June 4, 1957 M. J. FRANKIEWICZ ET AL 2,794,304

PROCESS FOR GRINDING AND POLISHING CATGUT SUTURES

Filed Jan. 23, 1956

Fig. 1.

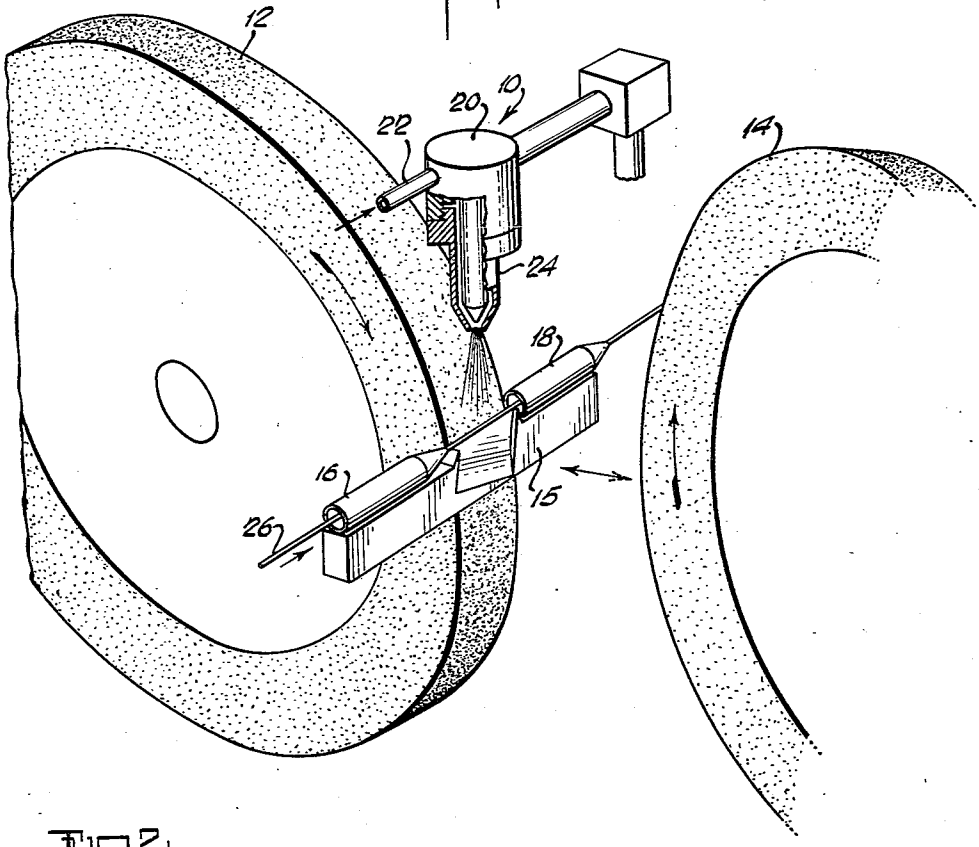


Fig. 2.

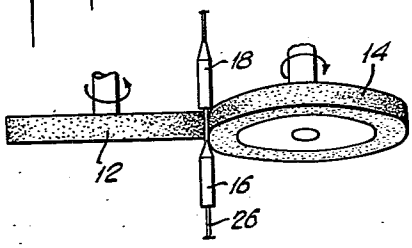
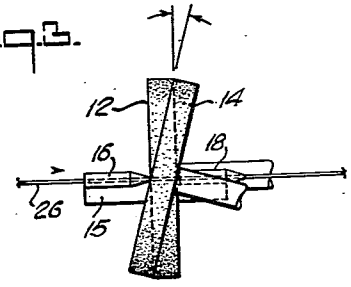


Fig. 3.



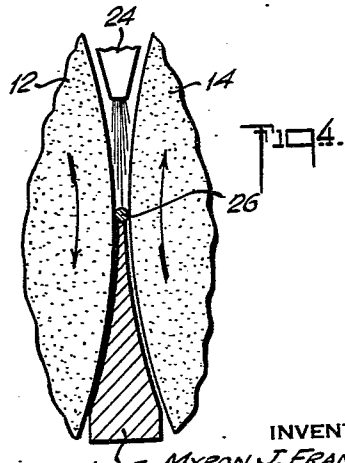


Fig. 4.

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PROCESS FOR GRINDING AND POLISHING CATGUT SUTURES

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Application January 23, 1956, Serial No. 560,842

2 Claims. (Cl. 51—281)

This invention relates to polishing of surgical catgut to a thoroughly circular cross-section and uniform gage throughout its effective length and particularly relates to an improvement in the mechanical polishing of surgical catgut which provides for more adequate control and lubrication at the point of polishing.

U. S. Patent No. 2,355,907, issued August 15, 1944, describes an apparatus and process for polishing surgical catgut by centerless grinding means. And although the apparatus and method of this patent have been successfully used and surgical catgut strands polished in the apparatus according to the method of the patent have been widely accepted in the medical profession, certain disadvantages are inherent in the said apparatus and method. The polishing method of the said patent provides for the passage of a surgical catgut strand through an area known as a grinding throat which is located between an abrasive regulating wheel and an abrasive grinding wheel which are relatively adjustable to provide a grinding throat of variable width. The grinding throat is modified to provide a support for and sustains the surgical catgut strand against whipping as it is axially fed at relatively high speed between the wheels. The surgical catgut strands are fed into a tubular conduit having an inlet to which the strands are directed and an outlet or nozzle which feeds the strands to the grinding throat. The nozzle which feeds the strand to the grinding throat is a fluid injector having a port for the admission of a high velocity stream of fluid which may be air, water, or a hydrocarbon oil. The fluid acts additionally as a cooling medium and to wash away the polishing debris. After the polished strand leaves the grinding throat it passes into a string receiving and pulling device comprising a blast or outfeed nozzle. The grinding wheels both rotate in a clockwise direction. One wheel, known as the regulating wheel, rotates at a considerably slower speed than the other wheel, known as the grinding wheel. As the grinding wheel comes in contact with the strand, it exerts a force downward and in order to maintain the strand in the proper position in the grinding throat, a support blade is positioned in the grinding throat. The regulating wheel exerts an upward force on the strand so that it is necessary to provide means whereby the upward force is neutralized and resisted. The upward force exerted on the strand by the regulating wheel becomes particularly apparent and troublesome if the regulating wheel should contact the strand before the grinding wheel or if the strand is small and consequently quite flexible. In the conventional machine the strand is supported against the downward force exerted by the grinding wheel by a hard steel support at the grinding throat and below the point where the strand passes through and is supported against the upward force exerted by the regulating wheel by a support fabricated of hard steel positioned at the grinding throat but above the part of the throat through which the strand passes as it is being ground and polished. In order to permit free passage of the strand through the wheels and through

the grinding throat, it has been necessary to place the upper and lower supports at a distance somewhat greater than the diameter of the strand and this has allowed an undesirable freedom of movement of the strand in a vertical plane and a resultant erratic action of the strand in the grinding throat. Because of this relative freedom of movement and erratic action of the strand in the grinding throat, there has been an uneconomically high incidence of damage to strands, particularly to smaller size strands, during the grinding and polishing operation.

The principal object of the present invention is to provide an improved method for polishing surgical catgut to uniform gage and circular cross-section and in the more specific aspects of the invention the object is to provide an improved method for polishing surgical catgut by use of an apparatus of the centerless grinding type having a liquid jet means for restricting the freedom of movement of the portion of the strand being ground and polished, which means also concurrently provides for lubrication and cooling of the strand.

The method, characteristic features, and scope of the invention will be more readily understood from the following description, taken in connection with the accompanying drawings, forming a part hereof, all constituting a part of this application for Letters Patent and wherein:

Figure 1 is a view in perspective of the apparatus showing a liquid jet assembly partially in section and its positional relationship to the grinding and regulating wheels, the regulating wheel being shown horizontally displaced;

Figure 2 is a plan view of the apparatus showing the positional relationship between the grinding wheel and the regulating wheel;

Figure 3 is an elevational view showing the positional relationship between the grinding wheel and the regulating wheel; and

Figure 4 is a view of the apparatus showing a portion of the grinding and regulating wheels, the bottom support means and a suture strand in cross section, and a portion of the nozzle of the jet assembly.

In the preferred practice of the invention, the catgut strands to be polished are pre-gaged to divide the string into units for polishing and classification, so that the unpolished strands are classified according to their areas of minimum cross-section since the minimum diameter is the factor which determines the size to which the strand is to be ground and polished.

Referring now to the drawings, and particularly to Figure 1, an unpolished strand **26** is introduced into an infeed guide tube **16** and then passes through the grinding throat and into outfeed guide tube **18**. As soon as the end of the strand enters the grinding throat and comes in contact with an abrasive regulating wheel **14**, it is propelled forward through the grinding throat and into outfeed guide tube **18**. Regulating wheel **14** exerts a propelling action on the strand because it is set at an angle with respect to abrasive grinding wheel **12**. A range of sizes of surgical catgut sutures may be ground and polished by variation of the width of the grinding throat. The width of the grinding throat may be varied by motion of one or both of the grinding and regulating wheels so they are closer together or farther apart at the grinding throat. The speed at which the strand goes through the grinding throat is a function of the angle at which regulating wheel **14** is positioned with respect to grinding wheel **12**, and in the modification of the apparatus shown in the drawing, and particularly as shown in Figures 2 and 3, the angle is fourteen degrees. Grinding wheel **12** is of a finer texture and rotates at a higher speed than regulating grinding wheel **14**. In a preferred modification of the device, grinding wheel **12** rotates at 2500 revolutions per minute and 6500 surface feet per minute while regulating wheel **14** rotates at 250 to 300 revolu-

tions per minute and a surface speed of 650 to 800 feet per minute. When the grinding and regulating wheels are rotated at these speeds respectively, and the angle of the regulating wheel with respect to the grinding wheel is fourteen degrees, a catgut suture strand will pass through the grinding throat at a speed of about 190 feet per minute.

It is also contemplated that surgical catgut strands may be propelled through the grinding throat by means of a push and pull operation in which the pushing and pulling instrumentalities operate to maintain tension on the strand and to minimize the building up of resistance forces therein. The push and pull operation contemplates a fluid conveyor which may be either of the pneumatic or hydraulic type. A fluid conveyor having a hydraulic infeed is preferred. When the push or pull instrumentality is of the hydraulic type, the outfeed is preferably of the pneumatic type in order that it may have a drying effect on the polished strands after they have passed through the grinding throat. In a propelling mechanism, such as a push and pull feeding system, the surgical catgut strand is fed into a fluid infeed nozzle having an axial bore, which serves as a conduit for the strand, and a port serving for the admission of a high velocity stream of fluid which propels the strand into the grinding throat. The strand as it leaves the grinding throat passes into a string receiving and pulling device comprising an outfeed nozzle having an axial bore, serving as a conduit for the strand, and a port for the admission of a high velocity stream of fluid. Fluid, such as air, water, lard oil, and particularly a hydrocarbon oil such as kerosene, are suitable for use in both the infeed and the outfeed described above. Both the infeed and the outfeed nozzles may be regulated in any well-known manner to vary the pressure and volume of the fluid medium passing through the ports in association therewith. In the preferred modification of this type of feeding system, the fluid introduced into the port of the infeed nozzle is kerosene and the fluid introduced into the part of the outfeed nozzle is air.

Strand support blade **15**, shown in Figures 1 and 4, acts to support the catgut suture strand as it passes through the grinding throat by enabling it to resist the downward force of the grinding wheel on the strand. The liquid jet assembly, generally indicated at **10** in Figure 1, is mounted to the device by means of mounting bracket **11** in a manner not shown in the drawing. The liquid jet assembly consists of a hollow body member **20**, a fluid inlet **22** leading into the body member, nozzle **24** leading downward from the body member, and a needle **23** secured to the body member in such a way as to be concentric with the inside of the nozzle. Nozzle **24** is a tube having a threaded outside diameter at its fully opened end and adapted to engage the body member and a partially closed end in the form of a truncated cone having an inside configuration adapted to contact the end of needle **23**; however, in a preferred form, the tip of the truncated cone has a slit positioned parallel to strand **26** and in a plane with support blade **15**. The end of needle **23** is cone-shaped and the body of the needle has a diameter less than the inside diameter of the nozzle to allow the passage of fluid through the nozzle. The amount of fluid passing through the nozzle may be regulated by rotation of the nozzle which moves it in or out of body member **20**.

The liquid introduced into the body member through the fluid inlet passes at high speed through the nozzle and downward toward the catgut suture strand and strand support blade **15** and exerts sufficient downward pressure on the catgut strand as it passes through the grinding

throat to neutralize the upward force exerted on the catgut strand by the regulating wheel. The liquid also has a cooling effect on the catgut strand as it passes through the grinding throat and washes away any finely divided debris removed from the strand by the grinding wheel. The fluid passing through the jet assembly may be water, lard oil, and so forth, but it is preferred that the fluid be of a hydrocarbon nature and a kerosene fraction of hydrocarbon oil has been found particularly suitable. The fluid is sprayed with a pressure of from 60 to 100 pounds per square inch and preferably at about 90 pounds per square inch when the polishing apparatus is operated under the preferred conditions with respect to speeds of the grinding and regulating wheels and the angle at which the regulating wheel is positioned. A fluid pressure of this order and under these conditions provides a downward force on the catgut strand as it passes through the grinding throat sufficient to continually maintain the strand in contact with strand support blade **15**.

It will be obvious to those skilled in the art to which the invention relates that modifications may be made in the method and in the details of constructions of the jet assembly of the apparatus used in the practice of the invention without departing from the spirit of the invention which is not to be restricted or limited in respect to such details or otherwise than as the prior art and appended claims may require.

This application is a continuation-in-part of our application Serial No. 392,212 filed November 16, 1953, now abandoned.

What is claimed is:

1. In a method for grinding and polishing a strand of surgical catgut to uniform gage and circular cross section by passing a strand of surgical catgut through a grinding throat provided by a grinding wheel, a regulating wheel and a support blade, in which the grinding wheel rotates in a clockwise direction, whereby a downward force is exerted on the strand, the regulating wheel rotates in a clockwise direction at a surface speed less than that of the grinding wheel and is positioned at an angle with respect to the grinding wheel axis, whereby an upward and propelling force is exerted on the strand and the support blade is positioned to form the base of the grinding throat and a support for the strand; the improvement comprising, directing a jet spray of liquid downward on the strand at a pressure of from 60 to 100 pounds per square inch, whereby the upward force exerted on the strand by the regulating wheel is neutralized and the strand is held firmly in contact with the support blade.

2. In a method for grinding and polishing a strand of surgical catgut to uniform gage and circular cross section by passing a strand of surgical catgut through a grinding throat provided by a grinding wheel, a regulating wheel and a support blade, in which the grinding wheel rotates in a clockwise direction, whereby a downward force is exerted on the strand, the regulating wheel rotates in a clockwise direction at a surface speed less than that of the grinding wheel and is positioned at an angle with respect to the grinding wheel axis, whereby an upward and propelling force is exerted on the strand and the support blade is positioned to form the base of the grinding throat and a support for the strand; the improvement comprising, directing a jet spray of liquid downward on the strand at a pressure of about 90 pounds per square inch, whereby the upward force exerted on the strand by the regulating wheel is neutralized and the strand is held firmly in contact with the support blade.

No references cited.