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LIGATURE TYING MECHANISM

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3,169,526

LIGATURE TYPING MECHANISM

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Filed Sept. 12, 1962, Ser. No. 223,022

3 Claims. (Cl. 128—326)

This invention relates to a mechanism for tying ligatures of the type having a noose-like configuration. Such ligatures comprise a loop portion which is adapted to be tightened around an object when the free end portion of the ligature is pulled. In a particular application, the device of this invention is designed for use in tying ligatures around the severed ends of blood vessels and the mechanism can therefore be utilized by surgeons during operations, for emergency situations and in similar circumstances.

In accordance with present techniques, strangulation of blood vessels is effected by tying the blood vessels with a ligature in the form of an elongate cord which is cut to length and then knotted about the vessel. This operation requires the use of at least three hands and therefore, at least two individuals, since one hand is needed to hold the hemostat while two hands are needed to slip the cord-ligature around the vessel, to tie knots, and to cut the free ends. Considerable time and effort is taken up in looping the cord and in tightly knotting the cord around the vessel. In the interim, considerable loss of blood can result and the course of an operation can therefore be materially influenced.

It would obviously be beneficial to provide for a material reduction in the time required to ligate a blood vessel during surgery or under emergency conditions, and it is an object of this invention to provide a mechanism for ligating whereby the time required for strangulation of the blood vessel is significantly reduced.

It is an additional object of this invention to provide a tool for use by surgeons and the like which is capable of tying ligatures in a manner such that the tying operation can be carried out by a single individual and can be done easily and quickly whereby strangulation of the blood vessel can be accomplished with a minimum of delay.

It is a more particular object of this invention to provide a tool of the type described which is adapted to carry the ligature to be tied, which is adapted to perform the tying operation, and which is adapted to cut off the free end of the ligature after tying.

These and other objects of this invention will appear hereinafter and for purposes of illustration but not of limitation, specific examples of this invention are shown in the accompanying drawings in which:

FIGURE 1 is an elevational view of one ligature tying mechanism embodying the principles of this invention,

FIGURE 2 is an elevational view, partly cut away, of the mechanism, illustrating the interior portions thereof,

FIGURE 3 is an enlarged detail view of the jaw end of the mechanism illustrating the ligature holding and cutting means prior to placement of a ligature therein,

FIGURE 4 is an enlarged detail view of the jaw end of the mechanism after placement of the ligatures therein,

FIGURE 5 is an enlarged detail view of the jaw end of the mechanism as it appears during strangulation of a blood vessel, and

FIGURE 6 is an enlarged detail view illustrating the manner of cutting off the free end of the ligature.

As indicated, the mechanism of this invention is designed for the tying of ligatures of the type employed by surgeons for the strangulation of blood vessels. In par-

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ticular, the mechanism is adapted for use in combination with noose-like ligatures having a free end which when pulled will cause closing of the loop of the ligature about the blood vessel to be tied.

The mechanism of this invention generally comprises a pair of clamping jaws adapted to hold the severed end of a blood vessel. A pair of arms extend from a pivotal connection for the jaws and these arms serve as the actuating means for opening and closing the jaws. A locking means is preferably provided for the mechanism so that the jaws can be held in a clamping position during the subsequent tying and ligature cutting operation.

The mechanism also includes a clamping means which is adapted to receive the free end of the ligature. This clamping means preferably comprises a mounting bracket which is slideably received on one of the arms of the mechanism. A clamp arm is mounted on this bracket and the free end of the ligature is releasably held by this clamp arm. Means are provided for pulling the clamping means away from the jaw end of the mechanism so that the loop of the ligature can be tightened around the blood vessel when the free end of the ligature is pulled between clamping means.

The ligature tying mechanism of this invention also includes cutting means which are adapted to sever the free end of the ligature after the loop thereof is tightened around the blood vessel. This cutting means preferably includes a blade having one end slideably received in one of the arms while the cutting end of the blade is received in the other arm. Actuating means for the blade are provided so that the cutting end thereof can be moved toward the jaw end of the mechanism into contact with the free end of the ligature after this free end has been pulled to tighten the loop around the blood vessel. This movement of the cutting end of the blade means serves to sever the free end of the ligature at a point immediately adjacent the tightened loop portion of the ligature.

The accompanying drawings illustrate a mechanism 10 which is characterized by the distinctive features of this invention. This mechanism includes a pair of jaws 11 and 12 which are pivotally connected at 14. Arms 16 and 18 form continuations of the jaws on the opposite side of the pivotal connection. Finger holes 20 and 22 serve as means for controlling the opening and closing movements of the jaws.

The arms 16 and 18 are preferably provided with means for locking the jaws together when they are clamped about the severed end of a vessel. The means shown in the drawing designed for this purpose comprise tooth extensions 24 and 26 formed in the arms 16 and 18. The teeth of these extensions are in approximately the same plane so that pressing of the arms toward each other will cause the teeth to slide over each other into interlocking engagement. It will be appreciated that various degrees of clamping force can be effected depending on the number of teeth being engaged. In order to release the jaws, the arms 16 and 18 must be pulled laterally away from each other to disengage the teeth.

The clamping means which receive the free ends of ligatures prior to a tying operation includes a bar 28 which is pivotally secured at 30 to a sliding, channel-shaped bracket 32. A clamp arm 34 is pivotally connected at 36 to the bar 28. A leaf spring 38 normally urges the clamp arm into engagement with the bar 28. The gripping end of the clamp arm and the corresponding portion of the bar 28 are preferably serrated to permit a firm grip. The bracket 32 disposed on the arm 18 is adapted to be moved along the arm by means of a finger grip 40.

The means for cutting off the free end of a ligature include a blade means 42 having one portion thereof

situated in a slot 44 which is defined in the arm 16. The blade means extends into an opening 64 in the jaw 11 and then downwardly into a channel 52 in the jaw 12. An actuating spring 46 normally pulls the blade means toward the finger hole 20 on the arm 16. This spring 46 is pivotally connected to the arm 16 at 48. The portion 50 of the blade means which extends into a channel 52 in the jaw 12 comprises the cutting end. This cutting end rides on the bottom wall of the channel and it will be apparent that application of downward pressure on the spring 46 will result in movement of the cutting end along the channel toward the end of the jaw 12.

As previously noted, the tool of this invention is utilized in combination with a noose-like ligature. A ligature 54 of this type (see FIGURE 4), which includes a free end 56 and a loop portion 57, is representative of the type of ligature contemplated.

The mechanism of this invention is provided with a hole 58 which is defined in the end of the jaw 12 and through which the free end 56 of the ligature can be threaded prior to tying. A funnel-shaped opening 60 extended through the bar portion 28 of the clamping mechanism is adapted to be moved into communication with the hole 58 when the clamping means is in the forward position. Accordingly, the free end 56 can be passed through the hole 58 into the opening 60 and then under the end of the clamp arm whereby the free end of the ligature can be firmly gripped.

In the explanation of the use of the mechanism of this invention, reference will be made to strangulation of the severed end of the blood vessel 62 illustrated in the drawings. It will be appreciated, however, that the mechanism of this invention is suitable for use in the tying of other objects and that the type of ligature described is capable of use in non-surgical application.

As a first step in the operation, the free end 56 of the ligature is fitted into the hole 58 and the opening 60 while the loop 57 is fitted around the jaws in the manner shown in FIGURE 4. With the jaws in the open position as shown in FIGURE 4, the severed end of the blood vessel 62 is located between the jaws and the jaws are then clamped and locked tightly around this vessel as shown in FIGURE 5. As previously explained, the clamping and locking operation takes place simultaneously with the mechanism of this invention due to the interlocking which results through engagement of the extensions 24 and 26.

The free end 56 of the ligature is clamped by the clamping means and the finger lever 40 is then engaged with the index or middle finger and pulled back whereby strangulation of the blood vessel is achieved. The thumb of the same hand can then be employed for pressing down on the spring 46 and this action results in movement of the cutting end 50 of the blade 42 toward the jaw end of the mechanism. As best shown in FIGURE 6, the cutting end 50 passes beyond the hole 58 and, accordingly, the free end 56 of the ligature will be severed. It will be appreciated that the severing of the ligature takes place at a point immediately adjacent the tightened loop. After severing in this manner, the finger holes 20 and 22 can be engaged by the thumb and forefinger to spread them laterally apart and to release the jaws from the blood vessel.

It will be obvious that extremely little time is necessary to provide for strangulation of a blood vessel in accordance with this invention. A material saving in the time to tie the blood vessels results in a distinct saving in the amount of blood loss and in the amount of effort necessary to ligate. Furthermore, the fact that the mechanism of this invention can be operated with one hand provides a material saving in time and effort and enables much more efficient surgery particularly where

blood vessels to be strangulated are relatively inaccessible.

It will be understood that various modifications may be made in the ligature tying mechanism described which provide the characteristics of this invention without departing from the spirit thereof, particularly as defined in the following claims.

That which is claimed is:

1. A mechanism for tying noose-like ligatures having a free end which when pulled causes closing of the loop of the ligature about an object to be tied, said mechanism comprising a pair of jaws adapted to hold the object to be tied, a pivotal connection for said jaws, a pair of arms forming a continuation of said jaws extending on the opposite side of said connection, finger holes in the ends of said arms and locking means associated with said arms adapted to restrain said jaws and arms from pivotal movement, a clamping means having a gripping end and being associated with one of said arms, the gripping end of said clamping means extending to a position adjacent the end of one of said jaws whereby the clamping means is adapted to receive the free end of a ligature, said clamping means being movably supported by said one arm whereby the loop of a ligature can be fitted around an object held in said jaws and the free end of the ligature can be gripped and pulled by said clamping means, and including a blade means adapted to cut off the free end of said ligature at a point immediately adjacent the tightened loop thereof, said blade means including a cutting end reciprocally movable in a slot defined in said one jaw, an opening in said one jaw extending from the outside end of said jaw to the end of said slot whereby the free end of a ligature can be inserted through said opening, clamped by the clamping means and pulled so that the loop will be tightened around the object to be tied, said cutting end being reciprocally movable in said slot whereby the free end portion extending through said opening can be engaged by said cutting end and severed, and including an actuating means for said blade means, said actuating means being attached to said blade means near the end opposite the cutting end thereof, said blade means extending through an opening defined in the other of said jaws with the opposite end of said blade means being positioned on the other of said arms, and said actuating means being connected to the other of said arms.

2. A mechanism in accordance with claim 1 wherein said clamping means comprises a mounting bracket slideably received on one of said arms, a bar connected to said mounting bracket and extending toward the jaw end of said mechanism, a clamp arm pivotally mounted on said bar and having one end resiliently urged into engagement with said bar whereby said free end of the ligature can be gripped between said clamp arm and said bar and the mounting bracket can then be moved along said one arm away from said jaws to pull said free end to tie said ligature.

3. A mechanism in accordance with claim 1 wherein said actuating means comprises a spring lever extending outwardly of said other arm and movably urging said blade means to a retracted position, said spring lever acting to force said blade means to cutting position when pressure is applied thereto.

References Cited in the file of this patent

UNITED STATES PATENTS

3,033,204	Wood	May 8, 1962
3,040,747	Wood	June 26, 1962

FOREIGN PATENTS

393,010	Great Britain	June 1, 1933
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