

Feb. 24, 1970

C. STEINMAN

3,496,940

SURGICAL SUTURE AND SLING DEVICE

Filed Sept. 19, 1966

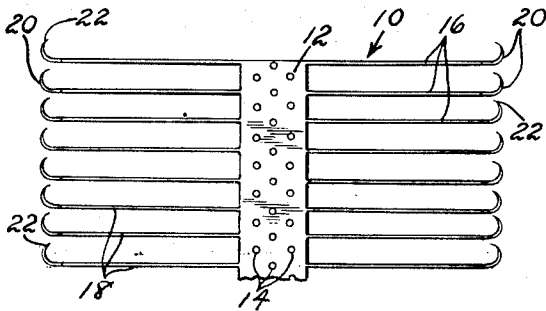


Fig. 1

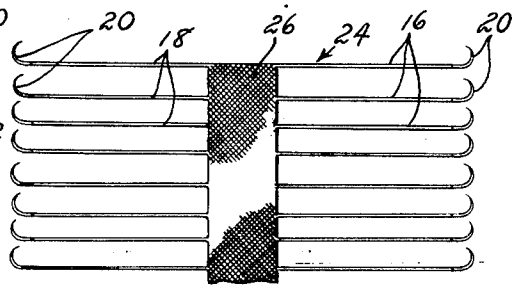


Fig. 2

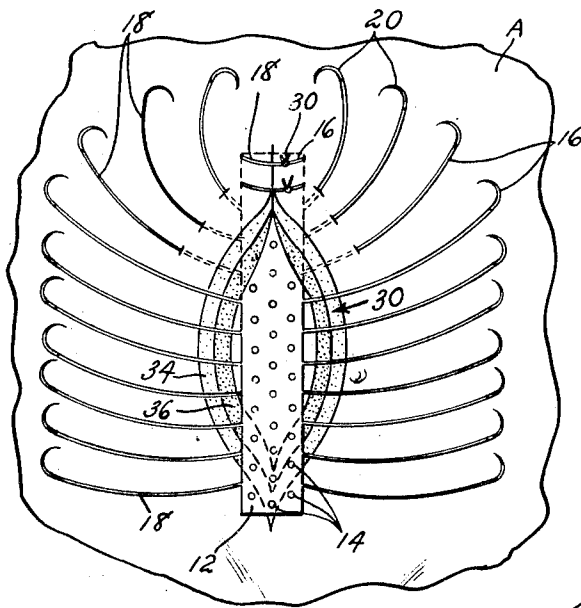


Fig. 3

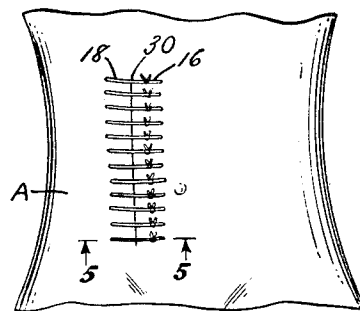


Fig. 4

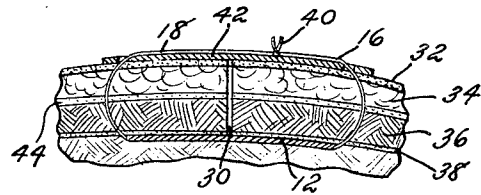


Fig. 6

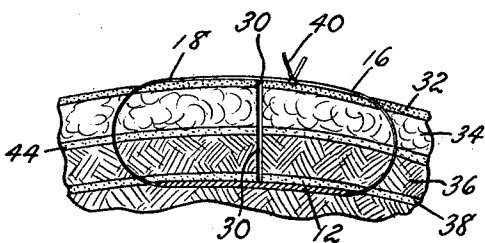


Fig. 5

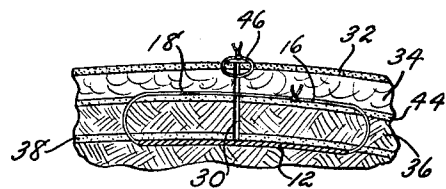


Fig. 7

INVENTOR.

CHARLES STEINMAN

BY

Edward F. Levy
ATTORNEY

1

2

3,496,940

SURGICAL SUTURE AND SLING DEVICE

Charles Steinman, 105 Stevens Ave.,
Mount Vernon, N.Y. 10550

Filed Sept. 19, 1966, Ser. No. 580,464

Int. Cl. A61b 17/08; A61f 13/00

U.S. Cl. 128—335

2 Claims

ABSTRACT OF THE DISCLOSURE

A combined suture and sling for closing an open wound or surgical incision, wherein an elongated strip of flexible hypo-reactive material is formed with a series of integral flexible filaments extending from each longitudinal side edge thereof. The filaments are sewn through the flesh on opposite sides of the wound opening and opposed pairs of filaments are drawn together across the opening and secured to each other to close the wound tightly, with the elongated strip underlying the wound opening and acting as a supporting sling on the under surface of the wound.

This invention relates to improvement in surgical wound closure means, and more particularly to a novel and improved wound closure device in the nature of a combined suture and sling for closure and internal reinforcement of a wound.

The device of the present invention is especially adapted for use in abdominal or thoracic surgery wherein an incision is made entirely through the abdominal or chest wall, or where the closure must be applied under considerable tension such as in the repair of an abdominal incisional hernia. Under present day surgical techniques, the incision wound is stitched together either in layers or by applying a plurality of spaced individual sutures through the full thickness of the wound in a line along the length of the incision. The sutures are conventionally in the form of flexible filaments made of silk, gut, nylon, metal wire, or the like, and each suture is individually applied by threading it on a curved surgical needle and passing the latter through the tissues at the edges of the wound. As the sutures are applied, they are individually tightened, looped and tied to hold the wound edges together.

In abdominal surgery, the aforementioned suturing techniques present several problems and difficulties. Because each suture is required to be applied with considerable tension, individual sutures are often drawn too tightly, causing necrosis of the impinged tissue and resulting separation of tissues. On the other hand, if individual sutures are drawn too loosely, the wound edges will separate in this area, resulting in slow healing, weakness of the wound, or herniation of inner tissues into and through the wound. Further, the wound area between individual sutures often leaves exposed raw edge surfaces on the inner surface of the wound, which, in the case of abdominal wounds, is engaged by internal organs, causing adhesions.

In accordance with the invention herein there is provided wound closure means in the nature of a combined sling and suture device including a flexible fluid-permeable strip of hypo-reactive material having spaced flexible filaments at each longitudinal edge. The strip is placed inside a wound or incision and the filaments are stitched through the tissues bordering the wound and secured together above the wound, to serve as sutures. The strip underlies the wound and acts as a supporting splint therefor, eliminating the aforementioned problems and difficulties, particularly in abdominal surgery.

An object of the present invention is to provide a wound closure device of the character described in which the

underlying strip permits placement of the filament sutures under considerable tension to draw together the wound edges without concentration of excessive tension along lines or points on the peritoneum and other wound surfaces, since peritoneal suture tension is distributed over the broad surface of the strip.

Another object of the invention is the provision of a device of the character described in which the underlying strip covers over the wound edges, preventing herniation of internal tissues into the wound, even if slight separation of the wound edges occurs.

Another object of the present invention is to provide a wound closure device of the character described, which not only reinforces the wound closure, but acts as a hypo-reactive covering for the internal edges of the healing wound to decrease the incidence of wound adhesions.

A further object of the invention is the provision of a wound closure device of the character described which has the advantages of rapid abdominal closure, suitability for use in the treatment of wound dehiscence or disruption, and adaptability for use as an abdominal wall closure for the repair of post-operative hernia procedures.

A further object of the invention is the provision of a wound closure device which may be used as a temporary wound closure and can be removed with relative ease when no longer required, or may be secured under the skin to act as a permanently implanted splint.

Additional objects and advantages of the invention will become apparent during the course of the following specification when taken in connection with the accompanying drawings, in which:

FIG. 1 is a partial plan view of a suture device made in accordance with the invention;

FIG. 2 is a partial plan view of a modified form of suture device made in accordance with the invention;

FIG. 3 is a plan view showing the manner in which the suture device of FIG. 1 is applied to an abdominal incision or wound;

FIG. 4 is a plan view of the abdominal portion of a human body, showing the suture device fully inserted and tied in place;

FIG. 5 is an enlarged section taken along line 5—5 of FIG. 4, and showing the suture device applied in exposed placement;

FIG. 6 is an enlarged sectional view similar to FIG. 5, but showing an outer protective strip applied in the exposed placement of the device; and

FIG. 7 is an enlarged sectional view similar to FIG. 5, but showing the suture device applied in buried placement.

Referring in detail to the drawings, there is shown in FIG. 1 a preferred form of sling and suture device 10 made in accordance with the present invention. The device 10 comprises a central elongated strip 12 made of a soft, flexible material which is hypo-allergic, and hypo-reactive, or of a delayed absorbable material. Preferably such material is a synthetic plastic such as "Teflon," "Dacron," nylon or the like, or may be made of cat gut. In the form shown in FIG. 1, the strip 12 is made of a thin flat material provided with multiple perforations 14 to permit passage of body fluids therethrough.

The device 10 also includes a plurality of evenly spaced filaments 16 which extend from one longitudinal edge of the strip 12, and a corresponding number of filaments 18 aligned with the respective filaments 16 and extending from the opposite longitudinal edge of the strip 12. The filaments 16 and 18 are secured to the edges of the strip 12 in any suitable manner, but preferably are integral therewith. That is to say, if the strip 12 is made of "Teflon," for example, the filaments are molded integrally therewith, or are drawn from the body of the strip in the process of manufacturing the latter. In any event, the filaments 16 and 18 are tough but flexible, and serve

3

as the sutures for the device, as will be presently explained.

The free end of each of the filaments 16 and 18 terminates in a rigid curved needle 20. Each needle 20 is made of rigid material in the arcuate shape shown, and has an edged cutting point 22 for piercing body tissue. The needles 20 may be the conventional semi-circular surgical needle of adequate dimension and shape and affixed to the suture in any conventional manner. Preferably, however, where practical, it is preferred to form the needles 20 of a rigid thermoplastic material so that including the central strip 12 with integral filaments 16 and 18 during manufacture of the device. Thus, a complete, unitary sling and suture device may be provided including the central strip 12 with integral filaments 16 and 18, and needles 20. Additionally, filament sutures may come off the top and bottom transverse edges of the strip 12 to further secure these edges.

The strips 12 may be made in varying widths, for example, in widths of one to three inches to fit various types of wounds or incisions. The filaments 16 and 18 are preferably spaced approximately one inch apart. In practice, the strips 12 may be made in assorted lengths or preferably in standard lengths sufficiently long to enable sections to be cut to suitable size at the time of surgery.

FIG. 2 shows an alternate form of device 24 similar to device 10 of FIG. 1 except that the central strip 26 is made of fine mesh material, preferably woven from strands of the synthetic plastics previously described. In other respects the device 24 is identical to the embodiment of FIG. 1, having spaced suture filaments 16 and 18 terminating in pointed needles 20.

The sling and suture device may be used either for buried placement beneath the skin, or for exposed placement in which the filament or suture ends are located and tied outside the skin surface. Surgical requirements will dictate the method of placement, and for purposes of illustration, both methods are shown and described with reference to the closure of an incision in the abdominal wall of a human body, wherein the incision is made completely through the wall to afford access to internal organs.

FIGS. 4, 5 and 6 show a portion of the abdomen A of the human body having an elongated incision 30 in the front abdominal wall. In FIG. 4 the incision 30 is shown entirely closed by the sling and suture device of the present invention in exposed placement. The strip 12 underlies and supports the incision 30 while the filaments or sutures 16 and 18 have pierced the abdominal wall bordering the incision and have been tied together outside the incision.

The cross-sectional view of FIG. 5 shows the detail of the abdominal wall as including the skin 32 and subcutaneous fat 34, the rectus muscle 36 with supporting fascia or tissue layers, and the inner membrane or peritoneum 38. The strip 12 is held firmly against the peritoneum 38 underlying the closed incision 30 by the filaments 16 and 18 which have been threaded through the entire abdominal wall from the interior of the abdominal cavity, utilizing the hooks or needles 20. The pairs of filaments 16 and 18 have been drawn tightly and tied together in external knots 40, and the needles 20 cut away.

FIG. 3 shows the manner in which the device 10 is inserted for exposed placement. While the incision 30 is open, exposing the abdominal cavity, the upper end of the strip 12, of suitable length, is inserted therein, and the two uppermost pairs of filaments 16 and 18 have been passed through the abdominal wall by means of their needles, and tied together. This closes the upper end of the incision and also serves to hold the strip 12 in its proper position. The remaining pairs of filaments 16 and 18 are then successively placed, the next three pairs of filaments being shown threaded through the abdominal wall in FIG. 3. After all of the filaments have been so placed by reaching through the incision into the abdomi-

4

nal cavity and passing the filaments outwardly through the abdominal wall, the matching pairs of filaments are tightened and tied, working downwardly, until the wound is completely closed, as shown in FIG. 4. After knotting, the excess lengths of filaments and terminal hooks or needles are cut away.

With the device in exposed placement, as described above, it may be readily removed after the wound has healed sufficiently to remain closed without sutures. For such removal, the external tied portions of the filaments are individually cut, the upper-most exposed suture exit is enlarged slightly, the underlying end of the strip 12 is grasped by a surgical tool and drawn through the small suture opening, carrying with it the cut ends of the filaments, so that the wound is free of foreign matter.

It will be observed that with the strip 12 underlying the incision and held firmly by the tightly secured filaments, the strip will act as a sling preventing separation of the incision edges between the sutures. In contrast to the use of individual sutures, there is no single point or line of tension on the peritoneum, but rather the peritoneal tension is distributed over the relatively broad surface of the strip. Even if incision separation should occur, the strip 12 still covers over the bottom surface of the incision, preventing inner tissue from herniating through the wound separation, as so often occurs. As a further feature, the underlying strip prevents the exposure of raw inner edge surfaces of the wound or incision, which surfaces often engage internal organs causing adhesions.

As tightly drawn filament sutures often have the tendency to cut or press into the skin, causing infection or scar deformities, the device of the present invention may be provided with means for preventing such undesirable occurrences. FIG. 6 shows the suture device inserted for exposed placement, in the same manner as in FIG. 5, except that an additional strip 42 is included to overlie the skin surface and the outer end of the incision. The suture device 10 or 12 is applied to the wound in the same manner as previously described, except that before the filaments are drawn and tied, the strip 42 is placed over the outer surface of the wound or incision, and the filaments are sewn through or over the strip 42 to hold it in position outside the wound. The strip 42 thus acts as a protective cushion between the skin and the outer tied ends of the filaments, preventing the latter from cutting into the skin. The strip 42 is preferably of a transparent material.

FIG. 7 shows the sling and suture device in buried placement, wherein it is tied under the skin as a permanently implanted splint. In this instance, the manner of application is the same as that previously described, except that the filaments are not sewn through the skin 32 or subcutaneous fat 34. Instead, these layers are spread apart and the filaments 16 and 18 are drawn and tied over the fascia layer 44 covering the rectus muscle 36. After the device is applied, the skin and layer of subcutaneous fat are closed by conventional individual sutures 46. When the wound has healed, the outer sutures 46 can be removed in the usual manner, but the device 10 or 12 is left permanently in place to support the inner tissues at the region of the wound.

While preferred embodiments of the invention have been shown and described herein, it will be obvious that numerous omissions, changes and additions may be made in such embodiments without departing from the spirit and scope of the present invention.

What is claimed is:

1. A combined surgical suture and sling device for closing and supporting an open wound, said device comprising an elongated strip of flexible hypo-reactive material of a length at least as long as said wound, and a plurality of flexible filaments formed integrally with and projecting from each longitudinal side edge of said strip, the filaments on each side of said strip being spaced along the length of said strip and being aligned with

5

the respective filaments on the opposite side of said strip, each pair of aligned filaments being adapted to extend outwardly through the flesh at opposite sides of the wound and to be brought together above the wound overlying the wound opening and secured together to serve as a suture for drawing together the edges of the wound opening with said strip underlying said edges of the wound opening and serving as a supporting sling, each of said filaments terminating in a needle sized and adapted to pierce the tissues bordering said wound from inside out, whereby to thread each of said filaments individually through said tissues.

2. A device according to claim 1 in which each of

6

said needles is integral with the end of a respective filament.

References Cited

UNITED STATES PATENTS

5	2,199,025	4/1940	Conn	-----	128—335
	3,124,136	3/1964	Usher	-----	128—334
	3,384,073	5/1968	Van Winkle	-----	128—334 X

FOREIGN PATENTS

10	1,021,977	1/1958	Germany.
----	-----------	--------	----------

DALTON L. TRULUCK, Primary Examiner