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APPARATUS FOR PACKAGING SUTURES

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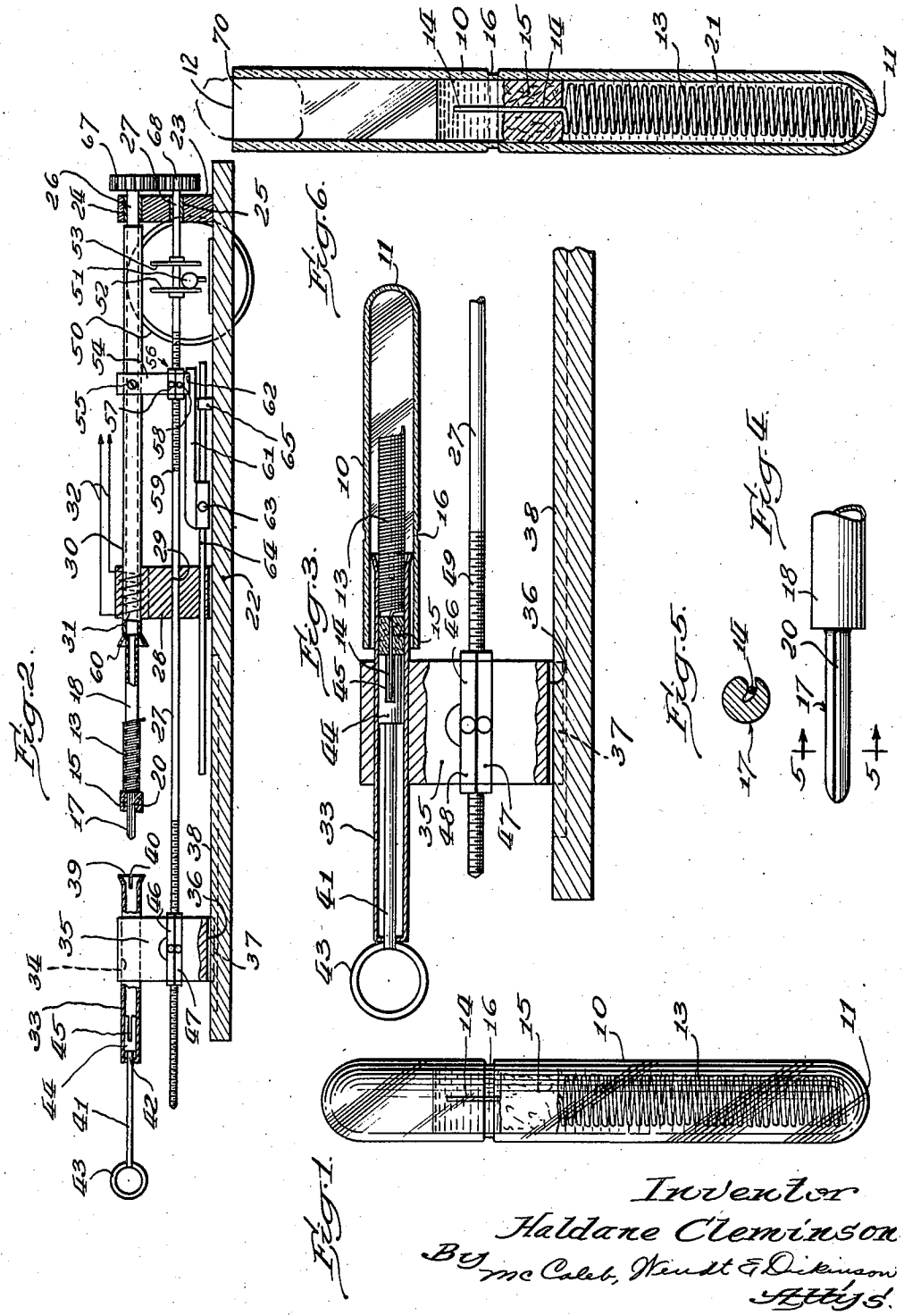


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

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APPARATUS FOR PACKAGING SUTURES

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13 Claims. (Cl. 226—18)

The present invention relates to apparatus for packaging sutures and is particularly concerned with improved devices for the packaging of sutures so that they are arranged in a more convenient form for the use of a part of a packaged suture, without exposing the rest of the suture to contamination.

The present application is a division of my prior application Serial No. 387,999, filed April 11, 1941, which relates to the method of packaging sutures.

One of the objects of the invention is the provision of an improved apparatus for packaging sutures in such manner that the suture is so arranged that a part of it may be withdrawn from the package while the remainder of the suture is still retained in the package and maintained in a sterile condition for future use.

Another object of the invention is the provision of an improved apparatus for packaging sutures by means of which the suture is made more readily available for withdrawal from the package without possibility of tangling.

Another object of the invention is the provision of an improved apparatus for packaging sutures by means of which a greater length of suture may be packaged in a relatively small tube or other container so as to utilize to the best advantage the space available.

Another object of the invention is the provision of an improved apparatus for packaging sutures by means of which the package is adapted to be put up with a minimum amount of hand labor, and with resulting economy and speed of production in the packaging of the sutures, by reason of the fact that the packaging may be carried on more quickly.

Another object of the invention is the provision of an improved apparatus for packaging sutures in such manner that economy in the use of the suture is effected on account of the possibility of using only as much as needed at one time, the remainder of the suture being kept in a sterile condition in its container, and the protruding part being maintained sterile by its immersion in a sterile alcohol bath.

Another object of the invention is the provision of an improved apparatus for coiling sutures, by means of which a suture may be helically coiled and placed in condition for insertion in a relatively small container, such as a glass tube, by (means of which provision is made for the protrusion into the upper part of the tube, which may be broken off, of the end of the suture to be grasped by the user.

Another object of the invention is the provision of an improved suture coiling device adapted to effect this result with a minimum amount of manual labor.

Another object of the invention is the provision of an improved suture coiling apparatus which is compact, simple and which may be duplicated so that a multiplicity of these devices may be driven by the same motor and attended by a number of different operators, one operator being provided to handle each of the coiling devices.

Another object of the invention is the provision of an apparatus of the class described which is simple, effective, durable, adapted to operate quickly and efficiently and adapted to be manufactured at a low cost.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawing, in which similar characters of reference indicate similar parts throughout the several views.

Referring to the single sheet of drawings accompanying the specification:

Fig. 1 is a transverse sectional view, taken through a packaged suture, made according to the present invention;

Fig. 2 is a diagrammatic sectional view, taken on a vertical plane through an apparatus adapted to be used in the packaging of sutures of the type shown in Fig. 1;

Fig. 3 is a fragmentary view of part of the apparatus of Fig. 2, with the parts in the position which they assume when the suture and supporting plug are being inserted into a glass tube;

Fig. 4 is a fragmentary elevational view of the needle used in the apparatus;

Fig. 5 is a sectional view through the needle, taken on the plane of the line 5—5 of Fig. 4;

Fig. 6 is an axial sectional view, taken through the suture container, showing its contents at the time of the sterilization and before the sealing operation.

Referring to Fig. 1, this is a vertical sectional view, taken on a plane passing through the axis of the suture package, showing the structure and arrangement of such a package.

The suture is contained in a glass tube 10 of substantially cylindrical form, having its lower end 11 closed and its upper end 12 sealed and similarly closed.

The suture indicated at 13 is helically coiled, and it is found that a greater length of gut can be placed in the small tube when arranged in

this way than when it is arranged according to the methods of the prior art.

The diameter of the coils of the suture 13 is such that there is preferably a small spacing between the inner wall of the tube 10 and the suture coils, and the coils may be placed quite close together in contact with each other, if desired, depending upon the relative sizes of the parts.

The lower end of the helically coiled suture 13 is free, but the upper end preferably extends in axial direction, as indicated at 14, through a fibrous plug 15 of absorbent and sterile cotton, which keeps the helical coils of the suture from becoming disarranged or getting outside of the tube after the upper end has been broken off at a scored portion 16.

The cotton plug 15 is made by rolling sterile cotton in the form of batting into a substantially cylindrical roll five-eighths of an inch or more in length, and placing it on the needle, which is indicated by the numeral 17.

The needle 17 is carried by a tube mandrel 18, and may be provided with longitudinally extending wedging slot 20 for receiving the axially extending end 14 of the suture, which may extend to the end of the needle and over the needle and down the opposite side of the needle. A sufficient length of this axial portion 14 is provided so that it will project beyond the breaking point of the tube indicated at 16 when the tube has been broken off.

The cotton plug is of sufficient size so that it has a tight fit in the tube 10, and the needle 17 is of sufficient size so that it makes the aperture for the suture portion 14 which is frictionally held as shown in Fig. 1.

The tube is preferably broken by placing it in a towel and exerting a bending force, which will produce a clean break at the scored groove 16. The operator may then grasp the axially extending end portion 14 of the suture and withdraw as much as is needed from the chamber 21 in the tube below the plug 15. As the end of the suture is drawn out, the helical coil 13 will rotate in the tube, and its coils adjacent the plug 15 will be at least temporarily straightened as they pass through the plug 15. The proper length of suture may be cut off, and the rest left in the tube and the liquid without being disturbed, where it will be maintained in its sterile condition.

Referring to Figs. 2 and 3, the apparatus for wrapping and packaging such sutures is illustrated in these figures. This apparatus preferably comprises a supporting base 22 consisting of a plate of suitable material such as "Bakelite," and at the right end, the plate is provided with an upwardly extending column 23 having a pair of bearings 24 and 25.

The bearing 24 rotatably supports an upper shaft 26, and the bearing 25 supports a lower shaft 27. The base 22 also has another column 28 provided with bearing 29 for the lower shaft 27, and providing a slidable support for an upper tube 30 which surrounds the upper shaft 26 and serves as a bearing.

An electric heating element 31 may surround the metal tube 30 and may be carried by column 28, and may have its leads 32 connected to a suitable source of energizing current, such as the electric light line, for energizing the heating element 31, and heating the tube 30 and shaft 26.

The shaft 26 may be made of a stainless steel tube, and its mandrel end 18 projecting toward the left in Fig. 2 from the tube 30, is heated sufficiently by the heating element 31 to produce a predetermined set in the previously prepared suture 13, when the suture is wrapped on the mandrel 18. Thus the suture 13 is adapted to be coiled in helical form, which shape it retains.

The length of the mandrel 18 beyond the end of the tube 30 and standard 28 is sufficient to receive the tubular member 33 which is mounted in a bore 34 in a third standard 35 carried by the base 22. The standard 35 is not fixedly mounted on the base 22, but is provided with a shoulder 36 on each side at the bottom engaging the top of the base 22, and with a guide rib 37 of reduced width, adapted to be slidably received in a complementary groove 38 in the base 22. The length of the groove 38 is sufficient to permit the range of movement of the standard 35 as further described herein.

The tubular member 33 comprises a tubular member of sufficient size to embrace the cotton plug 15 when it is still further compressed, and to embrace the helical suture 13 and mandrel 18, but it is also small enough to be received in the glass tube 10. It preferably has its open end 39 flared out, with or without the slots 40, for the purpose of facilitating the entrance of the cotton plug 15. At its opposite end it slidably supports a plunger 41 in a circular bore 42.

The plunger is formed at its outer end with a ring 43 or other handle, and at its inner end with a cylindrical plunger head 44 having an axial slot 45 of sufficient size to receive that part of the needle 17 which projects beyond the cotton plug 15.

The standard 35 comprises a block within which are housed a pair of nut plates 46 and 47 which are provided with a screw bore 48, that is threaded to receive the threaded portion 49 of shaft 27. The use of two plates permits the assembly and location of the block 35 at any desired point on the shaft 27, after the rest of the machine has been assembled.

The base 37 preferably supports an electric motor 50, the drift shaft of which is provided with a drive pulley 51 engaging one or the other of two friction drive discs 52, 53, carried by shaft 27.

The tube 30 may have a longitudinal movement on its shaft 18 which is controlled by a block 54 fixedly mounted on the tube 30 by means of a set screw 55. The block 54, at its lower end, is provided with a threaded member 56 comprising a pair of plates 57, 58 similar to the plates 46, 47, and having a threaded bore for receiving the threaded portion 59 of shaft 27.

A connecting rod 61 has a slot 62 for engaging the lower end of the block 54, and it is fixedly carried by means of a set screw 63 and a suitable bore on the rod 64. The rod 64 is slidably mounted in bores in the block 65 and standard 28 carried by the base 22. The shaft 26 and the shaft 27 are provided with meshing gears 67, 68, fixedly secured to these shafts.

The operation of the apparatus is as follows:

The motor 50 drives its shaft and driving pulley 51 constantly in the same direction, and may be caused to drive the shaft 27 in either direction by means of the friction discs 52, 53. Either one of these discs may be brought into engagement with the pulley 51, or both may be kept out of contact by pivoting the motor in its support.

The operator first secures the end of an ap-

propriate length of suture in the wedging slot of the needle 17, this suture being folded over at the end of the needle. A plug of cotton 15 is formed and located on the needle 17. The heating element 31 is at this time turned on and the mandrel 18 suitably heated, and this heating may be maintained throughout the operation of the apparatus.

The motor 50 may then be turned on and control rod 64 may be actuated by the operator as to drive the shaft 27 counter-clockwise, and the shaft 26 in a clockwise direction. As the shaft 26 rotates, the operator may guide the suture 13 as it wraps in a tight helical coil on the mandrel 18, as illustrated in Fig. 2. A suitable length is wrapped on the mandrel corresponding to the proposed length of the chamber 21 in the glass tube 10. The suture is then cut off close to the mandrel 18.

While this wrapping of the suture 13 is being accomplished, the shaft 27 is also rotating, and the rotation of this shaft in a counter-clockwise direction is such as to cause the screw 49 to make the block 35 progress on the shaft 27 toward the right. This causes the tube 33 to be moved over the needle 17, cotton plug 15, and coiled suture 13, until these members are practically completely housed in the tube 33.

The screw 49 may end at an appropriate point, and may be on a larger portion than the main body of the shaft 27, so that the tube 33 can only be driven toward the right to a predetermined point.

While the tube 33 is being moved toward the right by screw 49 on the shaft 27, screw 59 is also moving block 54 and tube 30 toward the right to expose the mandrel 18.

When a suitable amount of suture has been wrapped and cut off, the drive is reversed in direction by bringing the drive pulley 51 into engagement with the other one of the two discs 52, 53. The shaft 26 will then be rotated in the opposite direction, but the suture 13, having been given a predetermined set on the mandrel 18, will not be unwrapped.

The screw 59 will then be rotated in the opposite direction to cause block 54 to move toward the left, actuating tube 30 toward the left to strip the coiled suture 13 from the mandrel 18.

The tube 30 may be provided with an enlarged tubular portion 60 at the left end for engaging the end of the helical coil, and sliding the suture off the mandrel 18 without unwrapping the helical coil, since the coil will be housed in the enlarged portion 60.

As the coiled suture is stripped from the mandrel 18, the block 35 is also moved toward the left, carrying with it the tube 33 which at this time houses the cotton plug 15 and suture 13. Thus the suture and plug are transferred from the mandrel 18 to the tube 33.

The tube 33 is withdrawn sufficiently from the needle 17 to permit the glass tube 10 to be placed over the end 39 of tube 33, as shown in Fig. 3. Then the plunger 43 is moved toward the right in the metal tube 33 from the position of Fig. 2 to that of Fig. 3, engaging the cotton plug 15, which in turn engages the helical suture 13, forcing it out of the tube 33, into the position of Fig. 1, in the glass tube 10.

The tube shown in Fig. 1 then has its end plugged with a second cotton plug 70, located sufficiently above the end 14 of the suture so that the tube may be sealed between the plugs 15 and 70.

The assembly shown in Fig. 1 is then subjected to the simultaneous action of a vacuum and sterilizing heat in a closed container at a sterilizing temperature, and for a sufficient number of hours to insure the destruction of all micro-organisms and their spores.

Thereafter, the vacuum in the closed container may be broken and the ends of the tubes may be immersed in a predetermined amount of sterile preserving fluid, such as ethyl alcohol.

The container may then be subjected to a vacuum which will cause the air to bubble out through the alcohol from the chamber 21, through the cotton plugs 15 and 70.

The vacuum may again be broken to raise the pressure in the container, which will cause the preserving alcohol to filter through the plugs 15 and 70, into the chamber 21 to a predetermined level. The open end of the glass tube 10 may then be sealed, after drying out plug 70, below the plug 70, while the plug 70 is still in place, and the sealing of the glass tube is accomplished in the usual manner, by the application of heat and drawing out the tube.

The result is a packaged suture as shown in Fig. 1, which is arranged in helical form, with one end extending axially through the plug 15.

It will thus be observed that I have invented an improved apparatus for packaging sutures, by means of which the sutures may be arranged in a helical form with a minimum amount of hand labor. This arrangement permits the suture to be withdrawn and used only as needed, the remainder being kept sterile in its tube, which is thrown back in an alcohol solution.

The present product may be packaged more economically than the products of the prior art because less hand labor is required, and the machine may, of course, include a multiplicity of the devices shown in Figs. 2 and 3, operating simultaneously.

A greater length of suture may be packaged in the same size tube, or the same amount of suture may be packaged in a shorter or smaller tube than the arrangements of the prior art.

While I have illustrated a preferred embodiment of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction as set forth, but desire to avail myself of all changes within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. An apparatus for coiling sutures comprising a support, a metal shaft adapted to serve as a mandrel rotatably mounted on said support, and provided with a penetrating point of reduced size, means for rotating said shaft whereby a suture may be coiled in helical form on said shaft, and means for securing one end of the suture in axial position on said penetrating point, comprising a fibrous plug slidably mounted on said point surrounding the end of said suture.

2. An apparatus for coiling sutures comprising a support, a metal shaft adapted to serve as a mandrel rotatably mounted on said support, and provided with a penetrating point of reduced size, means for rotating said shaft whereby a suture may be coiled in helical form on said shaft, means for securing one end of the suture in axial position on said penetrating point, comprising a fibrous plug slidably mounted on said point surrounding the end of said suture, and a

housing member for temporarily supporting the coiled suture with its coils in substantial alignment with each other, during its insertion in a tubular container, said housing being movably mounted on said support to embrace said shaft, plug and coiled suture.

3. An apparatus for coiling sutures comprising a support, a metal shaft adapted to serve as a mandrel rotatably mounted on said support, and provided with a penetrating point of reduced size, means for rotating said shaft whereby a suture may be coiled in helical form on said shaft, means for securing one end of the suture in axial position on said penetrating point, comprising a fibrous plug slidably mounted on said point surrounding the end of said suture, a housing member for temporarily supporting the coiled suture with its coils in substantial alignment with each other, during its insertion in a tubular container, said housing being movably mounted on said support to embrace said shaft, plug and coiled suture, and slidable means carried by said housing for moving said plug and suture out of the housing into a container.

4. In an apparatus for coiling sutures, the combination of a support with a pair of drive shafts rotatably mounted on said support, and gearing for connecting said drive shafts, an electric motor and operative mechanical connections between said motor and one of said shafts whereby both shafts may be driven in a predetermined direction or reversed in direction, one of said shafts having a mandrel portion for receiving a helical wrapping of suture material, a tubular housing adapted to be driven by the other of said shafts into position to embrace the mandrel portion and helically wrapped suture as the suture is wrapped, said housing receding when the shafts are driven in reverse direction, and a stripping device adapted to slide the wrapped suture off the mandrel portion into said housing as the housing recedes from the mandrel portion, said stripping device being driven also by said other shaft.

5. In an apparatus for packaging sutures, the combination of a support with a mandrel and means for rotating said mandrel, said mandrel having at its free end a longitudinal projecting needle adapted to receive a fibrous plug and to support a longitudinally projecting end portion of a suture, heating means for heating said mandrel to give the suture a predetermined helical set while it is supported on said mandrel, and means for stripping said suture and plug from said mandrel and needle.

6. In an apparatus for packaging sutures, the combination of a support with a mandrel and means for rotating said mandrel, said mandrel having at its free end a longitudinal projecting needle adapted to receive a fibrous plug and to support a longitudinally projecting end portion of a suture, heating means for heating said mandrel to give the suture a predetermined helical set while it is supported on said mandrel, and means for stripping said suture and plug from said mandrel and needle, said means comprising a sleeve slidably mounted on said mandrel and having an end portion adapted to engage the coils of the suture.

7. In an apparatus for packaging sutures, the combination of a support with a mandrel and means for rotating said mandrel, said mandrel having at its free end a longitudinal projecting needle adapted to receive a fibrous plug and to support a longitudinally projecting end portion of a suture, heating means for heating said mandrel to give the suture a predetermined helical set while it is supported on said mandrel, and means for stripping said suture and plug from said mandrel and needle, said means comprising a sleeve slidably mounted on said mandrel and having an end portion adapted to engage the coils of the suture, and operative mechanical connections between said first means and said sleeve whereby the sleeve is moved axially on the mandrel to drive the suture off the mandrel.

8. In an apparatus for packaging sutures, the combination of a support with a mandrel and means for rotating said mandrel, said mandrel having at its free end a longitudinal projecting needle adapted to receive a fibrous plug and to support a longitudinally projecting end portion of a suture, heating means for heating said mandrel to give the suture a predetermined helical set while it is supported on said mandrel, means for stripping said suture and plug from said mandrel and needle, said means comprising a sleeve slidably mounted on said mandrel and having an end portion adapted to engage the coils of the suture, and operative mechanical connections between said first means and said sleeve whereby the sleeve is moved axially on the mandrel to drive the suture off the mandrel, said connection comprising a shaft having screw threads thereon and a threaded follower engaging said screw threads and engaging said sleeve.

9. In an apparatus for packaging sutures, the combination of a support with a mandrel and means for rotating said mandrel, said mandrel having at its free end a longitudinal projecting needle adapted to receive a fibrous plug and to support a longitudinally projecting end portion of a suture, heating means for heating said mandrel to give the suture a predetermined helical set while it is supported on said mandrel, means for stripping said suture and plug from said mandrel and needle, said means comprising a sleeve slidably mounted on said mandrel and having an end portion adapted to engage the coils of the suture, and tubular means carried by said support in substantially axial alignment with said mandrel for receiving the plug and suture as it is stripped from said mandrel.

10. In an apparatus for packaging sutures, the combination of a support with a mandrel and means for rotating said mandrel, said mandrel having at its free end a longitudinal projecting needle adapted to receive a fibrous plug and to support a longitudinally projecting end portion of a suture, heating means for heating said mandrel to give the suture a predetermined helical set while it is supported on said mandrel, means for stripping said suture and plug from said mandrel and needle, said means comprising a sleeve slidably mounted on said mandrel and having an end portion adapted to engage the coils of the suture, and tubular means carried by said support in substantially axial alignment with said mandrel for receiving the plug and suture as it is stripped from said mandrel, and operative mechanical connections between said tubular means and said first means whereby the tubular means is brought into proximity with the plug and suture as the first means rotates the shaft.

11. In an apparatus for packaging sutures, the combination of a support with a mandrel and means for rotating said mandrel, said mandrel having at its free end a longitudinal projecting needle adapted to receive a fibrous plug and to

support a longitudinally projecting end portion of a suture, heating means for heating said mandrel to give the suture a predetermined helical set while it is supported on said mandrel, means for stripping said suture and plug from said mandrel and needle, said means comprising a sleeve slidably mounted on said mandrel and having an end portion adapted to engage the coils of the suture, tubular means carried by said support in substantially axial alignment with said mandrel for receiving the plug and suture as it is stripped from said mandrel, and an ejecting member carried by said tubular means for engaging said plug and suture and driving it out of said tubular means into a container.

12. An apparatus for coiling sutures comprising a support, a metal shaft adapted to serve as a mandrel rotatably mounted on said support, and provided with a penetrating point of reduced size, means for rotating said shaft whereby a suture may be coiled in helical form on said shaft, means for securing one end of the suture in axial position on said penetrating point, comprising a fibrous plug slidably mounted on said point surrounding the end of said suture, and means for stripping said helical suture from said shaft comprising a tubular member slidably mounted on said shaft.

13. An apparatus for coiling sutures comprising a support, a metal shaft adapted to serve as a mandrel rotatably mounted on said support, and provided with a penetrating point of reduced size, means for rotating said shaft whereby a suture may be coiled in helical form on said shaft, means for securing one end of the suture in axial position on said penetrating point, comprising a fibrous plug slidably mounted on said point surrounding the end of said suture, and means for stripping said helical suture from said shaft comprising a tubular member slidably mounted on said shaft, and heating means for producing a predetermined set in said suture in helical form, comprising an electrical heating coil arranged about said shaft to heat said shaft.

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