the shaft and to cut a graft progressively as the skin is lifted.

11. A method of excising sections of skin including the steps of coating the skin with an adhesive, rolling a smooth, continuous cylindrical surface over the skin to be excised, causing the skin progressively to adhere to said cylindrical surface, whereby said rolling step will lift the skin adhering to said cylindrical surface, continuously cutting the lifted skin and maintaining the section along which the severance takes place a predetermined distance from said cylindrical surface.

12. A method of excising sections of skin including the steps of coating the skin to be excised with an adhesive, rolling a cylindrical surface over the skin to be excised, permitting the skin progressively to adhere to said cylindrical surface whereby said rolling step will lift the skin, continuously cutting the lifted skin and

maintaining the line of severance a predetermined distance from said cylindrical surface.

13. A method of excising sections of skin including the steps of coating a cylindrical surface with an adhesive, rolling the cylindrical surface over the skin to be excised, causing the skin progressively to adhere to said cylindrical surface through the action of said adhesive whereby said rolling step will lift the skin, continuously cutting the lifted skin and maintaining a predetermined distance between said cylindrical surface and said line of severance.

14. A method of excising sections of skin including the steps of coating a section of skin to be excised with an adhesive, coating a cylindrical surface with an adhesive, rolling the adhesive cylindrical surface over said adhesive skin whereby said skin will progressively adhere to said cylindrical surface, and continuously cutting the skin simultaneously with said rolling step along a line a predetermined distance from said cylindrical surface.

15. The method of excising sections of skin which comprises coating an arcuate surface with an adhesive, holding the skin in an elevated position by rolling the coated arcuate surface thereover, and cutting the skin to present a sheet thereof substantially uniform in thickness while so held.

16. A dermatome comprising a movable holder having an adhesive surface shaped and arranged to move over a patient's body and progressively lift an area of skin by adhesion thereto, a knife blade, and means for supporting said blade close to the holder for a cutting movement so that it may cut a graft progressively as the skin is lifted.

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