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DRIVING CONNECTION FOR SURGICAL INSTRUMENTS

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4 Claims. (Cl. 128—317)

This invention relates to surgical instruments in general and more especially to devices used in the medical profession in the treatment of bone fractures and the like and constitutes a division in part of application Serial No. 213,115, filed June 11, 1938, issued as Letters Patent No. 2,244,683 on June 10, 1941.

It is an object of the present invention to provide an improved combination shell and motor which can be operatively connected with a high speed surgical drill, saw or the like or with a low speed router screw or the like without interfering with any of the attributes essential to a surgical instrument that can be readily sterilized and satisfactorily retained in its sterilized condition.

These and other features, capabilities and advantages of the invention will appear from the subjoined detail description of one specific embodiment thereof illustrated in the accompanying drawing in which:

Fig. 1 is a longitudinal section of an auxiliary shell with a side elevation of a reduction associated therewith and a screw holding attachment partly in section in operative association with the main shell illustrated in Fig. 1;

Fig. 2 is an elevation showing two bone portions connected by a screw and the screw holder after having been removed from the screw;

Fig. 3 is a section on the line 11—11 of Fig. 2;

Fig. 4 is a section on the line 12—12 of Fig. 1;

Fig. 5 is a section of the auxiliary shell and associated parts on the line 13—13 of Fig. 4, the line 13—13 being inclined relative to the section of Fig. 1.

For high speed work when a Kirschner wire drill is operated then preferably the extension 39 of the shell 1 has connected thereto an intermediate connecting device such as shown in my co-pending application for patent Ser. No. 393,315, filed May 14, 1941.

The present invention aims to reduce the parts in a surgeon's kit to a minimum and for this reason shows a reducing element which may be attached to the shell 1 for operating, as an instance, a slow turning binding screw for binding two bone elements such as the elements 115 and 116 to one another. In the present instance, there is shown as attached to the reducing element the screw 117 which has a tapered end 118 and an angular head 119 to be gripped by a tool holder 120 having a spring finger 121 frictionally to engage one side of the angular head 119. The tool holder 120 has a spindle 122 which may be connected to the driven shaft 123 by any suit-

able means, such for instance as the intermediate element 223 having a chamber for the spindle 122 provided with recesses to receive pins on the shaft 123, and the locking nut 124 provided to secure locking jaws to the spindle 122, such as the locking jaws 95, in which case the intermediate element 223 is journaled in the bearing 125 supported by the end wall 126 of the auxiliary shell 127, while the shaft 123 as part of the intermediate element 223 is preferably journaled, as shown, in the partitions 128 and 129.

On the shaft 123, there is fixed in the present instance, the gear 130 in mesh with the small gear 131 on the shaft 132, which shaft 132 is journaled in the partitions 128 and 129. On the shaft 132, there is fixed the large gear 133 in mesh with the small gear 134 on the shaft 135 also journaled in the partitions 128 and 129. On the shaft 135, there is fixed the large gear 136 in mesh with the small gear 137 fixed on the shaft 138 also journaled in the partitions 128 and 129.

On a portion of the shaft 138 extending between the partition 128 and the end wall 126, there is fixed the large gear 139 in mesh with the small gear 140 fixed on the shaft 141 journaled in the block 142 and the partition 128. The inner end of the shaft 141 is provided with pins 143 to receive the slots 144 formed in the tubular portion of the intermediate connecting member 145 provided with another tubular portion in which are formed the slots 146 to receive pins on the shaft of the motor extending into the cylindrical extension 39 on the shell 1.

The shell 127 is provided with a bayonet slot 147 to receive the pin 148 on the shell 1 and thus lock it in position, the open end of the shell 127 being cammed into position by the rounded end of the shell 1, the connecting member 145 being floatable to facilitate connecting engagement with pins on the shaft of the motor.

The screw 117 is formed to facilitate movement of the same in a predetermined straight line. As an instance, the end 118 is provided with a centrally located point 153 from which the screw tapers outwardly into the tapered portion 118 to the main body portion with a very gradual incline to the thread approximating forty-five degrees to the axis of the screw. This screw 117, as shown in Fig. 2, is intended to be left in the bone until the fractured pieces have knit and in some cases is left there permanently.

In view of the foregoing, after the drill attachment, shown in Fig. 1, has turned the screw 117 into place, the spring lip 121 comes into play, it

then only being necessary to frictionally slip the spindle 122 from the screw head 119 and leave the screw 117 in the bone. In some cases, it may be desirable to remove the screw 117 after the bone portions have become knit. Then it will only be necessary to make a small incision to expose the head 119 and then frictionally slip the spindle 122 into place, set the motor for reverse movement and the screw will be rotated in the reverse direction and removed.

The reduction unit used when a screw, such as the screw 117, is to be secured in place or removed has already been explained, the reduction in revolutions per minute being approximately from sixteen thousand R. P. M. to one hundred R. P. M. which is reduced to eighty R. P. M. under load whereby any boring or drilling action will be effectively avoided and the screw merely cut itself into a locking position in the bone. Obviously, since the screw 117 is intended to be left in the bone tissue, it is desirable to produce these screws from non-oxidizing metal, such as stainless steel or the like.

When the wire drill is used, it is particularly desirous to have the wire 97 drill through a bone in a perfectly straight path since experience has taught that in such cases the accompanying pain to the patient when traction is made may be reduced to a minimum if not entirely eliminated. With the present guiding elements 101, 103 and 105 and the combination motor holder and instrument attachment, the operating surgeon is merely called upon to hold the motor steady after making contact. After the wire 97 has so been drilled through the bone, the ordinary Kirschner horse-shoe clamp may be used to maintain the wire stretched in a straight line and then the weight attached to the horse-shoe clamp in the usual way.

Before the horse-shoe clamp aforesaid is attached in order to remove a wire 97 from the drilling attachment, in some instances, the same is cut off leaving a small portion in the drilling attachment. In other cases, the guiding elements 101, 103 and 105 are moved away from the shell 1 to clear the ring 87 whereupon the projections 84, 85 and 86 are engaged and turned. To prevent the wire 97 from turning during this procedure, the motor is first shut off and then the stop pin 46 engaged and pressed to enter one of the slots 42 whereupon the ring 89 can with facility be turned, and thereupon the guiding elements 101, 103, 105 and wire drill attachment removed whereupon the clamping nut 94 can be turned to release the jaws 95 or else the nut 94 turned to release the jaws 95 before the ring 87 is turned.

It is obvious that various changes and modifications may be made to the details of construction without departing from the general spirit of the invention as set forth in the appended claims.

I claim:

1. The combination of an electric motor having a shaft with pins extending radially therefrom, a main shell having a main cylindrical outer periphery terminating in a rounded end with a shaft opening in the center of said rounded end registering with said shaft and a pin extending radially outward from said cylindrical outer periphery adjacent to said rounded end, and a removable unit including an auxiliary shell having a cylindrical open end conforming to the cylindrical periphery of said main shell to receive said rounded end and engage the

cylindrical outer periphery of said main shell, said auxiliary shell having a bayonet slot to receive said pin removably to connect said auxiliary shell to said main shell, said removable unit containing a reduction gearing including a fixed shaft having radially extending pins, a connecting shaft having tubular portions at its free ends with radially extending slots therein to receive the pins of said motor shaft and fixed shaft respectively and floatable to facilitate connecting engagement with said motor shaft when the open cylindrical end of said auxiliary shell is cammed on to the rounded end of said main shell, a driven shaft operatively connected to said reduction gearing, there being an opening in the end of said auxiliary shell, and a spindle for a surgical instrument extending through said opening and operatively connected to said driven shaft.

2. The combination of an electric motor having a shaft, a main shell having a main cylindrical outer periphery terminating in a rounded end with a shaft opening in the center of said rounded end registering with said shaft and a pin extending radially outward from said cylindrical outer periphery adjacent to said rounded end, and a removable unit including an auxiliary shell having a cylindrical open end conforming to the cylindrical periphery of said main shell to receive said rounded end and engage the cylindrical outer periphery of said main shell, said auxiliary shell having a bayonet slot to receive said pin removably to connect said auxiliary shell to said main shell, said removable unit containing a reduction gearing including a connecting shaft movable to facilitate connecting engagement with said motor shaft when the open cylindrical end of said auxiliary shell is cammed on to the rounded end of said main shell, a bearing in the end wall of said auxiliary shell, an intermediate rotatable element journaled in said bearing, a driven shaft operatively connected to said reduction gearing and extending into and fixed to rotate with said intermediate rotatable element, a spindle for a surgical instrument extending into said intermediate rotatable element and operatively connected to rotate with said driven shaft, and a lock nut screw threadedly connected to the outwardly projecting end of said intermediate element and clutching said spindle to said intermediate element against axial movement relative to said driven shaft but permitting rotatable movement.

3. The combination of an electric motor having a shaft, a main shell having a shaft opening registering with said shaft, and a removable unit including an auxiliary shell connected to said main shell, said removable unit containing a reduction gearing including a connecting shaft, a bearing in the end wall of said auxiliary shell, an intermediate rotatable element journaled in said bearing and having a cylindrical portion extending outwardly from said auxiliary shell with external screw threads thereon, a driven shaft fixed to rotate with said rotatable element having radially extending pins on its free end and operatively connected to said reduction gearing, a spindle for a surgical instrument extending into said bearing having radial slots on its inner end to engage the pins on said driven shaft to effect a rotatable engagement therewith, and a lock nut screw threadedly connected to the threaded portion of said intermediate element and clamping said spindle to anchor it against

axial movement relative to said driven shaft but permitting rotatable movement therewith.

4. In a surgical instrument, the combination of a shell containing a gearing including a connecting shaft operatively connected to the motor shaft, a driven shaft having pins extending radially therefrom, a shell having a bearing, an intermediate rotatable element journaled in said bearing into which said driven shaft extends fixed to rotate with said rotatable element, a spindle for a surgical tool having radially extending slots

to receive the pins of said driven shaft to effect a rotatable movement therewith, a lock nut clamping said spindle to said intermediate element to anchor it against axial movement relative to said drive shaft but permitting rotatable movement therewith, a tool holder on the end of said spindle including an angular recess and a spring tongue therein and a screw having an angular head frictionally held in said angular recess by said spring tongue.

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