March 21, 1967 T. J. ROBERTS ETAL 3,310,199

ARTICLE DISPENSING UNITS REMOVABLE FROM AN ENCLOSING CASING

Filed March 22, 1965 3 Sheets-Sheet 1

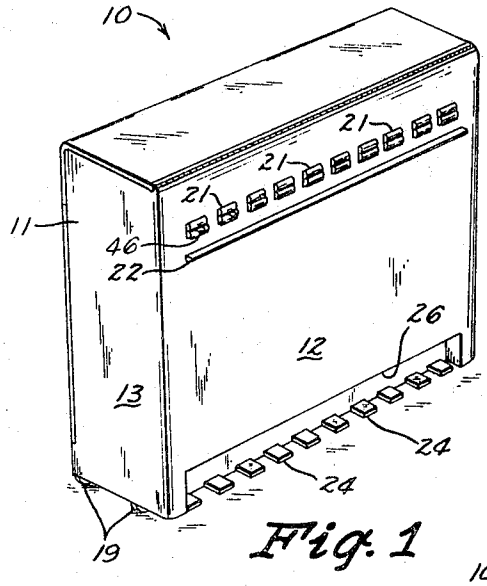


Fig. 1

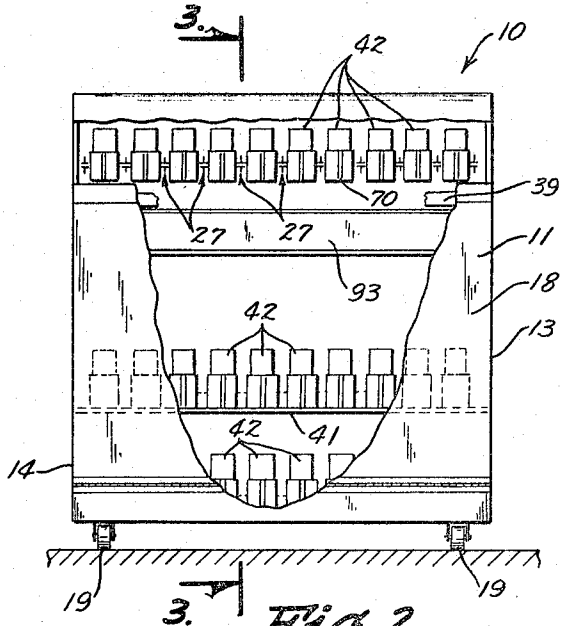


Fig. 2

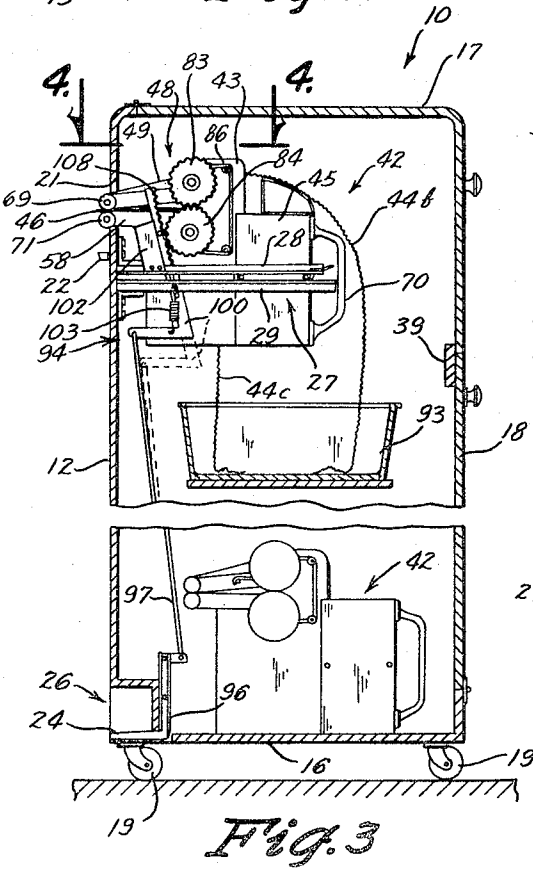


Fig. 3

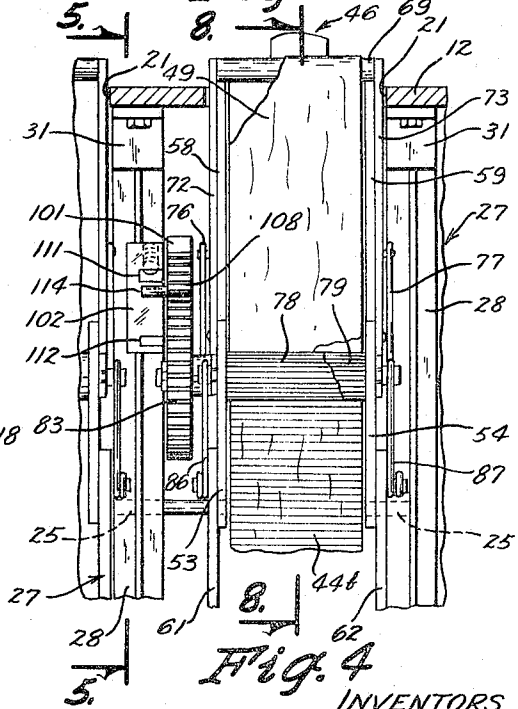


Fig. 4

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ARTICLE DISPENSING UNITS REMOVABLE FROM AN ENCLOSING CASING

Filed March 22, 1965 3 Sheets-Sheet 2

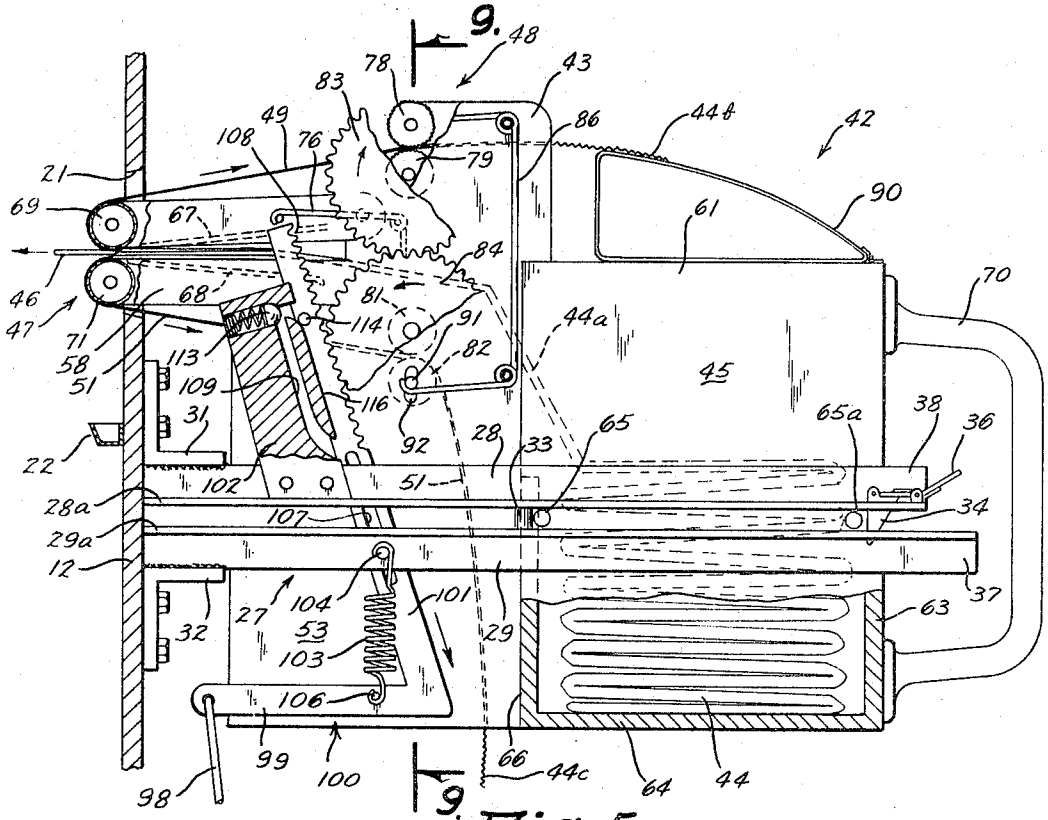


Fig. 5

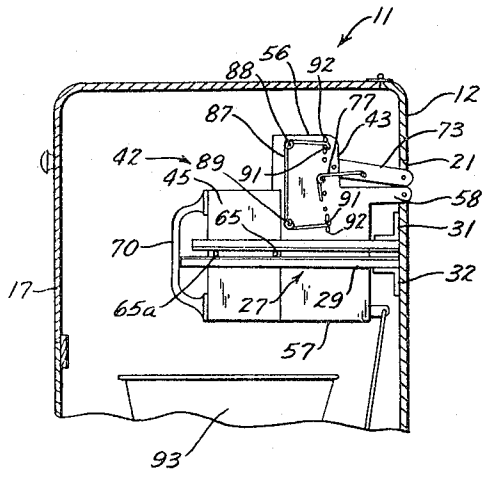


Fig. 6

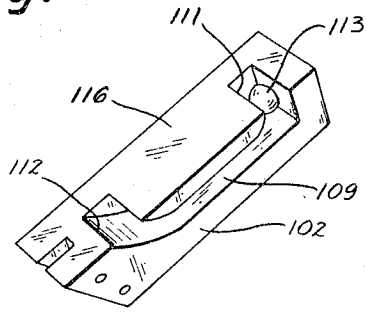


Fig. 7

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ARTICLE DISPENSING UNITS REMOVABLE FROM AN ENCLOSING CASING

Filed March 22, 1965 3 Sheets-Sheet 3

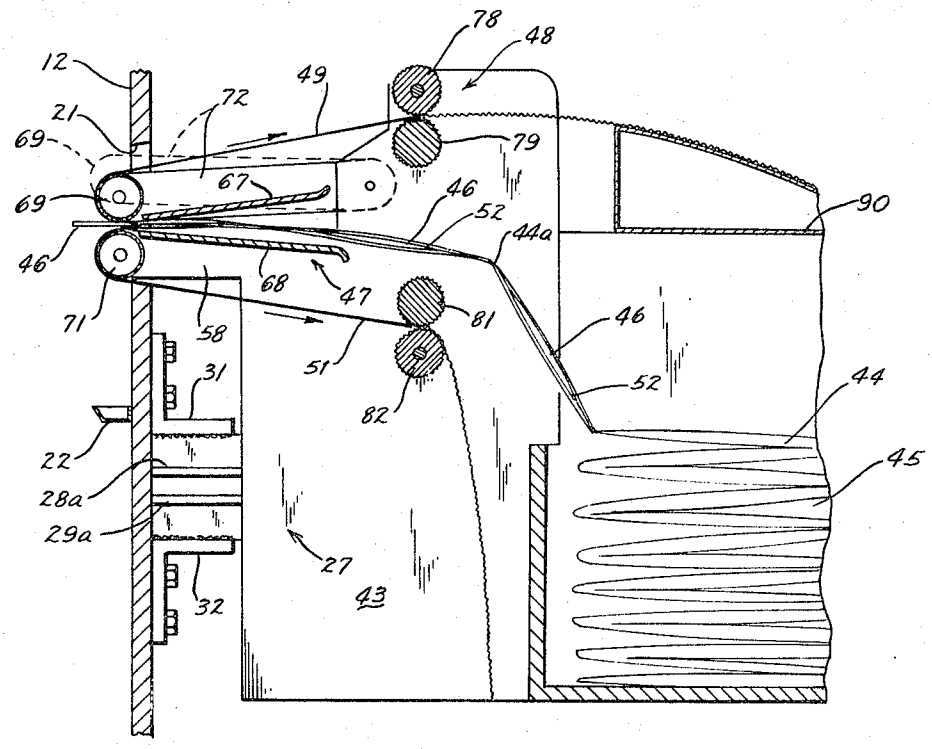


Fig. 8

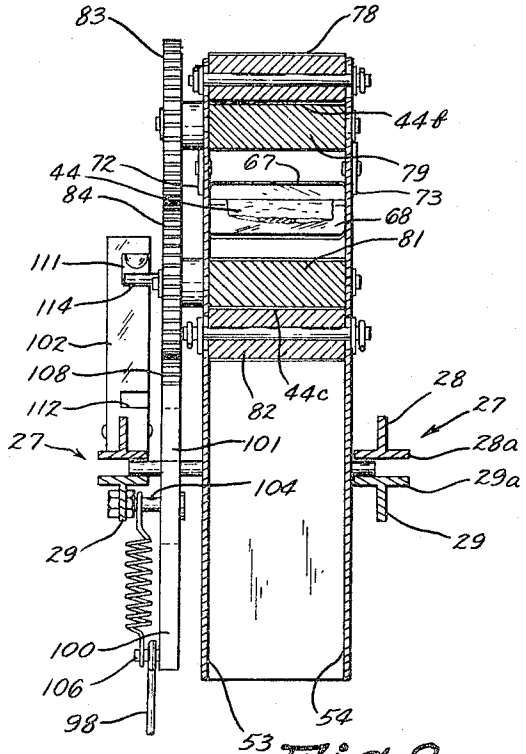


Fig. 9

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ARTICLE DISPENSING UNITS REMOVABLE FROM AN ENCLOSING CASING

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Filed Mar. 22, 1965, Ser. No. 441,482
2 Claims. Cl. 221—25)

This invention relates generally to sutures for stitching purposes, and particularly to individually dispensing sterile sutures and other relatively thin elements by a machine.

A suture is a strand or fiber used to sew parts of the living body together. It should be sterile when used. One method of sterile pre-packaging is the placing of a sterile suture in between a pair of strips of foil or the like, the insides of which are sterile. At the time of use, the strips are separated by hand. Due to the need of sterility, however, as the outer, exposed surfaces are non-sterile, an extra pair of hands must be used, in the operating room for example, to open the suture package for removal of the sterile suture by sterile hands.

In an attempt at even more sterilization, the picture is beclouded further by the placement of the suture package in between another pair of flexible, separable strips, whereby the non-sterile hands separate the first strips to empty out the sterile package for sterile hands. Other methods, just as cumbersome, are provided for dispensing sutures, one-by-one.

The clouded picture is made even more hazy by the fact that there are dozens and dozens of different sutures for different purposes, the sutures being of different length, thickness, strength, material, etc. The non-expert can begin to see a basis for a waste of sutures in the operating room, professional or make-shift, and the expert—particularly the hospital administrator, knows of the high amount of wastage of opened but unused sutures.

It is, therefore, an object of this invention to provide a means for dispensing one or more sutures which reduces substantially the waste of sutures.

It is another object of this invention to provide a means for dispensing sutures one at a time, the dispensing action literally stripping open a suture package in a sterile manner and presenting the suture for handling by sterile hands.

Yet another object of this invention is to provide a machine for individually dispensing sutures, whereby action of the operator, usually a nurse, results in first a stripping open of a suture package, secondly an extending of the suture outwardly of the machine toward the nurse, and thirdly in an exposure, to the nurse, of only the inner sterile surfaces of the package about the suture.

This latter object is all the more meaningful when it is realized that the mere dispensing of a suture through a hole, for example, would not accomplish all that is needed to be accomplished. As the suture must be grasped, were the fingers of the nurse to contact a non-sterile machine or cabinet front, not only would the suture be wasted, but the nurse would have to re-cleanse her hands.

Thus, an object of this invention is to expose or present to the grasping fingers of the nurse only the suture and the sterile inner portions of the package originally containing the suture.

Still another object of this invention is the provision of a machine for automatically dispensing in sequential, operator-controlled and timed steps, any number of relatively thin elements, without critical regard for size or shape.

Another object of this invention is the provision of a machine capable of attaining these objectives which can dispense any number of different elements, the different elements arranged in a side-by-side arrangement, whereby the operator can choose any one of the different elements; and further wherein a plurality of elements can be stored in the machine in a non-used but ready condition.

Yet another object of this invention is the provision of a machine capable of individually dispensing from a roll or the like, a plurality of thin elements in a sequential manner, and wherein a different roll of elements can be quickly and easily substituted for the first roll, without any actual physical handling or contacting of any of the elements.

Still another object of this invention is to provide a machine capable of individually dispensing in a sterile manner a suture or the like, which suture is one of any number of like sutures packaged in an end-to-end manner in an elongated web of material comprising a pair of flexible, superimposed strips between which the sutures have been inserted.

Another object of this invention is the provision of such a machine, wherein the dispensing is obtained by a foot actuated linkage, and the actuation being adjustable to adapt the machine to dispense elements of different length.

It is another object of this invention to provide a machine for individually dispensing a large number of individually wrapped sutures, the packages of which are joined end-to-end, and wherein the packaged sutures need not even be removed from the shipping carton therefor, assuming the carton is opened to permit a longitudinal withdrawal of the joined packages.

Still another object of the invention is to provide a machine capable of attaining all of the above mentioned objectives, which machine can easily be tailored to the needs of a user, is economical to manufacture, simple and rugged in construction, easily operated, and effective in operation.

These objects, and other features and advantages of this invention will become readily apparent upon reference to the following description, when taken with the accompanying drawings, wherein:

FIG. 1 is a perspective view of one embodiment of the present invention in the form of an enclosed machine;

FIG. 2 is a rear elevational view of the machine of this invention, with the rear broken away to show a plurality of dispensing units in place for present use, with other units stored in a ready condition for future use;

FIG. 3 is an enlarged, foreshortened sectional view taken along the line 3—3 in FIG. 2;

FIG. 4 is an enlarged, fragmentary sectional view taken along the line 4—4 in FIG. 3;

FIG. 5 is a sectional view taken along the line 5—5 in FIG. 4;

FIG. 6 is a reduced, fragmentary view of the side of the machine opposite from that of FIG. 3;

FIG. 7 is an enlarged, perspective view of a detail of a dispensing unit;

FIG. 8 is a sectional view taken along the line 8—8 in FIG. 4; and

FIG. 9 is a sectional view taken along the line 9—9 in FIG. 5.

Referring now to the drawings, one embodiment of the machine of this invention is indicated generally at **10** in FIG. 1. Generally, the machine **10** comprises a rectangular shaped housing **11** of any size depending upon considerations not pertinent to the invention, which housing **11** has a front panel **12**, side panels **13** and **14**, a bottom wall **16** (FIG. 3), a hinged top **17**, and a hinged back **10**. Casters **19** of a conductive material are mounted on the

bottom wall **16** of the housing **11** for safety purposes in an operating room.

Across the front panel **12** of the housing **11**, at the normal arm height for an average sized nurse are a plurality of horizontally spaced and aligned, substantially rectangular slots **21** (FIG. 1). Below the slots, a small drip pan **22** is mounted, the purpose of which is defined hereinafter. Then, at the bottom of the front panel **12** are mounted a plurality of horizontally spaced foot pedals **24**, again each foot pedal being vertically aligned with one slot **21**. It will be seen that the bottom front of the housing **11** is cut out at **26** whereby either foot of the nurse may easily be inserted above a foot pedal **24** for a depressing movement thereagainst.

Internally of the housing **11**, a trio of vertically spaced shelves are arranged across the entire width. The upper shelf comprises a plurality of horizontally spaced and aligned guide track units **27**, with each pair of adjacent units spaced on either side of a slot **21** (FIG. 4). Each unit **27** being the same, only one will be described.

Referring particularly to FIGS. 4 and 5, a guide track unit **27** comprises an upper T-bar track **28** and a lower T-bar track **29**, with the horizontal flanges **28***a* and **29***a* vertically spaced a predetermined distance. Each track is welded at one end to a bracket **31** and **32** respectively, with the brackets in turn being secured to the inner surface of the housing front panel **12**. A limit pin **33** (FIG. 5) is secured between the flanges **28***a* and **29***a* intermediate the ends of the tracks.

Adjacent the free ends of the tracks, a catch **34** is pivotally mounted for movement in a vertical plane through slots (not shown) provided therefor, which catch **34** is biased toward a position illustrated by a finger latch **36**. It will be noted that the free end **37** of the lower track **29** extends further than the free end **38** of the upper track **28**.

Referring to FIG. 2, the tracks **27** which comprise the upper shelf are all spaced above a cross brace **39** for the rear of the housing **11**, and with the top **17** hingedly moved upward, the entire upper part of the housing **11** is thereby exposed from above and to the rear of the upper part of the housing **11**. Below the cross brace **39**, the intermediate shelf comprises a horizontal panel **41**, and with the bottom shelf comprising the upper surface of the bottom wall **16**.

The three shelves are adapted to hold thirty suture dispensing units **42** of a magazine type, with each unit **42** being identical except for the type of suture held thereby. Thus, thirty different sutures may be held in the machine **10**, with the ten units on the upper, guide track shelf held in a presently usable position, and the twenty units placed on the lower storage shelves held in a future but ready position. With the units **42** being identical, only one will be described.

Each unit **42** comprises generally a frame **43** to which is secured a container **45** for holding a web **44** of individual sutures **46** (FIG. 8), a guide unit indicated generally at **47** in FIG. 8 for guiding the web **44** through a slot **21**, and a first actuating unit indicated generally at **48** for moving the web **44** through the guide means in a manner hereinafter described to expose and extend each suture **46** outwardly of the slot **21** and the forward portion of the guide unit **47**. As shown herein in FIGS. 4 and 5, for example, each suture **46** is actually a flat packet easily grasped and unfolded by the hand. Within the packet **46** is found the suture of a predetermined length and material, and which is attached to a predetermined needle for stitching purposes.

The web **44** includes a pair of parallel, identical, superimposed strips **49** and **51** of preferably flexible material. The strips are secured together by any bonding agent, or by heat sealing means and with a plurality of sutures **46** arranged in a longitudinally spaced, end-to-end manner. As best illustrated in FIG. 8, pockets **52** for retaining the sutures **46** may actually be formed, and it of course will be realized that the entire inner surface area of the web **44** is sterile, as are the sutures **46**.

The unit frame **43** includes a pair of vertical, parallel flat panels **53** and **54** (FIG. 9) having top and bottom edges **56** and **57** (FIG. 6) and including a pair of elongated stationary arms **58** and **59** (FIG. 4). At the rear of the panels **53** and **54**, the container **45** is mounted, and which also includes a pair of vertical, parallel flat panels **61** and **62** (FIGS. 4 and 5). The panels **61** and **62** are joined at their rear by a panel **63**, at their base edges by a bottom panel **64**, and intermediate their front edges by a short panel **66**. A handle **70** is secured to the rear of the container **45** to enable the nurse to push and pull, and otherwise handle the unit **42**.

Thus a box-like container is formed for supporting and holding the web **44** in an accordion folded manner. It is conceivable that were the web **44** in an open carton or box, or in a roll, for example, the container **45** could easily accommodate the web **44**. Referring to FIGS. 5 and 6, it is evident that a pair of horizontally spaced and aligned studs **65** and **65***a* protrude from the sides of the container **45**. It is further evident that by means of the studs **65** and **65***a* being inserted between the flanges of the guide track units **27**, the dispensing unit **42** is readily and easily interchanged with another unit having a different type of suture.

A lead portion **44***a* (FIG. 8) of the web **44** extends and is led through the guide unit **47**, which unit includes a pair of converging plates **67** and **68** forming thereby a gradually narrowing throat ended by a pair of rollers **69** and **71**. The lower plate **68** extends between and is secured to the stationary arms **58** and **59**, and the lower roller **71** also extends between and is rotatably supported by the arms **58** and **59** at their outermost limits.

Both the downwardly inclined upper plate **67** and the upper roller **69** are secured to and extended between a pair of arms **72** and **73**, similar to the stationary arms **58** and **59** and pivotally mounted thereabove by pivot pins **74** (FIG. 5). The upper arms, furthermore, are biased downwardly toward an engagement between the rollers **69** and **71** by a pair of L-type springs **76** and **77** mounted as illustrated. Thus, substantially any item of a relatively thin thickness may be passed between the stationary roller **71** and the floating roller **69**. See, for example, the upwardly pivoted position in FIG. 8 of the roller **69**, as illustrated in dotted lines.

The dispensing unit **42** is completed by the first actuating unit **48** which includes an upper pair of frictionally engaged, knurled rollers **78** and **79**, a lower pair of frictionally engaged, knurled rollers **81** and **82**, and a pair of meshed gears **83** and **84**. Both sets of rollers are rotatably mounted to and extended between the frame panels **53** and **54** on stud pins (see FIG. 9) or the like, and with the gears **83** and **84** mounted on extensions of the inner pair of rollers **79** and **81**.

The outer pair of rollers **78** and **82** are biased downwardly and upwardly, respectively, toward their adjacent rollers **79** and **81** by a pair of U-shaped springs **86** and **87** secured to vertically spaced projections **88** and **89**, and lapped over the extensions **91** of the rollers **78** and **82**. To accommodate a vertical floating of the rollers **78** and **82**, a pair of vertically elongated slots **92** are formed, each in a side panel **53** and **54**.

Each web lead portion **44***a* includes a pair of tabs **44***b* and **44***c* (FIG. 5) of indeterminate length, which are threaded, respectively between the upper pair of rollers **78** and **79**, and the lower pair of rollers **81** and **82**. Then, in response to clockwise rotation of the upper gear **83** (FIG. 5), and counterclockwise rotation of the lower gear **84** (FIG. 5), the roller pairs **78**, **79** and **81**, **82** are so rotated to draw both lead tabs **44***b* and **44***c* to the right as illustrated by the arrows in FIG. 5. This movement, when the web **44** proper is guided through the throat plates **67** and **68**, results in the strips **49** and **51** being separated at the guide rollers

69 and 71, being movably trained about the outer peripheral edges of these rollers and then being pulled themselves toward and through the rollers pairs 78, 79 and 81, 82.

This action thus results in each suture 46 (FIG. 8) being individually projected from between the strips 49 and 51 past the rollers 69 and 71, and through the front panel slot 21 (FIG. 5) for engagement by the nurse's fingers. Importantly, when the unit 42 is inserted into and between each pair of adjacent guide track units 27, the positions of the limit pin 33 (FIG. 5) and the catch 34 relative to the studs 65 and 65*a*, maintain the unit 42 such that at least the outer portions of the guide rollers 69 and 71 project beyond the outer surface of the front panel 12. It also will be noted that the vertical (FIG. 5) and horizontal (FIG. 4) dimensions of the slot 21 is such to permit the rollers 69 and 71 to project therethrough.

Thus, the web strips 49 and 51 (FIG. 8) extend beyond the front panel 12, and upon being separated, the inner, formerly enclosed surfaces of the strips 49 and 51 are exposed with the suture 46 for physical finger engagement in a vertical plane at least even with the front panel 12. And advantageously, formerly the outer nonsterile surfaces of the strips 49 and 51 are removed from physical engagement by the nurse, being permitted to fall into an elongated pan 93 extended across the width of the housing 11 below all the units 42 (FIGS. 2 and 3). A curved guide 90 is hingedly mounted on the container 45 to aid in guiding the spent upper strip 51 rearwardly to the pan 93.

To operate the first actuating unit 48, and to provide a variable amount of rotations to the gears 83 and 84 (FIG. 3), a second actuating unit is provided, indicated generally at 94 in FIG. 3. A single, complete unit 94 is provided for each pair of track units 27, it having been noted in FIGS. 4 and 9 particularly that the gears 83 and 84 are mounted on only one side of each dispensing unit 42. Thus, each second actuating unit 94 is so located as to be cooperably engaged by each and every dispensing unit 42 retractably inserted in between each pair of track units 27.

As the second actuating units 94 are identical, only one will be described. A foot pedal 24 (FIG. 3) is vertically slidably mounted in a bracket 96 secured to the housing 11 near the base area 26 thereof, and is pivotally connected to an elongated link 97 the upper end 98 (FIG. 5) of which is connected to the horizontal leg 99 of an L-shaped slide bar 100 having an upper leg 101 reciprocally mounted in a guide block 102. The block straddles and is secured to the upper track 28.

The link 97 and foot pedal 24 are biased to their raised full line positions by a spring 103 extended between a stud 104 in a lower track 29 and a projection 106 on the leg 99. The stud 104 serves a dual purpose in that it also extends through (see FIG. 9) an elongated slot 107 formed in the leg 101 whereby to aid in retaining and guiding the slide bar 100.

Referring particularly to FIG. 5, it is seen that the upper edge 108 of the leg 101 has gear teeth formed thereon, and which are normally in mesh with the teeth of the first actuating unit lower gear 84. Thus, in response to a full depressing movement of the pedal 24, the leg 101 acts as a rack and rotates the gear 84 a certain amount, whereby the roller pairs 78, 79 and 81, 82 are rotated to advance the web 44 sufficiently to expose another suture 46, assuming it is desired to expose one suture for every depression of a foot pedal 24.

It is evident that upon a return of the slide bar 100 to its original position shown in FIG. 5, the leg rack 108 must be separated from the gear 84 during the return stroke. To accomplish this, a passage 109 (FIGS. 5 and 7) is formed in the guide block 102, extended from an upper entrance 111 to a lower entrance 112, and with a spring urged ball 113 mounted in the block 102 at the upper entrance 111.

A pin 114 (FIGS. 5 and 9) is secured to one side of the leg 101, and engages the face 116 of the guide block 102 due to the bias of the spring 103. Thus, upon downward movement of the bar 100, when it reaches the lower end of its stroke, the pin 114 will fall—again due to the spring bias, into the lower entrance 112 of the passage 109. The slide bar 100, riding along side the guide block 102, and capable of tilting about the stud 104 due to the articulated nature of the linkage, is thereby pulled away from the gear 84 during its return stroke by the pin 114 riding upwardly inside the passage 109. At the upper entrance 111 of the passage 109, to ensure that the leg 101 is again placed in mesh with the gear 84 for the next stroke, the biased ball 113 aids in kicking the pin 114 out of the passage 109 where it is brought back against the face 116 of the guide block 102.

In certain instances, sutures are packaged such that a small amount of fluid is contained within each pocket 52 for storage purposes. Thus, should any of the fluid not be evaporated upon exposure of the interior of the pocket 52 by the stripping action, the drip pan 22 is provided to prevent the fluid from running down the face of the panel 12. It should also be noted herein that the second actuating unit 94 need not be limited to a foot actuated linkage. It is entirely conceivable that an electric motor or the like, energized for example by the nurse's hand or foot interrupting a light ray between a pair of photoelectric cells, could be easily adapted to adjustably reciprocate the slide bar 100.

The importance of the capability of the machine 10 to effect an extremely quick change of a "stored suture dispensing unit 42 for a unit 42 on the top shelf, cannot be over-emphasized. Due to the structure provided, a circulating nurse in an operating room, for example, need merely depress the latch 36 (FIG. 5); pull the upper unit 42 off the tracks 28 and 29; set the unit 42 aside; pick up a stored lower unit 42 (FIG. 2) from a lower shelf; insert the new unit in between the open pair of tracks, guided by the lead studs 65 on the protruding lower track end 37; and push the unit 42 forward until the limit pins 33 are engaged by the studs 25, whereupon the latches 36 lock.

This action automatically meshes the lower gear 84 with the slide bar rack 108, whereby the first and second actuating units for the new unit 42 are immediately available for utilization by the scrub nurse. She depresses the correct foot pedal 24, whereupon the strips 49 and 51 of that particular web 44 are separated to expose for use the next suture 46.

Due to the web 44 between each pocket 52, or between each suture 46 or the like, being bonded transversely across the entire width, the element 46 just exposed by the scrub nurse has remained sterile for an indefinite period of time. It thus may be appreciated that no suture 46 in the machine 10 need be exposed until absolutely necessary for use, and that no suture 46 not used need even be contacted or handled in any manner after originally being loaded, it being retained by the machine in an antiseptic condition until actually used.

In view of this description, it is believed that a means for automatically dispensing sutures and the like in an individual and sterile manner has been disclosed, which means is novel, practical, and economical, and which means when placed in an operating room would be of tremendous value and savings to all concerned.

Although a preferred embodiment of this invention has been described and disclosed hereinbefore, it is to be remembered that various modifications and alternate constructions may be made thereto without departing from the true spirit and scope of the invention as defined in the appended claims.

We claim:

1. A machine for individually dispensing thin elements

such as sutures and the like, comprising in combination:

a housing having a slot formed therein through which the elements may pass;

a magazine unit containing a means for holding a plurality of the elements retractably inserted into said housing and supported thereby adjacent said slot;

said holding means including a pair of superimposed, flexible, separately connected strips between which a plurality of the elements are inserted in longitudinally spaced relation;

said unit including guide means protruded outwardly through said slot for guiding said strips as a unit outwardly of said housing;

said unit including further upper and lower pairs of rollers for gripping said strips such, upon rotation, to separate said strips and feed the elements successively through said guide means and outwardly of said slot;

first actuating means including at least a gear mounted on said unit for rotating said rollers;

second actuating means mounted on said housing, and including a reciprocal rack engageable by said gear upon insertion of said unit into said housing; and

means for reciprocating said rack in a predetermined manner whereby one element is fed through said slot at a time.

2. A machine as defined in claim **1**, and further wherein said means for reciprocating said rack includes a foot-operated linkage mounted within said housing, with a foot pedal thereof exposed at the bottom front of the housing.

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