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P. P. GROSSO

2,507,710

ADJUSTABLE-ANGLE SURGICAL INSTRUMENT

Filed July 2, 1949

FIG. 1.

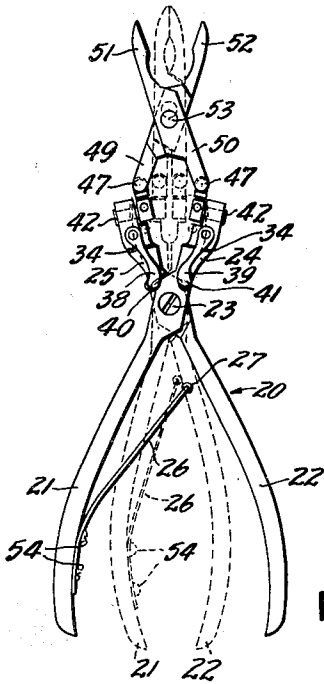


FIG. 2.

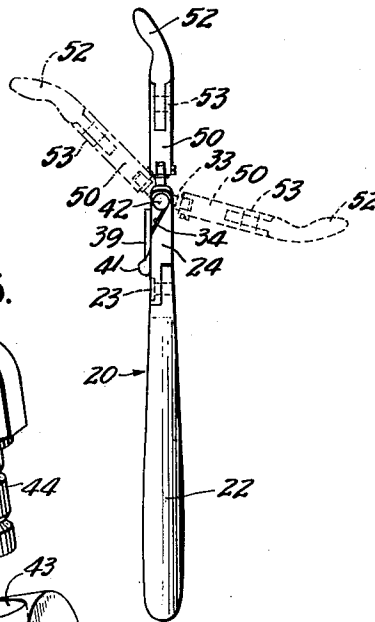


FIG. 5.

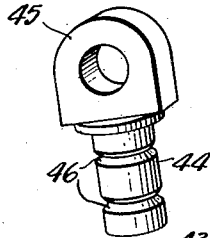


FIG. 6.

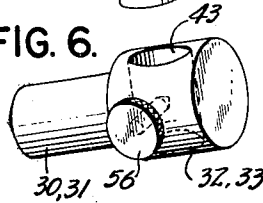


FIG. 3.

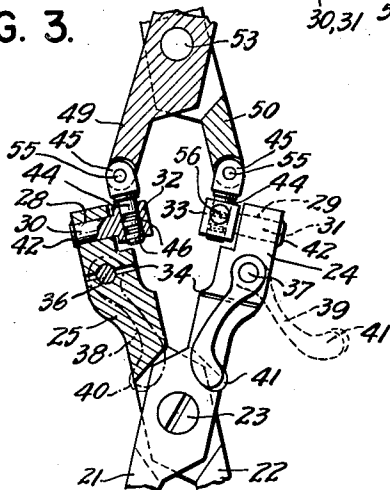
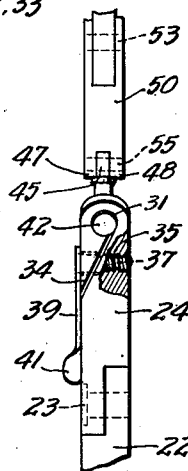


FIG. 4.



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2,507,710

ADJUSTABLE-ANGLE SURGICAL
INSTRUMENT

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4 Claims. (Cl. 128—312)

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This invention relates to improvements in adjustable-angle surgical instruments such as are shown generally in my prior Patent No. 2,109,147, patented February 22, 1938. While my improved adjustable-angle instrument is particularly useful in the fields of surgery and dentistry, it is also adapted to many other fields of use.

One object of this invention is an improved form of angle-setting-and-locking mechanism for an adjustable angle surgical instrument.

Another object is an adjustable-angle surgical instrument, which can be instantaneously unlocked to permit a change of angle setting, and instantaneously relocked at the new setting.

Another object is an adjustable-angle surgical instrument wherein the operating jaws are adjustable for lateral displacement.

Another object is an adjustable-angle surgical instrument having an angle-setting-and-locking mechanism of but few and simple parts, which is inexpensive and easy to manufacture, readily assembled and disassembled, easy to manipulate, rapidly adjusted and readjusted, and which is very efficient and durable in use.

Other objects will appear from the detailed description which follows:

In the drawings comprising one sheet of six figures, numbered Figs. 1 to 6 inclusive:

Fig. 1 is a front view illustrative of one form of surgical instrument embodying my invention, the broken lines indicating the instrument when in closed position;

Fig. 2 is a side view of said instrument, the broken lines indicating various angular settings of the operating jaws;

Fig. 3 is a front view of the angle setting and locking mechanism, with some of the parts shown in section;

Fig. 4 is a side view of the device of Fig. 3; and

Fig. 5 and 6 are perspective views of the knuckles which make up the angle setting mechanism.

Like reference characters designate corresponding parts throughout the several figures of the drawings.

The surgical instrument 20 may be any form or kind of grasping, holding, carrying, crushing, cutting or clamping, instrument, such as forceps, clamps, hemostats, tenaculums, rongeurs, carriers, scissors, or one of the special instruments such as gall bladder forceps, intestinal forceps, nose and throat instruments, and/or a dental or veterinarian instrument. As illustrated, the invention is shown applied to a pair of rongeurs.

The operating handles 21 and 22 of the surgical instrument may be of any preferred form and

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may be suitably pivotally interconnected in any suitable manner as by the stud screw 23. The operating handles 21 and 22 extend beyond the pivotal connection 23 to form a pair of short lever arms 24 and 25. In the structure illustrated the operating handles 21 and 22 are normally held in the partially open position by means of spring 26 which is secured at one end to one of the operating handles 21 as by the screws 54. The free end of the spring 26 may carry a rotatably mounted roller 27 for reducing friction, insuring a smooth action, and reducing wear between the parts. When the handles are moved towards each other the roller 27 engages the inner face of the handle 22 to energize the spring 26, and when the operating handles 21 and 22 are released, the spring 26 causes the handles to separate, thus increasing the separation between the short lever arms 24 and 25.

The short lever arms 24 and 25 are provided with through openings 28 and 29 wherein the shanks 30 and 31 of the knuckles 32 and 33 are mounted to turn in said through openings 28 and 29 about the lever arms 24 and 25. Each lever arm 24 and 25 is partially split at 34, each split 34 extending to and merging with one of the through openings 28 or 29, as the case may be, to permit the width of the bore of the through openings to be varied as hereinafter described. The lever arms 24 and 25 are drilled, at right angles to the axes of the through openings 28 and 29, and the portions 35 of the lever arms are threaded to receive the right and left hand threaded pins 36 and 37 which are suitably attached to the rocker arms 38 and 39, as by riveting, so that when the pins 36 and 37 are screwed into the threaded portions 35, the split sections 34 of the lever arms may be drawn towards the threaded portions 35 thereof when the rocker arms 38 and 39 are rocked in the proper direction to reduce the width of the bores of the through openings 28 and 29, thus locking the shanks 30 and 31 to immobilize the knuckles 32 and 33. By rocking the rocker arms 38 and 39 in opposite directions through a small angle, the split sections 34 move away from the threaded portions 35 thus releasing the shanks 30 and 31 which are now free to turn upon the lever arms 24 and 25. The outer extremity of each rocker arm 38, 39 may be bent upwards to form a thumb latch 40 or 41.

Each knuckle 32, 33 and its shank 30, 31 is turned in one piece, the shank 30, 31 being reduced in size, so that the head of the knuckle overhangs its shank to form a shoulder or stop

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which engages the edge face of the lever arm 24 or 25 to limit the extent of movement of the shank 30, 31 in the through opening 28 or 29. The end of the shank 30, 31 may be riveted over at 42 to prevent the knuckle 32 or 33 from being removed from its lever arm 24 or 25. Each knuckle 32, 33 is also provided with a through opening 43 forming a socket for receiving the shank 44 of one of the knuckles 45.

Each shank 44 may be provided with two or more spaced annular grooves 46, so that by sliding the shank 44 up or down in the socket 43, one of the grooves 46 may register with, and be engaged by, the knurled-headed set-screw 56 to adjust and lock the shank 44, and prevent the knuckle 45 from pulling out of the knuckle 32, 33 in which the knuckle 45 is mounted. Each knuckle 45 includes a holed ear which cooperates with the holed ear(s) 47, 48 formed at the end of one of the short arms 49 or 50 of the operating jaws 51 and 52 of the surgical instrument 20. The operating jaws 51 and 52 are pivotally connected together as at 53 so that whenever the operating handles 21 and 22 are closed the operating jaws 51 and 52 are also closed substantially as shown in broken lines in Fig. 1; and whenever the operating handles 21 and 22 are forced apart by the release of the spring 26 the operating jaws 51 and 52 of the instrument are likewise separated, substantially as shown in bold lines in Fig. 1.

To effect lateral displacement of the operating jaws 51 and 52, one of the shanks 44 is extended until its lower annular groove 46 registers with the stem of the knurled-headed set-screw 56 which is then screwed down to lock the knuckle in the extended position, thus displacing the operating jaws 51, 52 laterally. By extending both shanks 44 to the maximum, length adjustment of the operating jaws, and a change in leverage, may be obtained.

To adjust the instrument 20 to any desired angle, the rocker arms 38 and 39 are respectively moved clockwise and counter-clockwise through a small angle to unlock the shanks 30 and 31 of the knuckles 32 and 33. The operating jaws 51 and 52 may now be turned through a circular arc to any desired angular setting relative to the operating handles 21 and 22 (see Fig. 2). The rocker arms 38 and 39 are now moved towards each other to force the split sections 34 inwards thus reducing the cross section of each through opening 28 and 29 to lock and immobilize the shanks 30 and 31 to prevent any premature change in the angular setting. The operating handles may now be manipulated to actuate the operating jaws 51 and 52.

By using this adjustable-angle and laterally displaceable surgical instrument many surgical procedures are facilitated, particularly where structures, organs, tissues, blood vessels, or nerves, are difficult to reach with ordinary instruments. Its use likewise eliminates delay and expedites operative procedure in cases where some particular fixed angle instrument has not been sterilized, and is therefore not available for immediate use when unexpectedly needed. This multi-angle instrument can be used to great advantage in those cases where the surgeon requires an instrument having one angle for picking up a structure, and another instrument having an entirely different angle for holding the structure while the operative procedure is completed. In such cases this multi-angle instrument is invaluable, because the angular setting

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of the operating jaws 51 and 52 relative to the operating handles 21 and 22 can be changed almost instantaneously, and the operating handles 21 and 22 moved to that position which least obstructs the surgeon's field of operation.

What is claimed is:

1. In an adjustable-angle surgical instrument and in combination, a pair of operating handles, a pivotal connection therebetween, the ends of said handles extending beyond said pivotal connection to form a pair of relatively short lever arms, each of said lever arms having a hole formed therein and being split cross-wise, each split extending through the wall of said hole and merging with one face of the lever arm to form an air gap, a pair of T-shaped connectors, each connector including a cross-head and a shank depending from and in continuation of said cross-head, each cross-head having a socket recessed therein, said socket extending at right angles to the longitudinal axis of the shank of the connector, said shanks being mounted to rotate in the holes in said lever arms to effect angular movement of said connectors relative to their associated lever arms, a pair of operating jaws, a pivotal connection therebetween, the ends of said operating jaws being prolonged beyond said pivotal connection and terminating in holed ears, a pair of knuckles, each of said knuckles including a shank portion having a holed ear formed at one end thereof, a plurality of annular grooves encircling each of said shanks in spaced relation to each other, the holed ears in said knuckles being pivotally connected to the holed ears of said operating jaws as prolonged, the shanks of said knuckles being slidably adjustable in the sockets in said connectors, and means carried by the short lever arms for contracting the air gaps to lock the shanks of the connectors to the lever arms and immobilize the connectors against change in angular setting.

2. In an adjustable-angle surgical instrument and in combination, a pair of operating handles, a pivotal connection therebetween, the ends of said handles extending beyond said pivotal connection to form a pair of relatively short lever arms, each of said lever arms having a hole formed therein, each lever arm also being split crosswise, each split extending from the face of the lever arm and passing through the wall of the formed hole to form an air gap, a pair of T-shaped connectors, each connector including a cross-head and a shank depending from and in continuation of said cross-head, each cross-head having a socket opening formed therein, said socket extending at right angles to the longitudinal axis of the shank of the connector, said shanks being mounted in the holes in said lever arms to rotate and effect angular movement of each connector-socket relative to its associated lever arm, a pair of operating jaws, a pivotal connection therebetween, the ends of said operating jaws being prolonged beyond said pivotal connection and terminating in holed ears, a pair of knuckles, each of said knuckles including a shank portion having a holed ear formed at one end thereof, the holed ears in said knuckles being pivotally connected to the holed ears of said operating jaws as prolonged, the shanks of said knuckles being plugged in the sockets in said connectors, pins penetrating said short lever arms and threadably mounted therein, rocker arms attached to the free ends of said pins and movable across the face of said short lever arms, and said rocker arms being rockable to impart

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increased tension to said pins and bring said rocker arms into physical engagement with said short lever arms thereby reducing the air gaps and locking the shanks of the connectors to the short lever arms to immobilize the connectors against change in angular setting.

3. In an adjustable-angle surgical instrument and in combination, a pair of operating handles, a pivotal connection therebetween, the ends of said handles extending beyond said pivotal connection to form a pair of relatively short lever arms, each of said lever arms having a hole defining a socket formed therein, the wall of each socket being split lengthwise, said split extending to the face of the lever arm to subdivide said lever arm into two sections one relatively fixed and the other relatively movable with the split socket disposed therebetween, a pair of T-shaped connectors, each connector including a cross-head and a shank depending from and in continuation of said cross-head, each cross-head having a socket opening formed therein extending at right angles to the longitudinal axis of the shank of the connector, said shanks being mounted to rotate in the split sockets to effect angular movement of each connector-socket relative to its associated lever arm, set-screws threadably mounted in said connectors, a pair of operating jaws, a pivotal connection therebetween, the ends of said operating jaws being prolonged beyond said pivotal connection and terminating in holed ears, a pair of knuckles, each of said knuckles including a shank portion having a holed ear formed at one end thereof, a plurality of annular grooves encircling each of said shanks in spaced relation to each other, the holed ears in said knuckles being pivotally connected to the holed ears of said operating jaws as prolonged, the shanks of said knuckles being slidably adjustable in the sockets in said connectors to bring said annular grooves successively into registry with said set-screws, each set-screw being operable to engage said regis-

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tering groove to lock said shank to said connector, a pair of L-shaped pins there being one pin associated with each of said lever arms, one arm of each pin penetrating the relatively movable section of its associated lever arm and being threadably mounted in the relatively fixed section thereof, and the other arm being rockable to draw the movable and the fixed sections together and immobilize the shanks of the connectors in the split sockets.

4. In an adjustable-angle surgical instrument and in combination, a pair of operating handles, a pivotal connection therebetween, the ends of said handles extending beyond said pivotal connection to form a pair of relatively short lever arms, each of said lever arms having a hole defining a socket formed therein, the wall of each socket being split lengthwise, said split extending to the face of the lever arm to subdivide said lever arm into two sections one relatively fixed and the other relatively movable with the split socket disposed therebetween, a pair of T-shaped connectors, each connector including a cross-head and a shank depending from and in continuation of said cross-head, each cross-head having a socket opening formed therein extending at right angles to the longitudinal axis of the shank of the connector, said shanks being mounted to rotate in the split sockets to effect angular movement of each connector-socket relative to its associated lever arm, a pair of L-shaped pins there being one pin associated with each of said lever arms, one arm of each pin penetrating the relatively movable section of its associated lever arm and being threadably mounted in the relatively fixed section thereof, and the other arm being rockable to draw the movable and the fixed sections together and immobilize the shanks of the connectors in the split sockets.

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No references cited.