June 27, 1967 C. P. VALLIS 3,327,711

SKIN GRAFTING DEVICE

Filed Dec. 13, 1963 2 Sheets-Sheet 1

FIG. 1

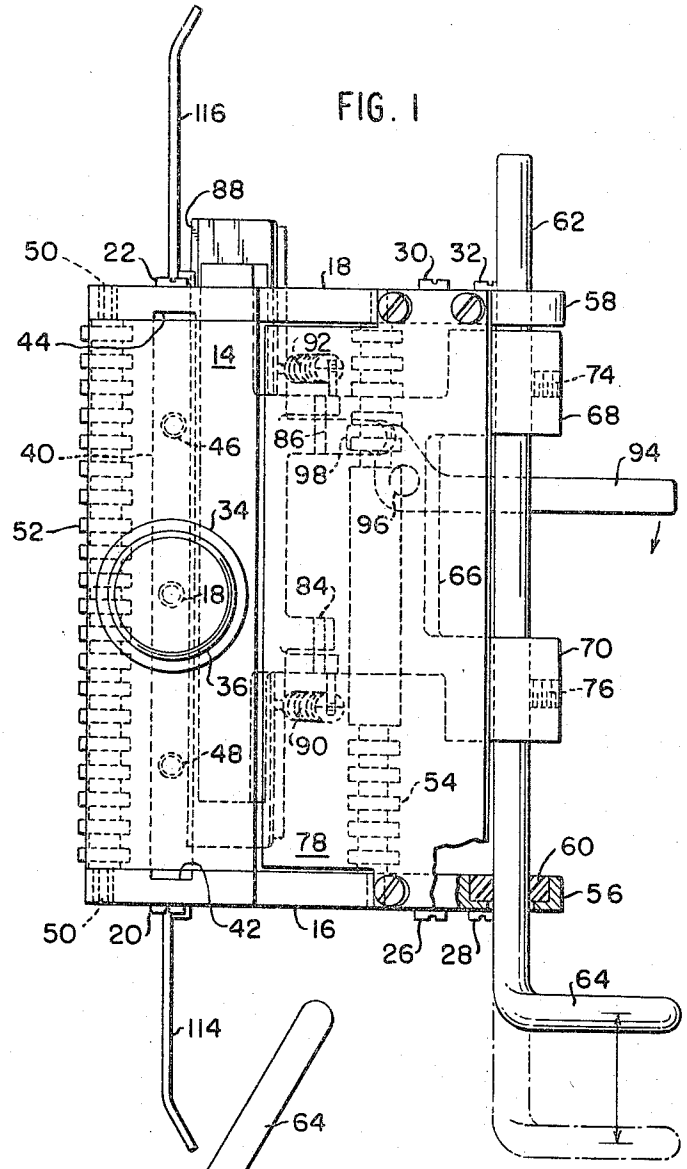


FIG. 2

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FIG. 3

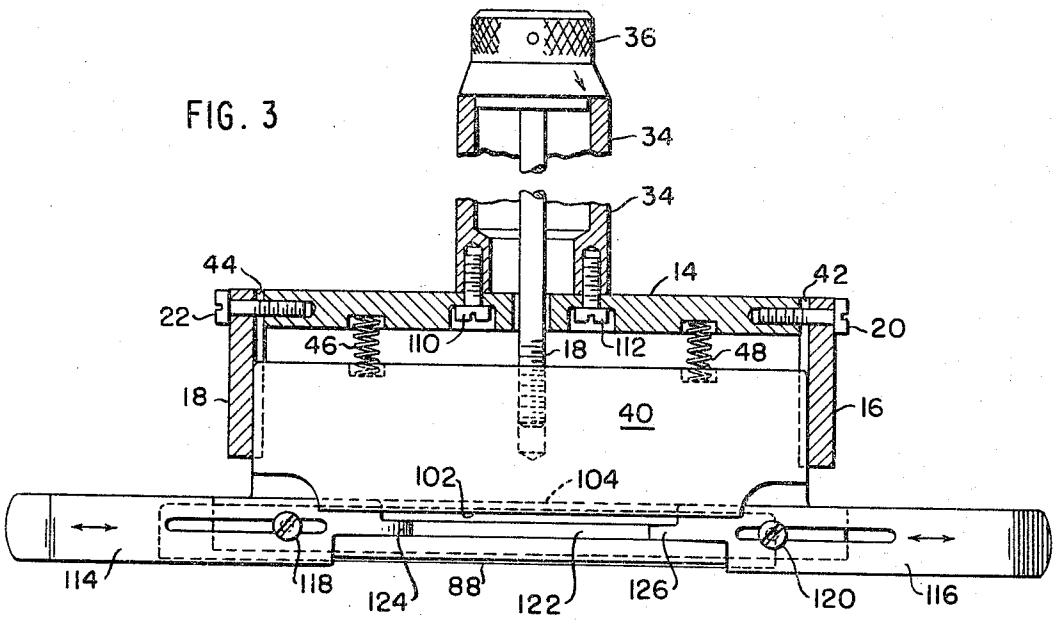
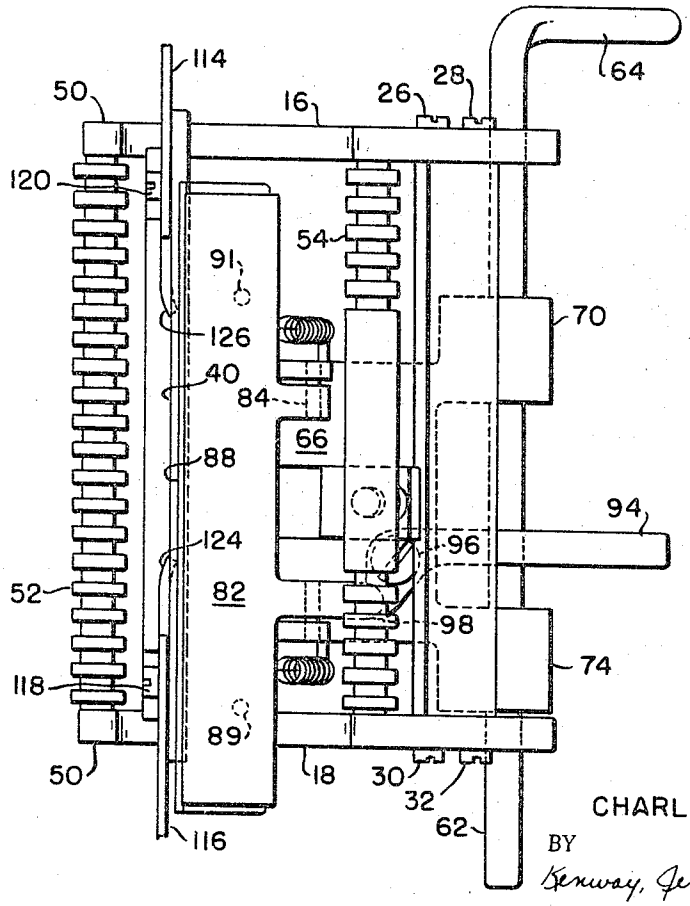


FIG. 4



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SKIN GRAFTING DEVICE

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8 Claims. (Cl. 128—305)

This invention relates in general to skin grafting and in particular to a manually operated precision dermatome for cutting a uniform segment of skin from the body surface.

Skin grafting is becoming an increasingly important operative procedure for cosmetic and functional repair and for reconstruction of soft tissue defects. Because the success of such procedures is dependent in large part on the quality and uniformity of the segment of skin used in the grafting, much thought has gone into the design of suitable instruments for taking intermediate split skin grafts.

Fundamentally, all of the dermatomes that have been developed follow the general principle of placing a sharp cutting edge in close apposition to the skin surface. To accomplish the desired relationship between the blade and the skin, numerous techniques and devices have been proposed and used. In one well known technique, a vacuum device is utilized to elevate the skin and to maintain it at the edge of the blade. In other instruments the skin is literally glued to a metal drum or to a disposable member of cloth, rubber or plastic by which the skin may be elevated to a proper position relative to the cutting blade. In some instances the knife blade is reciprocated manually, and in other instruments an electric motor oscillates the cutting blade while the blade is held firmly against the skin.

Various refinements have been added to instruments of the type described including one wherein rollers are mounted ahead of and behind the oscillating blade to distribute evenly the tension in the skin as it is contacted by the cutting edge. Dermatomes such as those described have been reasonably successful, although much experience is usually required before the necessary degree of skill is ultimately developed by the surgeon.

There are also certain inherent problems associated with the use of the various instruments described. In those instruments where glue is used to raise the skin to the cutting position, the maintenance of consistent adhesive qualities in the glue is frequently difficult or impossible, preventing the necessary uniformity of cutting. Where a vacuum is used to raise the skin to the cutting position, a compromise must be made between easy manipulation of the instrument and the maintenance of sufficient vacuum to bring the skin to the desired cutting position. In those instruments which are electrically driven from a conventional source, the power cord impedes free movement and occasionally interferes with other equipment or supplies, inhibiting proper operation. Moreover, although explosion-proof motors have been developed, even where power cords are eliminated, there is always some risk of explosion because of the highly volatile and inflammable nature of anesthetic agents which are necessarily present during use of the skin grafting instrument. Also, of course, instrument sterilization is essential, and electrical equipment must be specially designed and protected to be so treated in an autoclave.

It is, therefore, a primary object of the present invention to improve and simplify the taking of skin grafts.

Another object of the present invention is to void the danger of explosion and the difficulties of manipulation and sterilization associated with electrically driven instruments.

A further object is to maintain not only predetermined uniform thickness of skin segments being cut from the skin surface, but also predetermined and uniform width of skin segments being cut from the skin surface.

A still further object is to standardize the taking of skin grafts by the utilization of replaceable knife blades.

In general, the present invention consists in a cutting instrument in which metal rollers are mounted in relationship to a cutting blade such that the skin is brought to the blade as a uniform mound of tissue against which the blade may be manually reciprocated by the surgeon. The rollers serve the additional function of permitting free and balanced movement of the instrument over the skin surface. A micrometer head provides precise vertical adjustment of blade guards to determine the depth of the cut, and the same blade guards are adjustable horizontally to vary precisely the width of skin being cut as the blade is reciprocated. The blade is retained in a holder which opens easily for quick change of blade, and the holder is also provided with a positive lock to retain the blade in a fixed position during use of the instrument. For a better understanding of the present invention, together with other and further objects, advantages and features, reference should be made to the following detailed specification thereof, which should be read in conjunction with the appended drawings, in which:

FIG. 1 is a top view, partly in section, of a preferred embodiment of an instrument built in accordance with the present invention;

FIG. 2 is a side view of the same instrument;

FIG. 3 is a sectional view of the same instrument, taken along the lines 3—3 in FIG. 2; and

FIG. 4 is a bottom view of the same instrument, showing particularly the cutting edge, blade guards and rollers.

In FIGS. 1 and 2, there may be seen a frame 12 which includes an upper cross-member 14 and upright members 16 and 18. The upright members are connected at their upper surfaces in fixed spaced relationship by the upper cross-member 14, into which screws 20 and 22 are threaded. The uprights are also connected together and spaced by means of a lower cross-member 24, which is firmly attached to the upright 16 by means of screws 26 and 28 and to the upright 18 by means of screws 30 and 32. The various frame members could, of course, be held in proper spaced relationship by other suitable connecting elements or, alternatively, the entire frame could be cast as a single piece.

Mounted upon the upper cross-member 14 is a handle 34, by means explained in greater detail below and shown in another view. The handle is preferably knurled or fluted in order that the instrument may be held by the operator without risk of slipping or other untoward movement. Adjacent the top of the handle 34 are various calibrated markings which serve in conjunction with a rotatable cap 36 to form a micrometer head. The cap 36 is also preferably knurled or fluted, and marked on the cap is a vertical line or arrow to show the rotary position of the cap relative to the handle 34.

Extending downwardly from the cap and through the handle 34 and the cross-member 14 is a shaft 38, a portion of the lower end of which is threaded. The threaded end of the shaft is screwed into a guard mount 40. The mount 40 is disposed for sliding movement in slots 42 and 44 formed in the inner sides of the frame uprights 16 and 18, respectively. A pair of springs 46 and 48 are compressed between the guard mount 40 and the upper cross-member 14. Suitable openings are formed in both the underside of the cross-member 14 and the top surface of the guard mount 40 to maintain the springs 46 and 48 in position. Movement of the cap 36 relative to the handle 34 causes the guard mount 40 to be advanced or retracted

in its slots against the loading provided by the springs **46** and **48**, the amount of such movement being indicated by the calibrations on the handle **34**.

At the forward or left-hand end of the uprights, as they are seen in FIGS. 1 and 2, are downwardly extending legs which are drilled to form openings for receiving nylon or Teflon bushings and a shaft **50**. Mounted on the shaft **50** is a grooved roller **52**. The shaft **50** and the roller **52** may be turned from a single piece or the rollers may be mounted upon stub shafts serving as pivots to permit free motion of the roller **52**. Similar extensions, openings and bushings are provided at the back or righthand end of the uprights to accommodate a roller **54**.

The uprights **16** and **18** also include upwardly extending portions **56** and **58**. Countersunk openings are formed in the two upward extensions, and bushings preferably made of Teflon, nylon or other suitable material are pressed in the openings. The bushing **60** shown in the section of the upward extension **56** is identical to that utilized in the upward extension **58**.

Mounted for reciprocal movement in the bushing **60** and its counterpart in the upright **58** is a shaft **62**. One end of the shaft **62** is turned through a 90° angle to form a handle **64**. A yoke **66** is attached to the shaft **62** by means of collars **68** and **70** and set screws **74** and **76** which are threaded into the collars to bear against the shaft **62**. Mounted on the upward extensions **56** and **58** is a guide plate **78** which extends downwardly and forwardly into the center of the frame for purposes explained in detail below. The yoke **66** extends beneath the guide plate and supports a fixed blade-holding element **80**. The fixed element may, in fact, be integral with the yoke **66**. A movable blade-holding element **82** is pivoted from a pair of lugs **84** and **86** and cooperates with the fixed holder **80** to hold a blade **88** sandwiched between the blade-holding members. A pair of springs **90** and **92** are attached between pins on the yoke **66** and pins on the movable blade-holding member to insure toggle action in order that the blade-holding elements may be held in either a fixed open position or a fixed closed position.

In addition to the toggle, a positive lock is provided to prevent movement or slipping of the blade **88** between the blade-holding members **80** and **82**. It consists of a lever **94** which pivots upon a pin **96** set in the yoke **66**. The outer end of the lever **94** extends beneath the shaft **62** outwardly to a position where it may be easily manipulated. The inner end of the lever **94** projects beneath an extension **98** formed adjacent one of the pivots of the movable blade-holding element **82**. With the inner end of the lever **94** between the yoke and the blade holder extension **98**, the movable blade-holding element may not be rotated. Extending downwardly from the yoke is a guide-post **100**, at the lower extremity of which two bearing buttons of Teflon, nylon or other suitable material are provided, the button **106** being typical. The central area of the roller **54** is not grooved, and the buttons bear against the smooth surface of the roller to aid in maintaining alignment of the blade and its supporting mechanism relative to the frame **12**.

Adjustment of the depth of cut is provided by the previously mentioned cap **36** and handle **34** which form a micrometer head. In FIG. 3, details of one method of attachment of the handle **34** to the upper cross-member **14** are shown. In this instance, a pair of screws **110** and **112** are used, but the handle could be threaded into the cross-member or other suitable mechanical means could be used. Also, in FIG. 3, the retaining openings for the springs **46** and **48** in the upper cross-member **14** and the guard mount **40** are clearly visible. The lower edge of the front of the guard mount plate **40** is relieved to form a shoulder **102**, and a vertical slot **104** is formed in that shoulder to accommodate a pair of slideable transverse blade guards or masks **114** and **116**. The guards are retained in the vertical slot of the guard mount **40** by means of screws **118** and **120**. The screws **118** and **120** pass through horizontal slots in the guards **114** and **116** and are threaded into the relieved portion of the mounting plate **40**. In addition to the vertical solt formed in the lower edge of the mounting plate **40**, a horizontal slot **122** is also formed in the front of the relieved portion of the plate. The guards **114** and **116** are provided with key tongues **124** and **126** which closely fit into the slot **122** and serve as guides for the guards when they are moved.

In FIG. 4, the underside of the instrument is shown in some detail. The arrangement of the movable blade-holding member and the locking of that member by the lever **94** may be seen quite clearly. The lever **94** pivots upon the pin **96** which is set in the yoke **66**. Beyond the pin **96**, the operative extension of the lever **94** may be seen to project beneath the extension **98** of the movable blade-holding element **82**, preventing accidental rotation of the element from its closed position. Also, the bearing buttons and their relationship to the smooth central portion of the roller **54** may be seen. The bearing buttons serve to assure maintenance of alignment betwene the movable yoke and the roller **54** which is, of course, fixed in position relative to the frame **12**.

The action of the guards or masks **114** and **116** may easily be understood by reference to FIGS. 3 and 4. As is obvious, the close fit of the guards **114** and **116** themselves in the vertical slot **104** and the similar close fit of the key tongues **124** and **126** in the horizontal slot **122** serves to prevent undesired movement of the masks in either of two planes after they are set by the locking screws **118** and **120**. Rotation of the cap **36** causes the guards **114** and **116** to be raised or lowered, varying the vertical exposure of the blade **88** in the area between the masks.

Blade replacement is effected by moving the lever **94** to the unlocked position and snapping the movable blade-holding element to its open position. Two or more pins, such as the pins **89** and **91**, extend from the surface of the blade-holding element **82**, and openings are formed in the surface of the other element to accommodate the pins. Corresponding openings are provided in the blade **88**, and it is thus held in fixed position when the blade-holding members are snapped together and locked by movement of the lever **94**.

In operating the device, the surgeon first sets the guards **114** and **116** to obtain a desired width of cut. He then adjusts the cap **36** relative to the handle **34** to lift the marks **114** and **116** to a point at which the proper blade exposure for the desired depth of cut is obtained. FIG. 2 illustrates the actual operation of the instrument after the desired settings are made. The instrument is held by the handle **34** against the skin from which a segment is to be taken. With a light amount of pressure on the instrument, the skin is brought up behind the roller **52** as a uniform mound of tissue. The instrument is moved over the skin surface steadily and easily. The front or mounding roll **52** and the rear roll **54** are in fixed position so that the elevated mound of tissue at the edge of the blade is always uniform and under the same tension. Accordingly, the skin being cut away is completely uniform regardless of the consistency of the underlying soft tissue. The handle **64** is reciprocated by the other hand of the surgeon in a simple to-and-fro motion to slice a uniform segment of skin. To avoid any variable factors in operating the device, it is desirable that the blade **88**, which as noted is replaceable, should be a new blade in each operating procedure. The skin segment being removed rides up over the fixed blade-holding element **80** and over the depending edge of the guide plate **78**, from which it may easily be removed.

Although what has been described constitutes a preferred embodiment of the invention, various modifications and changes will occur to those skilled in the art upon a reading of the foregoing specification. For ex-

ample, the vertical blade exposure adjustment need not be incorporated within the handle, nor must the handles be formed exactly as shown. Other operators might prefer independent adjustment or different configurations of handles or levers. Similarly, the horizontal adjustment of the blade guard might well be changed so that a single member or a portion of such a member might be moved to obtain desired width of blade exposure. These and similar modifications or variations of design are believed to be within the preview of the present invention which should be limited only by the spirit and scope of the appended claims.

What is claimed is:

1. In a dermatome for taking segments from the skin surface, said dermatome including a frame and a pair of rollers mounted in parallel spaced relationship for rotation in and beneath said frame, the combination of a cutting blade disposed in said frame between and parallel to said rollers, means for applying said rollers to said skin surface, a hollow handle attached to said frame whereby said frame may be manually moved over said skin surface with said rollers maintained in contact therewith to cause said skin to rise in a uniform mound between said rollers in close apposition to said blade, a guard masking the cutting edge of said blade, means within said hollow handle attached to said guard for adjusting the amount of vertical exposure of said blade in accordance with the position of said guard relative to said blade, and means for manually reciprocating said blade in said frame along a line parallel to said rollers during movement of said rollers over said skin surface to cut a segment therefrom.

2. In a dermatome for taking segments from the skin surface, said dermatome including a frame and a pair of rollers mounted in parallel spaced relationship for rotation in and beneath said frame, the combination of a hollow handle attached to said frame, a cap disposed upon said handle and rotatable relative thereto, a cutting blade disposed in said frame between and parallel to said rollers, a guard adjacent to and aligned with said blade, a threaded shaft connecting said guard to said cap whereby rotation of said cap varies the vertical exposure of said blade to vary the depth of cut of segments from said skin surface.

3. In a dermatome as defined in claim 2, the further combination therewith of cooperating calibration markings on said handle and said cap, said calibrations being related to the vertical position of said guard relative to said blade, whereby a micrometer head is formed.

4. In a dermatome for taking segments from the skin surface, said dermatome including a frame and a pair of rollers mounted in parallel spaced relationship for rotation in and beneath said frame, the combination of a yoke disposed for reciprocal movement in said frame parallel to said rollers, a fixed blade-holding element carried by said yoke, a movable blade-holding element pivotably mounted on said yoke, toggle apparatus connecting said yoke and said movable blade-holding element whereby said movable blade-holding element is releasably urged into a first position closely adjacent said fixed blade-holding element, a cutting blade retained between said blade-holding elements when said

movable blade-holding element is closely adjacent said fixed blade-holding element, said toggle apparatus releasably holding said movable blade-holding element in a second position remote from said fixed blade-holding element upon actuation thereof for removal of said blade.

5. In a dermatome as defined in claim 4, the further combination therewith of pins disposed in one of said blade-holding elements, the other of said blade-holding elements having openings formed therein for receiving said pins, said blade having similar openings formed therein for passage therethrough of said pins to hold said blade in a fixed predetermined position in said blade-holding elements.

6. In a dermatome as defined in claim 4, the further combination therewith of an extension formed on said movable blade-holding element and disposed within said frame and a lever pivotably mounted on said yoke, a projection of said lever being rotatable into a position beneath said extension to lock said movable blade-holding element in said first position.

7. A dermatome for taking segments from the skin comprising a frame, a pair of rollers mounted in spaced parallel relationship for rotation in and beneath said frame, an upper cross-member forming a portion of said frame, a first handle attached to said cross-member, a yoke mounted for reciprocation in said frame along a line parallel to said rollers, a fixed blade-holding element carried by said yoke between said rollers, a cutting blade mounted against said fixed blade-holding element, a movable blade-holding element pivoted from said yoke, a toggle for urging said blade-holding elements together in a first position for holding said blade therebetween, and a second handle attached to said yoke, whereby said dermatome may be held by said first handle with said rollers against said skin to bring said skin into close apposition to said cutting blade, and said second may be reciprocated to cut a segment from said skin surface as said dermatome is moved over said skin surface.

8. A dermatome for taking segments from a skin surface comprising a frame, a pair of rollers mounted for rotation in and beneath said frame with their axes in spaced parallel relationship, a cutting blade mounted for reciprocation along a line parallel to and between said rollers to cut segments from said skin surface as said rollers pass thereover, a blade guard adjacent said blade, a micrometer head mounted on said frame and connected to said blade guard to vary the exposure of said blade in a direction normal to the plane of the axes of said rollers, and means for adjusting the position of at least a portion of said guard along a line parallel to said axes to adjust the amount of exposure of said blade along said line.

References Cited

UNITED STATES PATENTS

1,594,613	8/1926	Hagen	128—305
1,935,605	5/1932	Altruda	128—305
2,457,772	12/1948	Brown et al.	128—305

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