May 9, 1944. J. D. KARLE 2,348,218

SURGICAL STITCHING INSTRUMENT

Filed April 9, 1942

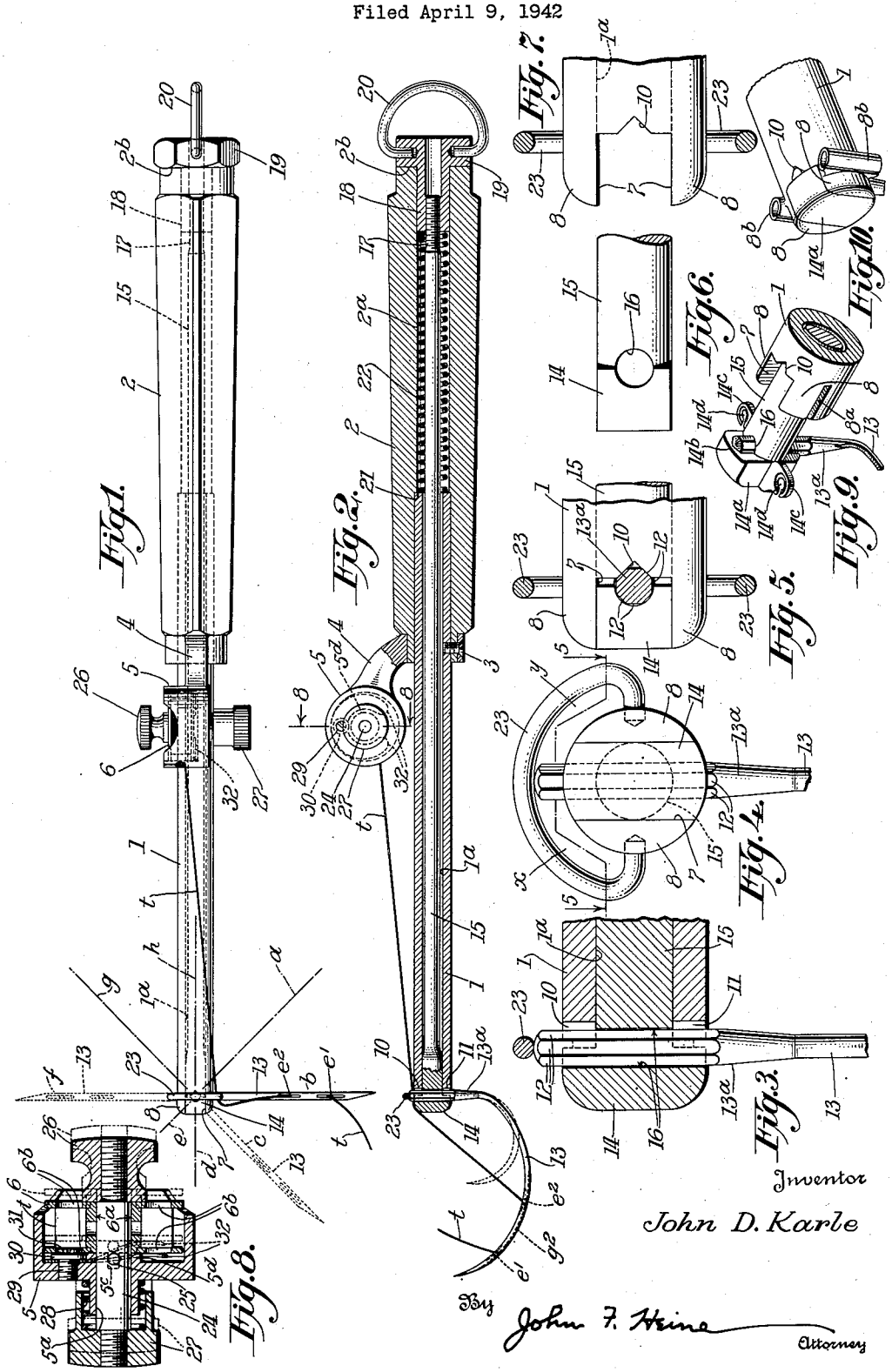

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

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Patented May 9, 1944

2,348,218

UNITED STATES PATENT OFFICE

2,348,218

SURGICAL STITCHING INSTRUMENT

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Application April 9, 1942, Serial No. 438,292

21 Claims. (Cl. 128—340)

This invention relates to surgical stitching instruments and it has as its primary object to improve the instrument disclosed in my pending United States patent application Serial No. 398,708, filed June 19, 1941.

Stated more specifically, my invention has as an object to provide, in a surgical stitching instrument, improved needle-clamping means and an improved needle adapted to be positively secured therein in any one of a considerable number of predetermined angular positions.

Another object of the invention is to provide an improved needle-clamping means for surgical stitching instruments in which the needle is impositively held within the needle-clamp during angular adjustment of the needle but which also is designed positively to lock the needle against turning after the desired angular position has been attained.

A further object of the invention is to provide an improved needle-clamp for surgical stitching instruments which will not increase the overall size of that end of the instrument which, during use, is required to be inserted into small openings, thereby rendering the instrument particularly useful in forming suturing stitches in relatively small and relatively inaccessible places such for example as when performing cleft palate, tonsil, appendix and brain operations.

A still further object of the invention is to provide improved means for supporting and locking a spool of suturing thread on the instrument, including means to place a slight tension on the spool to prevent overrunning of the spool and spilling of the thread during the time it is unlocked and thread is being drawn therefrom.

Still another object of the invention is to provide improved easy-threading, duplex thread-guides designed to guide the thread in its passage from the spool to the needle when the instrument is used in either the right or the left hand.

With the above and other objects in view, as will hereinafter appear, the invention comprises the devices, combinations and arrangements of parts hereinafter set forth and illustrated in the accompanying drawing of a preferred embodiment of the invention, from which the several features of the invention and the advantages attained thereby will be readily understood by those skilled in the art.

In the drawing,

Fig. 1 is a plan view of the improved instrument, showing the needle in full lines in one position, and in dotted lines, in two of the eight positions in which it is possible positively to clamp the needle,

Fig. 2 is a longitudinal sectional view of the instrument shown in Fig. 1 showing, in full and dotted lines, respectively, both large and small needles held therein.

Fig. 3 is an enlarged sectional view of the needle-clamping end of the instrument, with the shank of the needle clamped therein.

Fig. 4 is an enlarged left end view of the instrument shown in Fig. 1 with a portion of the needle broken away.

Fig. 5 is a section taken on the line 5—5 of Fig. 4 showing the shank of the needle positively locked by stationary and movable clamp jaws.

Fig. 6 is an enlarged plan view of a movable needle-clamping jaw, later to be described.

Fig. 7 is an enlarged plan view of the left end portion of the main supporting element of the instrument shown in Fig. 1, including the stationary needle-clamping jaw and, in section, the thread-guide.

Fig. 8 is an enlarged section on the line 8—8 of Fig. 2 showing the manually releasable locking means for the thread-spool and the means applying friction to the spool when it is released.

Fig. 9 is a detail perspective view of the needle-clamping end of the instrument, with the elements partially disassembled, showing a modified form of needle-clamp and thread-guide.

Fig. 10 is a detail perspective view of the needle-clamping end of the instrument showing a second modified form of thread-guide.

Referring more specifically to the drawing, the invention is disclosed as embodied in a surgical stitching instrument comprising a main supporting element 1, of tubular form, to one end of which is secured a handle 2 by means of which the instrument may be held and manipulated. The handle preferably has its outer surface roughened or fluted to facilitate holding the instrument while in use. Upon one end of the handle there is secured, by a screw 3, a bracket 4 which carries a spool-case 5 in which is rotatably mounted a spool 6. The spool has wound thereon a suitable suture thread *t* for use with the instrument. The screw 3, which secures the bracket 4 to the handle, also secures the handle to the main supporting element 1. Manually releasable means, later to be described, is provided for locking the spool against rotation. Means also is provided for controlling rotation of the spool when it is released.

At its free end, the supporting element is formed with a transverse substantially rectangular open-ended guideway 7 located between cheek pieces 8 provided by the supporting element. At

the innermost end of the guideway 7 the tubular wall of the supporting element 1 is formed with aligned V-shaped notches 10 and 11, the opposed flat surfaces of which are adapted to receive complemental flat surfaces 12 formed on the shank 13ª of a curved eye-pointed needle 13. The walls of the notches thus constitute a fixed needle-clamping jaw. Cooperating with the fixed jaw is a movable needle-clamping jaw comprising a transversely arranged head 14, formed on one end of a needle-clamp actuating pull-rod 15 extending lengthwise within the central bore 1ª in the main supporting element 1. As shown most clearly in Figs. 3 and 6, a bore 16 is formed transversely of the rod 15, approximately one-half of the bore being in the head 14 and the other half being in the rod 15. The bore 16 is adapted to receive the shank of the needle and the wall of that portion thereof in the head 14 constitutes a needle-shank engaging surface of the movable needle-clamping jaw which, in conjunction with the stationary jaw in the element 1, clamps the shank of the needle and holds the needle in operative position relative to the element 1 and handle 2.

Preferably the shank of the needle is of polygonal form in cross-section as, for example, octagonal, as shown in Fig. 5. With this construction of needle shank and needle-clamp, the needle selectively may be set in the clamp in any one of eight angular positions and in each position two of the flat surfaces 12 of the needle shank will be in contact with the opposed walls of the V-notches 10 and 11. Thus when the clamp is tightened the needle will be held positively against all angular movement. In Fig. 1 the needle 13 is shown, in full lines, as occupying a position *b* in which it extends to the left from and at an angle of ninety degrees to the axis of the main supporting element 1 and handle 2 and in dotted lines in a position *c* in which it is forty-five degrees from said axis. The needle may also be adjusted to each of the operative positions indicated by the lines *a*, *d*, *e*, *f* and *g*. The positions *a*, *b* and *c*, are usually employed when using the instrument in the right hand, while the positions *e*, *f* and *g* are usually employed when using the instrument in the left hand. The position *d* is equally convenient when using the instrument in either hand. The needle may also be secured in a protected position *h* one hundred eighty degrees from position *d* in which it underlies the supporting element 1, but this is not an operative position.

The needle 13 is preferably provided with main and auxiliary thread-eyes e^1 and e^2, respectively, and a groove g^2 extending along the convex surface of the needle between said eyes. This construction insures that, during the making of a suturing stitch, the thread will lie in the needle groove and only the free end of the thread, which projects from the main needle eye, will be accessible to the operator so that engagement of the improper limb of the thread, and consequently accidental unthreading of the needle, is precluded.

The needle-clamp actuating pull-rod 15 extends through the bore 1ª in the main supporting element 1 and into a bore 2ª in the handle 2 where it is externally threaded, at 17, to receive the complemental internal threads formed in a cylindrical nut 18 fitted within the open end of the bore 2ª. The nut 18 is formed with an enlarged hub or flange 19 adapted to bear against the outer end 2ᵇ of the handle so that rotation of the nut will cause the rod to be moved lengthwise toward the right in Figs. 1 and 2 thereby positively to lock the needle against rotation in the V-notches 10 and 11. The flange 19 is preferably formed with a plurality of flat surfaces to facilitate manual rotation of the nut. To further facilitate rotation of the nut it may be fitted with a ring 20 which may serve as a wrench to rotate the nut.

Interposed between a shoulder 21 within the handle 2 (preferably the inner end of the tube 1) and the inner end of the nut 18 is a coil spring 22 normally maintained under tension and constantly urging the rod 15 to the right as seen in Figs. 1 and 2. This causes the movable needle-clamping jaw 14 to spring shut and yieldingly engage the shank of the needle and thereby impositively to hold the same even when the nut 18 is partially backed off to release the needle-clamp. With the nut 18 backed off and the needle shank impositively gripped between the stationary jaw 10, 11 and the movable jaw 14, the needle may be rotated about the axis of its shank to any one of the positions *a*, *b*, *c*, *d*, *e*, *f*, *g*, or *h* without any danger of the needle (which previously has been sterilized) from falling from the needle-clamp and being contaminated.

An important feature of this invention resides in the size and construction of the needle-clamp. It will be observed that the movable jaw 14 slides between the cheek pieces 8 provided by the free end of the supporting element 1 and therefore the overall size of the needle clamp is no larger than the diameter of the element 1. Thus the instrument is well adapted for forming suturing stitches in relatively small and relatively inaccessible places especially when fitted with a small needle, as indicated in dotted lines in Fig. 2.

Secured upon the free end of the main supporting element 1 is a combined thread-guide and needle-stop comprising a wire loop 23 having its free ends fitted in and brazed to the cheek pieces 8 in line with and at diametrically opposite sides of the shank of the needle. As shown in Figs. 3 and 4, the mid-portion of the wire loop 23 serves as an abutment which limits the upward movement of the needle shank when it is inserted into the needle-clamp. The arcuate spaces *x* and *y* (Fig. 4) between the wire loop 23 and the end of the member 1, at opposite sides of the needle shank constitute easy-threading non-clogging right and left thread-guides through which the thread passes in its travel from the spool 6 to the eye of the needle. When the needle is adjusted to any one of the positions *a*, *b* or *c* the thread is passed through the space *y* in the thread guide. When the needle is swung to any one of the positions *e*, *f*, or *g*, the thread is passed through the space *x*.

Slidingly mounted in a central bore 5ª (see Fig. 8) formed in the base 5*b* of the spool-case is a spool-supporting pin 24 having projecting from opposite sides thereof the opposite ends of a cross pin 25 which enter notches 5ᶜ formed in the inner face of the spool-case. The engagement of the pin 24 with the notches 5ᶜ prevent rotation of the pin while permitting it to be shifted axially. The spool 6 is provided with a hub having a central bore 6ª adapted to fit upon the pin 24 and a nut 26 threaded on one end of the pin engages the spool and prevents outward movement of the spool on the pin. The opposite end of the pin 24 has threaded thereon a cup-nut 27 which houses one end of a compression spring 28 surrounding the pin 24 between the nut 27 and the base 5ᵇ of the

spool-case. That spring normally urges the pin in a direction to cause the nut 26 to force the spool into contact with an annular shoulder 5d formed in the spool-case with the inner flange of the spool spaced slightly from the base 5b.

Provision is made for locking the spool against rotation except when it is desired to draw suture-thread therefrom. This is effected by means of a screw 29, threaded into the base 5b of the spool-case, and having a flanged collar 30 and a reduced head 31. The head 31 is adapted to enter any one of a plurality of holes 6b formed in the flanges of the spool when the spool is moved inwardly by the action of the spring 28, as shown in full lines in Fig. 8. When it is desired to draw thread from the spool pressure is applied upon the nut 27 thereby shifting it and the pin inwardly in opposition to the spring 28. The pin 25 bearing against the inner flange of the spool shifts the spool outwardly thereby freeing the hole 6b in the flange of the spool from the head 31 of the stud 29. The spool is then free to rotate to permit thread to be pulled therefrom. It sometimes happens that a user will jerk the thread which, were the spool freely rotatable, would result in spinning of the spool and spilling of the thread in the spool-case. To prevent this from occurring, without interfering with free pulling of the thread, there has been provided a light friction spring 32 which, as shown in full and dotted lines in Fig. 8, bears against the innermost flange of the spool thereby sufficiently retarding rotation of the spool to prevent spinning thereof. The spring 32 is punched out of flat stock and, as shown in face view in dotted lines in Fig. 2, is of substantially C-shape. It is held in place in the spool-case by the screw 29, the head of which also serves as one of the elements of the spool-locking means. The free ends of the C-shaped spring 32 are deflected laterally out of the plane of the main body portion thereof and maintain a pressure against the innermost flange of the spool.

In Fig. 9 there is disclosed a modified form of needle-clamp and thread-guide. In this construction the needle-clamp-actuating pull-rod 15 carries a head 14a, generally similar to the head 14 of the preferred form, which constitutes the movable needle-clamping jaw. This head also is designed slidingly to fit within the guideway 7 formed between the cheek pieces 8 at the free end of the main supporting element 1. This modified construction also includes the bore 16 formed partially in the pull-rod 15 and partially in the head 14a but in this form the bore does not extend entirely through the head so that a portion 14b thereof overlies the end of the needle-shank 13a and forms a stop therefor. The thread-guides provided by this modified construction comprise ears 14c which project laterally from the head 14a and which are provided with open or so-called "self-threading" eyes 14d into which the suture thread readily may be placed without inserting the end therethrough. When the parts are assembled into needle-clamping position the ears 14c fit within slots 8a (only one of which is shown) formed in the cheek pieces 8.

The second modified construction disclosed in Fig. 10, differs from the above described modified construction in that the thread-guides consist of split tubes 8b welded or otherwise secured to the cheek pieces 8 of the main supporting element 1.

Inasmuch as the spool case 5 is offset from the axis of the shaft 1 in a direction midway between the right and left positions *b* and *f* of the needle, the suture thread may be led with equal facility from the spool, through the appropriate thread guide, and to the needle in either position.

Having thus set forth the nature of the invention what I claim herein is:

1. A surgical suturing instrument comprising a pair of needle-gripping jaws, telescopically arranged elements each carrying a respective one of said jaws, spring means applied to said elements to urge them endwise relative to one another to carry said jaws into needle-gripping relation, and means supplemental to said spring means to tighten the grip of said jaws upon said needle.

2. A surgical suturing instrument comprising a pair of needle-gripping jaws, telescopically arranged elements each carrying a respective one of said jaws, spring means applied to said elements to urge them endwise relative to one another to carry said jaws into needle-gripping relation, and screw means acting in opposite directions on said elements and supplemental to said spring means to tighten the grip of said jaws upon said needle.

3. A surgical suturing instrument comprising a pair of needle-gripping jaws, telescopically arranged elements each carrying a respective one of said jaws, a hollow handle secured upon the outer one of said elements and constituting an extension thereof, spring means applied to said elements to urge them endwise relative to one another to carry said jaws into needle-gripping relation, and a nut threaded upon the innermost one of said elements and bearing upon the adjacent end of said handle to tighten the grip of said jaws upon said needle.

4. A surgical suturing instrument comprising a pair of relatively movable needle-gripping jaws one of which is provided with a flat, needle-engaging surface, a needle having a shank of polygonal shape, in cross section, located between said jaws with a flat surface thereof in contact with the flat, needle-engaging surface of the said one of said jaws and with the other jaw engaging the opposite side of the needle shank and means to urge said jaws toward each other to grip the shank of the needle therebetween in any one of more than four predetermined angular positions.

5. A surgical suturing instrument comprising a pair of needle-gripping jaws one of which is provided with flat, angularly arranged, needle-engaging surfaces, a needle having a shank of polygonal shape in cross section, located between said jaws with flat surfaces thereof in contact with the flat, angularly arranged, needle-engaging surfaces of the said one of said jaws and with the other jaw engaging the opposite side of the needle shank, spring means to urge said jaws toward each other to grip the shank of the needle therebetween, and means supplemental to said spring means to tighten the grip of said jaws upon said needle.

6. A surgical suturing instrument comprising a pair of needle-gripping jaws one of which is provided with flat, angularly arranged, needle-engaging surfaces, a pair of telescopically arranged elements each carrying a respective one of said jaws, a needle having a shank of polygonal shape, in cross section, located between said jaws with flat surfaces thereof in contact with the flat, angularly arranged, needle-engaging surfaces of the said one of said jaws and with the other jaw engaging the opposite side of the needle shank, spring means to urge said jaws toward each other yieldingly to grip the shank of the needle therebetween to permit angular adjustment of

the needle in said jaws, and screw means acting in opposite directions on the adjacent ends of said elements to tighten the grip of said jaws upon said needle to hold it in its adjusted position.

7. A surgical suturing instrument comprising a pair of needle-gripping jaws one of which is provided with flat, angularly arranged, needle-engaging surfaces, a pair of telescopically arranged elements each carrying a respective one of said jaws, a hollow handle secured upon the outer one of said elements and constituting an extension thereof, a needle having a shank of polygonal shape in cross section located between said jaws with flat surfaces thereof in contact with the flat angularly arranged needle-engaging surfaces of the said one of said jaws and with the other jaw engaging the opposite side of the needle shank, spring means to urge said jaws toward each other yieldingly to grip the shank of the needle therebetween to permit angular adjustment of the needle in said jaws, and a nut threaded upon the innermost one of said elements and bearing upon the adjacent end of said handle to tighten the grip of said jaws upon said needle to hold it in its adjusted position.

8. A surgical suturing instrument comprising a supporting element, a handle element secured upon one end of said supporting element, a curved eye-pointed needle carried by the other end of said supporting element, a spool-holder carried by one of said elements, a spool of suturing thread supported by said spool-holder, the free end of the thread on said spool being threaded through the eye of said needle, means to lock said spool against rotation relative to said spool-holder to prevent thread from being drawn therefrom, means to render said spool-locking means ineffective, thereby to permit rotation of said spool and removal of thread therefrom, and means to retard the rotation of the spool thereby to prevent overrunning of the spool and spilling of thread therefrom.

9. A surgical suturing instrument comprising a supporting element, a handle element secured upon one end of said supporting element, a curved eye-pointed needle carried by the other end of said supporting element, a spool-holder carried by one of said elements, a spool of suturing thread supported by said spool-holder, the free end of the thread on said spool being threaded through the eye of said needle, means to lock said spool against rotation relative to said spool-holder to prevent thread from being drawn therefrom, means to render said spool-locking means ineffective, thereby to permit rotation of said spool and removal of thread therefrom, and a flat-metal spring secured within said spool holder and bearing against said spool to retard rotation of the spool, thereby to prevent overrunning of the spool and spilling of thread therefrom.

10. A surgical suturing instrument comprising a pair of needle-gripping jaws one of which is provided with a flat, needle-engaging surface, a needle having a curved blade and a straight shank of polygonal shape in cross section located between said jaws with a flat surface thereof in contact with the flat, needle-engaging surface of the said one of said jaws and with the other jaw engaging the opposite side of the needle shank and spring means to urge said jaws toward each other yieldingly to grip the shank of the needle therebetween while permitting rotation of said needle about the axis of its shank to various angular positions relative to said jaws.

11. The combination with an eye-pointed needle having a curved blade and a straight multi-sided shank, of a needle-holder including a shaft, and a spring-shut needle-clamp comprising complemental fixed and movable needle-clamping jaws at the free end of said shaft.

12. The combination with an eye-pointed needle having a curved blade and a straight multi-sided shank disposed at an angle to the adjoining portion of said curved blade, of a needle-holder having a handle and a shaft, a spring-shut needle-clamp at the free end of said shaft, and screw means acting on said handle and shaft to tighten the grip of said needle-clamp on said needle.

13. A surgical suturing instrument having, telescopically arranged shafts, needle-gripping jaws carried by said shafts, a hollow handle on the external one of said shafts, a coil spring surrounding the internal shaft within said hollow handle, a shoulder within said handle against which one end of said spring reacts, and a nut threaded onto the end of the internal shaft remote from said jaws, said nut being engaged by the other end of said spring and reacting against the butt end of said handle to tighten the grip of said jaws upon the needle.

14. A surgical suturing instrument comprising a supporting element, a handle element connected therewith, a needle-clamp at one end of said supporting element, a curved eye-pointed needle having its shank secured in said needle-clamp, a spool of suturing thread carried by one of said elements and a combined thread-guide and needle-stop carried by said supporting element adjacent said needle-clamp for locating the needle in said clamp and directing the suturing thread from said spool to the eye of said needle.

15. A surgical suturing instrument as set forth in the preceding claim in which the combined thread-guide and needle-stop comprises a substantially C-shaped wire loop having its end portions secured in opposite sides of the free end of said supporting element and its main body portion spaced from and substantially concentric with the free end portion of the supporting element and in line with the axis of the shank of the needle held in said needle-clamp.

16. A surgical suturing instrument comprising a supporting element, a needle-clamp at one end of said supporting element constructed and arranged to hold the shank of an eye-pointed needle in any one of a plurality of angular positions, a spool-holder supported from said element and a plurality of quick-threading thread-guides at one end of said supporting element, each of said thread-guides consisting of an ear projecting laterally from one side of said needle-clamp and provided with an open-sided thread-eye.

17. A surgical suturing instrument comprising a supporting element, a needle-clamp at one end of said supporting element constructed and arranged to hold the shank of an eye-pointed needle in any one of a plurality of angular positions, a spool-holder supported from said element and a plurality of quick-threading thread-guides at one end of said supporting element, each of said thread-guides consisting of a slotted tube secured to said supporting element adjacent said needle-clamp.

18. A surgical suturing instrument having a needle formed with a curved eye-pointed blade and a straight shank, a needle-holder formed with a shaft having needle-shank clamping means at one end permitting the needle to be selectively set with its point at either the right

or left side of said shaft, a suture spool case offset from the axis of and carried by said shaft, the direction of such offset being between the right and left positions of the needle, and suture thread guiding means disposed at each of the right and left sides of said needle clamping means, closely adjacent the latter.

19. A surgical suturing instrument comprising a cylindrical supporting element having at one end an open-ended guideway formed between opposed cheek-pieces provided by the sidewalls of said supporting element, the innermost wall of said guideway affording a fixed needle-clamping jaw, a movable needle-clamping jaw slidingly fitted in said guideway between said cheek-pieces and having a needle-engaging surface opposed to said fixed jaw and adapted to bear upon one side of a needle to force the opposite side thereof into pressure contact with said fixed jaw to clamp a needle therebetween, and means to actuate said movable needle-clamping jaw.

20. The construction set forth in claim 19 in which the over-all size of the cheek-pieces and the movable needle-clamping jaw does not exceed the outside diameter of the cylindrical supporting element.

21. A surgical suturing instrument comprising a tubular supporting element having at one end an open-ended guideway formed between opposed cheek-pieces provided by the sidewalls of said supporting element, the innermost wall of said guideway being provided with a notch the walls of which afford a fixed needle-clamping jaw, a movable needle-clamping jaw slidingly fitted in said guideway between said cheek-pieces and having a needle-engaging surface opposed to said notch and adapted to bear upon one side of a needle to force the opposite side thereof into pressure contact with the walls of said notch to clamp a needle between said fixed and movable jaws, and means including a rod extending through said supporting element and carrying said movable jaw to actuate the latter.

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