

Feb. 26, 1963

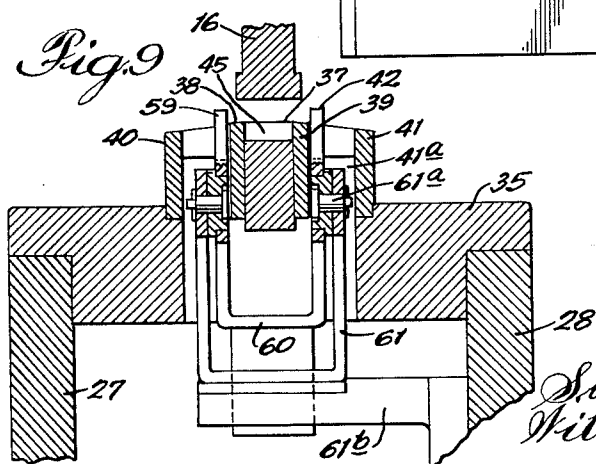
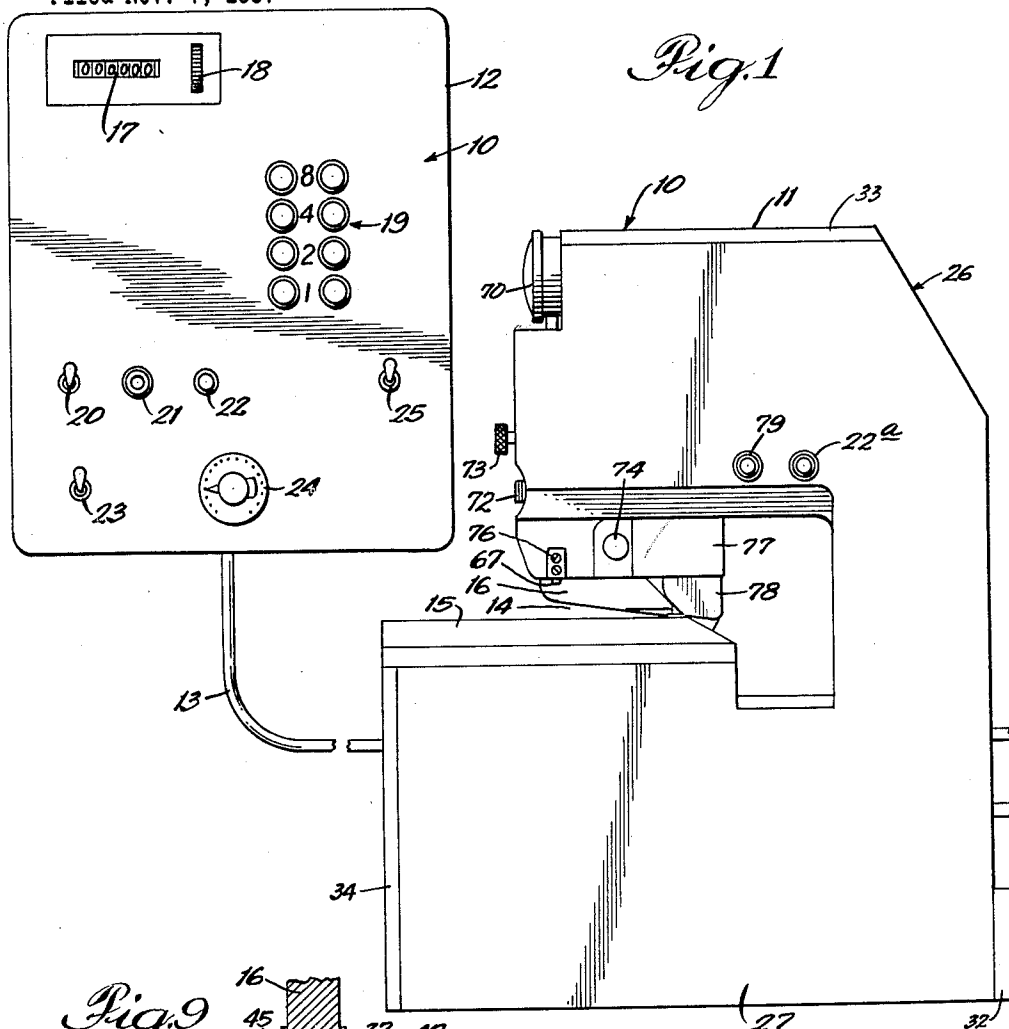
S. L. HALENAR ET AL

3,079,078

FILAMENT-HANDLING DEVICE AND METHOD

Filed Nov. 7, 1957

4 Sheets-Sheet 1



INVENTORS:
Simeon Larry Halenar and
William A. Kaepernik,
 BY *Dawson, Sittou, Fallon & Langenmeier,*
 ATTORNEYS.

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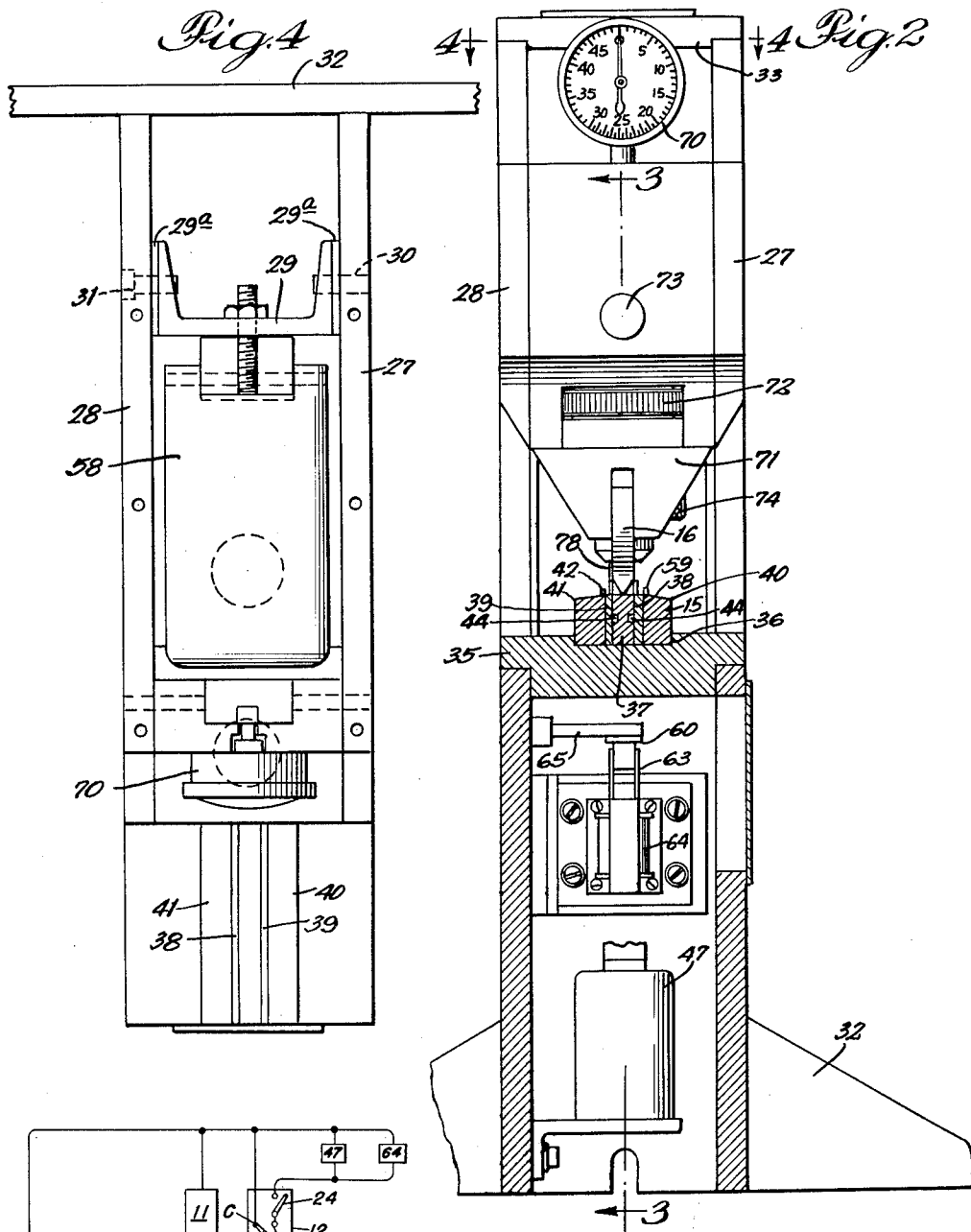
S. L. HALENAR ET AL

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FILAMENT-HANDLING DEVICE AND METHOD

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4 Sheets-Sheet 2



INVENTORS:
Simeon Larry Halenar and
William A. Kaepernik,
 BY *Dawson, Jilton, Fallon & Langmuir,*
 ATTORNEYS.

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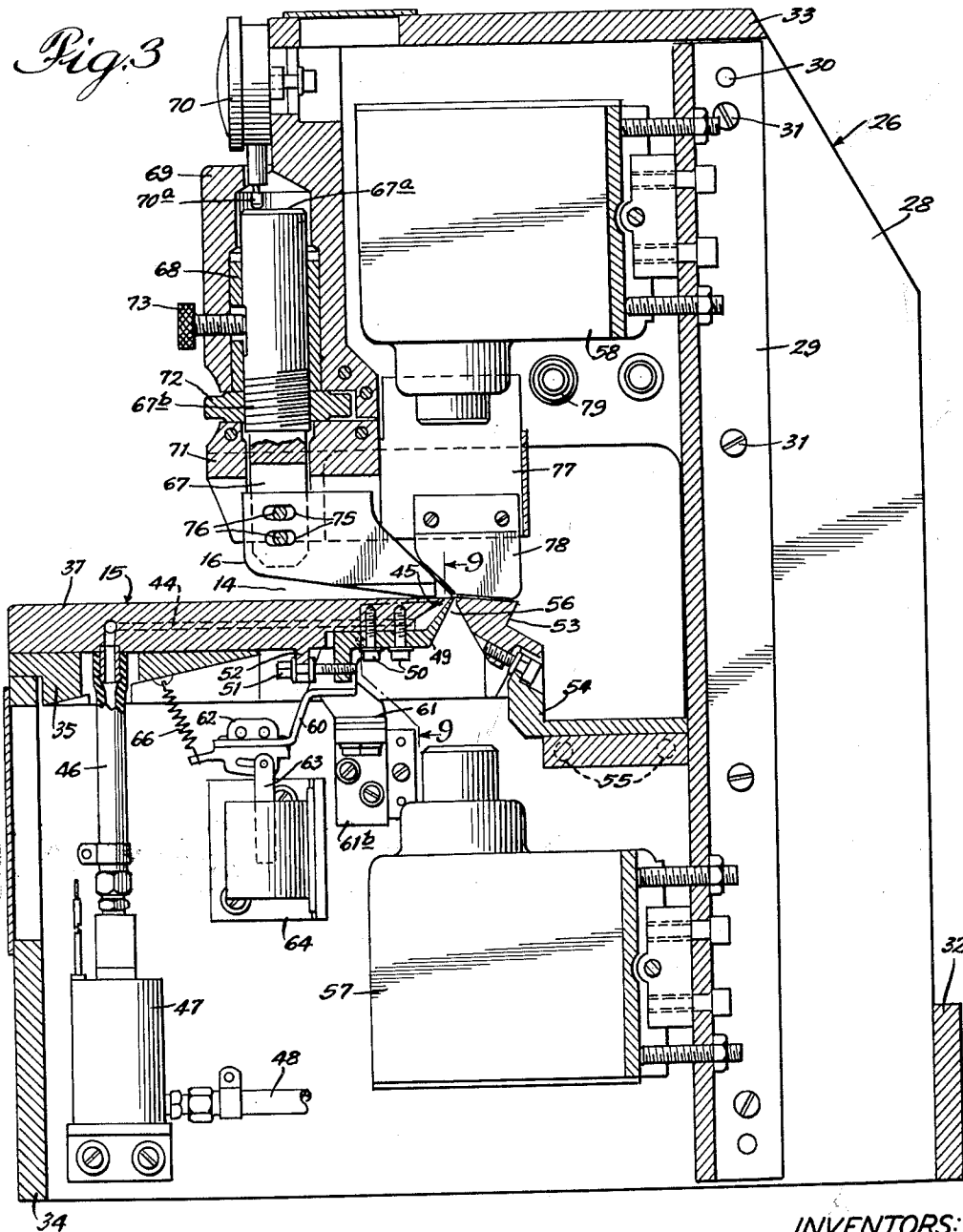
S. L. HALENAR ET AL

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FILAMENT-HANDLING DEVICE AND METHOD

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4 Sheets-Sheet 3



INVENTORS:

*Simeon Larry Halenar and
William A. Kaepernik,*

BY Dwyer, Tilton, Fallon & Langmuir,
ATTORNEYS.

Feb. 26, 1963

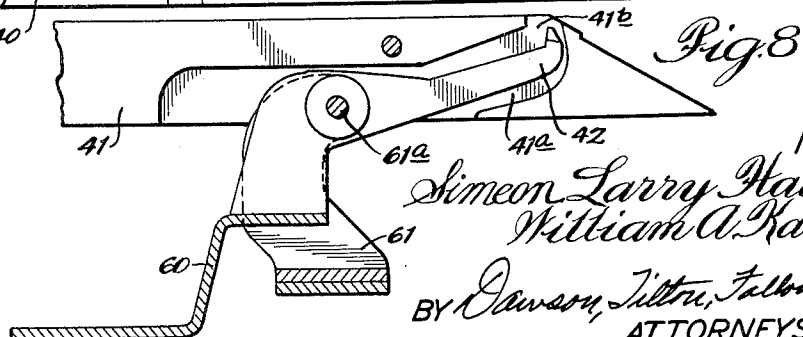
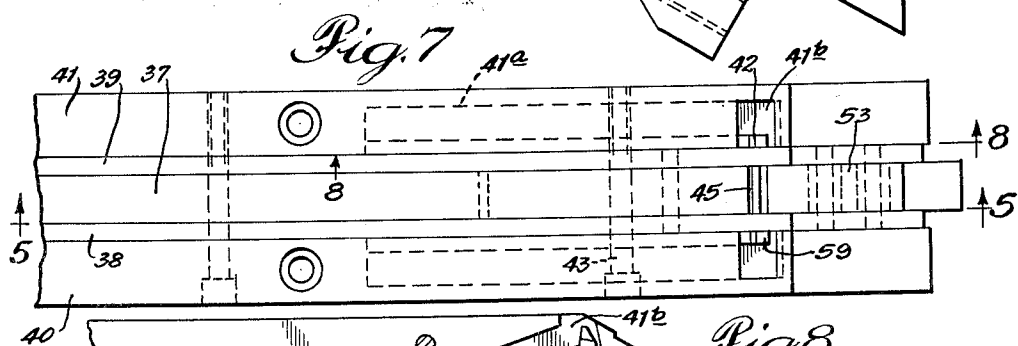
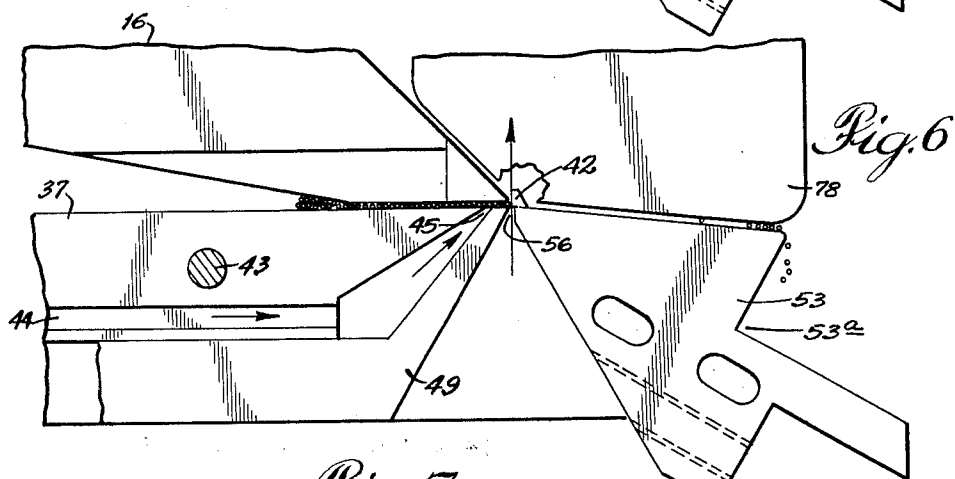
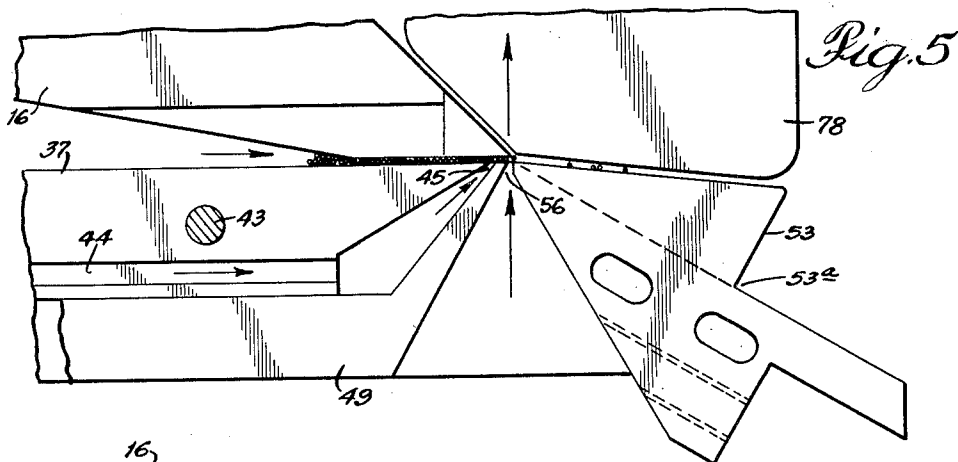
S. L. HALENAR ET AL

3,079,078

FILAMENT-HANDLING DEVICE AND METHOD

Filed Nov. 7, 1957

4 Sheets-Sheet 4



INVENTORS:
Simeon Larry Halenar and
William A. Kaepernik,

BY Dawson, Tilton, Talbot & Longmire,
ATTORNEYS.

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3,079,078

FILAMENT-HANDLING DEVICE AND METHOD
Simcon Larry Halenar, Chicago, Ill., and William A. Kaepernik, Somerville, N.J., assignors to Ethicon, Inc., a corporation of New Jersey
Filed Nov. 7, 1957, Ser. No. 694,965
7 Claims. (Cl. 235—132)

This invention relates to a filament-handling device and method and can be used to provide either a count of the total number of filaments included in a given group, or in separating a predetermined number of filaments from a group containing a larger number.

This invention can be practiced in the handling of many types of filaments which may be considered slender, elongated, tubular members. Filaments may be constructed of various materials, both metallic and nonmetallic, such as plastics and animal tissues. In industrial operations, it is often important to separate and align filaments as well as count them. In all of these instances, there are problems which can be articulated in terms of a particular type of filament for which this invention can be used especially satisfactorily—that type being sutures.

Sutures are thread-like members, generally of rather small diameter and considerable length, which are used by surgeons in closing incisions, and the like. It is estimated that millions of these sutures, each generally about twenty to sixty inches long, are used each year. In the production of sutures, it has been found desirable to separate them into groups for further processing. Until the advent of our invention, no satisfactory mechanical means was available for providing sutures in such batches, or, for that matter, counting the number of sutures in a batch which had already been set aside. It is to be appreciated that there might arise a question as to exactly how many sutures are in a given batch. The mechanical expedients advanced heretofore for solving this problem have uniformly been less satisfactory than the counting provided by humans manually separating and counting the sutures. When several hundred sutures are included in a group or batch, it is further to be appreciated that it is relatively easy for a person counting them to make an error, especially since the sutures are identical and hence indistinguishable one from the other.

It is therefore, a general purpose of this invention to provide a novel means for handling filaments. A further general object is to provide a novel method for the handling of filaments in which the filaments are oriented with intermediate portions thereof in substantially parallel relation in a common plane, and thereafter advancing the portions so arranged sequentially through a gas stream. Another object is to provide a filament-handling device that uniformly gives greater accuracy in the counting of filaments than that previously experienced. Still another object is to provide a filament-handling device capable of separating a predetermined number of filaments from a more numerous group. Yet another object is to provide a novel filament-handling device which incorporates means for warning an attendant shortly prior to the separation of the last filament of a predetermined number from a more numerous group of filaments.

A further object of this invention is to provide a filament-handling device incorporating means for advancing filaments singly past a counting station. A still further object is to provide a filament-handling device in which means are provided for advancing filaments singly past a counting station and in which means are associated with the station responsive to the passing therethrough of a filament. Yet a further object is to provide, in a device of the character described in the object set forth immediately above, tabulating means for the signals produced by the signal-producing means.

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Another object of this invention is to provide a novel filament-handling device which incorporates an adjustable gap adapted to pass but one filament at a time therethrough, along with means sensitive to such passage for indicating the number of filaments passing through the gap. Another object, in a device of the character described in the object immediately preceding, is to provide means for advancing filaments through the gap along with means for blocking further advancement of filaments whenever a predetermined number have passed through the gap.

An additional object of this invention is to provide a novel filament-handling device in which means are provided for advancing filaments singly past a counting station, signal-producing means associated with the station which are responsive to the passing through the station of a filament, and means associated with the signal-producing means for halting the advancing means whenever the passage of a predetermined number of filaments past the counting station has occurred. A further object is to provide, in a filament-handling device, an adjustable gap that permits the passage therethrough of but one filament at a time, along with means for feeding single filaments through the gap, means sensitive to the passage of filaments through the gap, and check means preventing the return through the sensitive means. Another object is to provide a filament-handling device which is especially adapted for handling sutures. Other objects and advantages of this invention can be seen as this specification proceeds.

This invention will be explained in an illustrative embodiment in conjunction with the accompanying drawings, in which—

FIGURE 1 is an elevational view of a machine embodying teachings of this invention and including a filament-handling portion and a tabulating portion; FIG. 2 is an enlarged end view, partially in section, of the filament-handling portion of FIG. 1; FIG. 3 is a longitudinal sectional view, taken along line 3—3 of FIG. 2; FIG. 4 is an enlarged cross-sectional view taken along the line 4—4 of FIG. 2; FIG. 5 is an enlarged fragmentary view of the adjustable gap portion of the filament-handling device seen in the central portion of FIG. 3 and which view corresponds to a cross-sectional view taken along the line 5—5 of FIG. 7; FIG. 6 is a view similar to FIG. 5 but showing the parts thereof in different operating conditions; FIG. 7 is an enlarged fragmentary internal plan view of the filament-handling portion of the device; FIG. 8 is a fragmentary sectional view taken along the line 8—8 of FIG. 7; FIG. 9 is an enlarged sectional view taken along the line 9—9 of FIG. 3; and FIG. 10 is a schematic diagram of the electrical controls of the inventive machine.

In the illustration given, the numeral 10 (see FIG. 1) designates generally a machine or device adapted to handle filaments and which is constructed according to the teachings of this invention. The device 10 includes a filament-handling portion 11 and a tabulating or counting portion 12. It is to be appreciated that portions 11 and 12 are of some size and require support upon tables or platforms not shown. The two portions 11 and 12 are connected by an electrical cable 13.

It is believed that a brief description of the operation of the device 10 would be helpful in understanding the interrelationship of parts thereof to be set forth in greater detail hereinafter. For this purpose, the following description is set forth, using sutures as the specific type of filament handled.

In FIG. 1, the numeral 14 designates a gap provided by abutment means in the form of a base 15 and a shoe 16 movably positioned above the base. The gap 14 is adapted to receive a group of strands or filaments such as sutures which are not shown in FIG. 1. The sutures are

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spread out upon the base 15 and moved into the most constricted portion of the gap, where they fall under the influence of an air jet. The air jet forces strands singly through the most constricted portion of the gap and through a photoelectric beam. The photoelectric beam, being interrupted by the passage of a single suture, yields a signal which is transmitted through cable 13 to tabulating portion 12. For this purpose, a counter such as Model 651 of the Potter Instrument Co., Inc., of Flushing, New York, may be used. Portion 12 provides either a total count of all sutures in a given bundle, or permits the separation therefrom of a predetermined smaller number.

Should it be necessary to ascertain the total number of sutures in a given batch, the tabulating portion yields the desired information by means of a mechanical register 17 which provides counts in terms of hundreds. The register 17 may be reset to zero through the employment of a knurled reset wheel 18. The numeral 19 designates eight neon glow bulbs which give the exact fraction of one hundred sutures that have been counted in the machine. The left-hand column of bulbs indicates tens of sutures counted, while the right-hand group indicates units. In element 12, the numeral 20 designates a main power switch, and the number 21 a light indicating whether power is on or off. The numerals 22 and 22a designate reset buttons for the counter and the neon lamps 19 which derive signals from the counter. The numeral 23 designates a switch which, in one position, permits the total number of sutures in a group to be counted, and in the other position permits a predetermined smaller number to be counted out of a larger group of sutures. For the last-mentioned operation, a selector switch 24 is provided which can be set to the desired predetermined number. The switch designated 25 operates as an on-off switch to stop further operation of the counter portion 12, the filament-handling portion 11 still operating.

Referring now to FIG. 3, the numeral 26 designates generally a frame for portion 11 of machine 10. The frame 26 is narrow, as can be appreciated from a consideration of FIG. 2. Frame 26 includes vertical frame members 27 and 28 which are on the right and left sides of FIG. 2, respectively. Frame members 27 and 28 are maintained in spaced relation by channel 29 and spacers 29a (best seen in FIG. 4). Channel 29, spacers 29a, and right and left-hand vertical frame members 27 and 28 are secured together by means of dowels 30 and cap screws 31 (best seen in FIGS. 3 and 4).

The numeral 32 designates a transversely disposed stabilizing leg which is secured to the rearward end portions of right and left-hand frame members 27 and 28. The numerals 33 and 34 (best seen in FIG. 3) designate a top cover and a front cover, respectively, for frame 26 and which further cooperate with channel 29 in maintaining vertical frame members 27 and 28 in spaced relation.

The numeral 35 designates a top plate which is disposed parallel to top cover 33 but spaced below the cover and which also operates to maintain vertical frame members 27 and 28 in spaced relation. Top plate 35 is provided with a longitudinally-extending slot 36 in the top surface thereof (best seen in FIG. 2) which receives base 15 previously described. Base 15 is made up of the following elements which are secured together and which can be seen in cross-sectional view in FIG. 2: a central bar member 37, right and left plates 38 and 39, respectively, and right and left shields 40 and 41, respectively. The role of the made-up base can be appreciated from a consideration of FIGS. 7 and 8, particularly FIG. 8, where finger 42 can be pivoted upwardly in recess 41a and through slot 41b in shield 41 to block further passage of sutures along base 15. The position of finger 42 in such an operation can be seen in FIG. 6. The means for securing the various elements (designated by the numerals 37-41, inclusive) of base 15 together, can be seen in FIG. 7 in the form of cap screws 43.

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Base 15, and more specifically bar 37, provides a pair of air channels 44 herein terminating in a jet or orifice 45, all of which can be readily seen in FIGS. 5 and 6. Attached to the bottom of bar 37, as seen in FIG. 3, is a compressed air line 46, which is connected to a source of compressed air (not shown) through a solenoid valve 47 and a hose 48. Orifice 45 is provided by adjusting block 49 (FIGS. 3, 5 and 6) from bar 37, block 49 being secured to bar 37 by cap screws 50. The spaced relationship between block 49 and bar 37 providing orifice 45 can be adjusted through adjusting screw 51, which is mounted in a depending lug 52 of bar 37 and which at one end is threadedly received in block 49.

The base 15 is completed by providing at the throat or rearward end thereof a second block 53 which is positionably mounted on member 54 (see FIG. 3). Member 54 in turn is secured to frame 26 by means of cap screws 55, which are threadedly received in suitable openings in the left and right vertical frame members 27 and 26, respectively. The second block 53 cooperates with the first block 49 to provide a second adjustable opening 56, as best seen in FIG. 5, and which permits a photoelectric beam to pass from a sender 57 to a receiver 58, both of which are secured in channel 29, as seen in FIG. 3. Thus, for smaller diameter sutures, opening 56 can be reduced in width so that a small diameter suture will effectively interrupt the light beam.

Associated with finger 42 which is positioned on the left side of the machine, is a second finger 59, the disposition of which can be appreciated from a consideration of FIG. 9. The two fingers are provided as part of a finger body 60, seen best in FIGS. 3 and 9 and shown in enlarged section in FIG. 8. Finger body 60 is pivotally mounted in yoke 61, as at 61a, yoke 61 in turn being supported on a bracket 61b secured to vertical frame member 28. The numeral 62 designates a bracket which is secured to the end of body 60 opposite that equipped with fingers 42 and 59, and is best seen in FIG. 3. Bracket 62 is provided with a slot which receives the ends of armature arms 63, the armature being part of solenoid 64. Solenoid 64 is suitably mounted on frame 26. Movement of the armature arm 63 by solenoid 64 causes a rocking motion of body 60 and thereby pivots fingers 42 and 59 upwardly or downwardly, as the case may be. The numeral 65 (seen only in FIG. 2) designates a stop or limiting member for the movement of body 60. Urging body 60, and therefore fingers 42 and 59, to a retracted position with respect to base 15, is spring 66, connected at one end to bracket 62 and at its other end to top plate 35, as seen in FIG. 3.

The shoe 16, as seen in FIG. 3, is shown secured to a stud 67 which is slidably mounted in a sleeve bearing or bushing 68. Bushing 68 is carried in an annular recess in block 69, block 69 being secured to frame 26 by suitable bolts. Carried by block 69 is a gauge 70, which has a sensing member 70a bearing against the upper machine surface 67a of stud 67 to indicate the spacing between base 15 and shoe 16.

A second block 71 is secured to block 69 and provides a mounting space for adjusting ring 72. Ring 72 is internally threaded and engages male threads 67b of stud 67. This permits the vertical positioning of stud 67 and thereby the positioning of shoe 16 with respect to base 15. Stud 67 is held in position by lock screw 73, which is threadedly carried by block 69 and which bears against stud 67, as seen in FIG. 3.

A second lock screw 74 (seen in FIGS. 1 and 2) fixes the position of shoe 16 laterally of the machine. Shoe 16 is laterally movable with respect to stud 67 by virtue of the slots 75 provided in shoe 16 and which receive cap screws 76 threadedly carried by stud 67, shown only in FIG. 3. The lock screw 74 is mounted in block 71 and bears against shoe 16 to immobilize it in a desired position laterally of the machine, as seen in FIGS. 1 and 2.

The numeral 77 designates a guard housing mounted

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on frame 26 which is positioned about the light beam provided by sender 57. Secured to housing 77 is guard member 78. Guard member 78 is so mounted as to be positioned on one side of slot 56 and thereby not interrupt the light beam passing from sender 57 to receiver 58. Guard member 78 operates to prevent the return of a suture which would otherwise re-interrupt the beam of light and give a false reading.

It is believed that a further description of the operation of the device herein described will be helpful in appreciating the interrelationship of the parts.

When, for example, it is desired to isolate a predetermined number of sutures from a larger numbered group, the machine is set into operation as previously described, that is, switch 20 is placed in the "On" position, providing power to both portions 11 and 12, as indicated by indicator light 21. Switch 23 is placed in a position for a predetermined count, the exact number to be isolated being set on selector switch 24. Switch 25 is positioned so as to permit a signal to be transmitted to solenoids 47 and 64 when the predetermined number of sutures has passed through the light beam.

The machine can then be adjusted for the particular size of suture to be counted. Sutures ordinarily are provided in a number of diameters such as are set forth in the following table:

U.S.P. Sizes:	Nonboilable Polishing Diameter in mils
6-0	4.3
5-0	6.5
4-0	8.5
3-0	11.2
2-0	14.1
0	16.8
1	19.8
2	22.8
3	25.8

The specifications for sutures permit of a variation of .2 mils, plus or minus. From the foregoing table, it is to be seen that the different sized sutures are, therefore, not overlapping because of the tolerance. When a given size of suture is to be counted, lock screw 73 is loosened and adjusting ring 72 is turned until the proper reading on gauge 70 is achieved, gauge 70 being calibrated in mils. Thereafter, lock screw 73 is again tightened and shoe 16 is properly spaced from base 15.

With the device in this condition, the operator places a group of sutures on base 15 so that the sutures are positioned as shown in FIG. 5. A slight pressure on the group of sutures feeds them singly in the gap between shoe 16 and base 15, whereupon a jet of air issuing from orifice 45 kicks one suture at a time through the light beam indicated by arrows on FIGS. 5 and 6. Thereafter, the suture passes through the slot defined by guard member 78 and block 53, the guard member preventing return of a suture through the light beam. Normally, sutures fall into the notched-out portion 53a of block 53, as seen in FIG. 6. It is to be appreciated that because of the length of the sutures handled, each being up to five feet in length, it is possible that only the central portion of the length of a suture might be passed through the light beam so that the ends would tend to bring this central portion back through the light beam if guard member 78 were not there to prevent this.

Where, for example, it is desired to separate 400 sutures from a group containing a larger number, when about 390 have been separated, a warning light 79 actuated by counter portion 12 indicates to the operator that the end of the predetermined count is approaching. When the 400th suture has passed through the light beam, a signal is sent by counter portion 12 to solenoids 47 and 64. Solenoid 47 operates to close off the flow of compressed air to orifice 45, and solenoid 64 operates to pivot fingers 42 and 59 into a position blocking further

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passage of sutures through the gap between shoe 16 and base 15.

As can be seen from FIG. 10, the portions 11 and 12 are connected to a source of electricity V. A main switch 20 and an indicating light 21 are provided in the power line leading to the portions 11 and 12, and a separate switch 25 is interposed in the power line so as to permit operation of the portion 11 independently of the operation of the portion 12, as pointed out previously. In other words, the thin filament-handling portion is operative independently of the counter portion 12. The filament-handling portion 11 receives power to actuate the sender 57 and receiver 58. It will be appreciated that switch 20 can also power any necessary valves for supplying air to the orifice 45.

Also, as pointed out previously, the switch 23 within the counter portion 12 may be placed in one position designated C so as to permit the counting of a total number of sutures in a group. In the alternative position of switch 23, the alternative position being designated S, a separate electronic circuit (not shown) is actuated for the counting or separation of a portion of a larger group of filaments. When the predetermined number of filaments had been counted, a switch 24, set to the predetermined number, is actuated to permit flow of current to the solenoids 47 and 64 (see FIG. 3), which shut off the accelerating air and position the fingers 42 and 59 in blocking position, respectively.

While in the foregoing specification we have set forth a specific embodiment of our invention in considerable detail, it will be readily apparent to those skilled in the art that changes may be made in the details set forth without departing from the spirit and scope of the invention.

We claim:

1. In a filament-handling device,
 - (A) a frame providing a platform,
 - (B) a shoe adjustably mounted on said frame above said platform and cooperating with said platform to provide an elongated, generally horizontal slot adapted to pass one filament at a time,
 - (C) guard means mounted on said frame rearward of said shoe and above said platform,
 - (D) a block adjustably attached to said platform below said guard means, said shoe, guard means, block and platform all cooperating to provide a confined, generally smooth path for filament travel, with said block and platform cooperating to define a light slit,
 - (E) a light positioned in line with said slit,
 - (F) air blast means in said platform under said shoe for accelerating a filament to expel the same from said slot,
 - (G) signal-producing means between said shoe and guard means responsive to the interruption of said light by an accelerated filament, and
 - (H) counting means coupled to said signal-producing means.

2. The structure of claim 1 in which said block and said platform under said guard means are equipped with top surfaces angling downwardly in the direction of filament travel.

3. The structure of claim 1 in which said block is equipped with a notch to receive filaments issuing from said slot.

4. The structure of claim 1 in which said counting means is equipped with means for recording the number of filaments passing said signal-producing means.

5. In a filament-handling device,

- (A) a frame providing a platform,
- (B) a shoe adjustably mounted on said frame above said platform and cooperating with said platform to provide an elongated, generally horizontal slot adapted to pass one filament at a time,

- (C) guard means mounted on said frame rearward of said shoe and above said platform,
 (D) a block adjustably attached to said platform below said guard means, said shoe, guard means, block and platform all cooperating to provide a confined, generally smooth path for filament travel, with said block and platform cooperating to define a light slit,
 (E) a light positioned in line with said slit,
 (F) air blast means in said platform under said shoe for accelerating a filament to expel the same from said slot,
 (G) signal-producing means between said shoe and guard means responsive to the interruption of said light by an accelerated filament, and
 (H) tabulating means coupled to said signal-producing means, said tabulating means being equipped with means for halting further advancement of filaments by said accelerating means whenever a predetermined number of signals has been received by said tabulating means.

6. The structure of claim 5 in which said halting means includes finger means pivotally mounted on said frame for movement into the path of a filament being accelerated by said air blast means.

7. The structure of claim 5 in which said filament-halting means includes valve means for stopping the passage of air through said air blast means.

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