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**Anderson et al.**

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(54) **ROBOTIC SURGICAL TOOL WITH  
ULTRASOUND CAUTERIZING AND  
CUTTING INSTRUMENT**

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(51) **Int. Cl.**<sup>7</sup> ..... **A61B 18/04**

(52) **U.S. Cl.** ..... **606/28; 606/1**

(58) **Field of Search** ..... 606/1-19, 49-52

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*Primary Examiner*—Roy D. Gibson

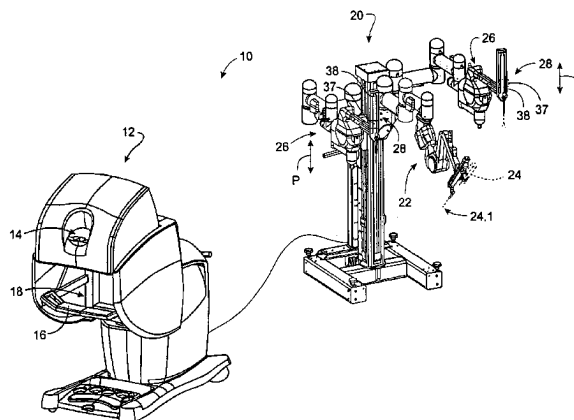
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(57) **ABSTRACT**

A surgical instrument for enhancing robotic surgery generally includes an elongate shaft with an ultrasound probe, an end effector at the distal end of the shaft, and a base at the proximal end of the shaft. The end effector includes an ultrasound probe tip and the surgical instrument is generally configured for convenient positioning of the probe tip within a surgical site by a robotic surgical system. Ultrasound energy delivered by the probe tip may be used to cut, cauterize, or achieve various other desired effects on tissue at a surgical site. In various embodiments, the end effector also includes a gripper, for gripping tissue in cooperation with the ultrasound probe tip. The base is generally configured to removably couple the surgical instrument to a robotic surgical system and to transmit forces from the surgical system to the end effector, through the elongate shaft. A method for enhancing robotic surgery generally includes coupling the surgical instrument to a robotic surgical system, positioning the probe tip in contact with tissue at a surgical site, and delivering ultrasound energy to the tissue.

**19 Claims, 28 Drawing Sheets**



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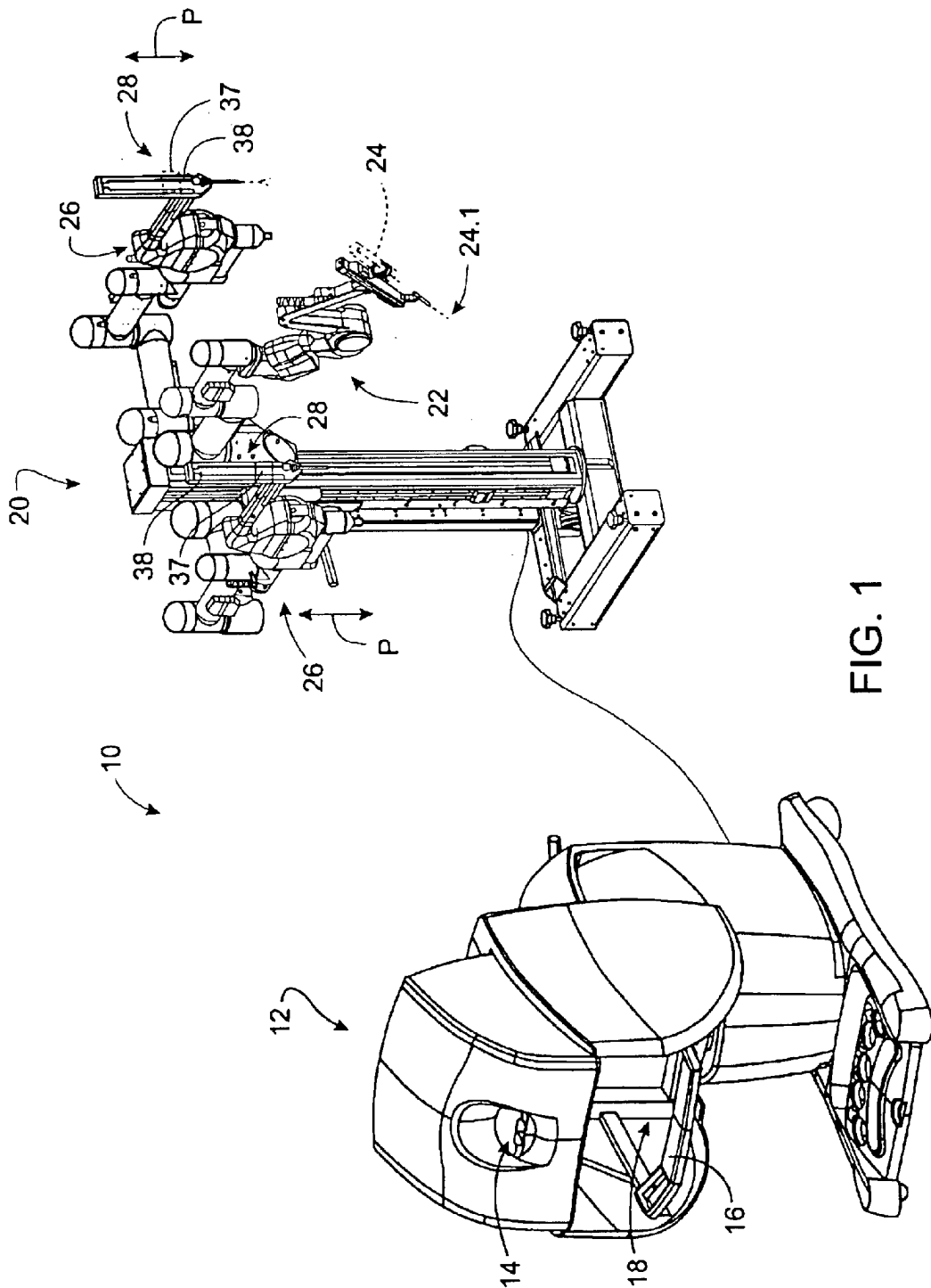
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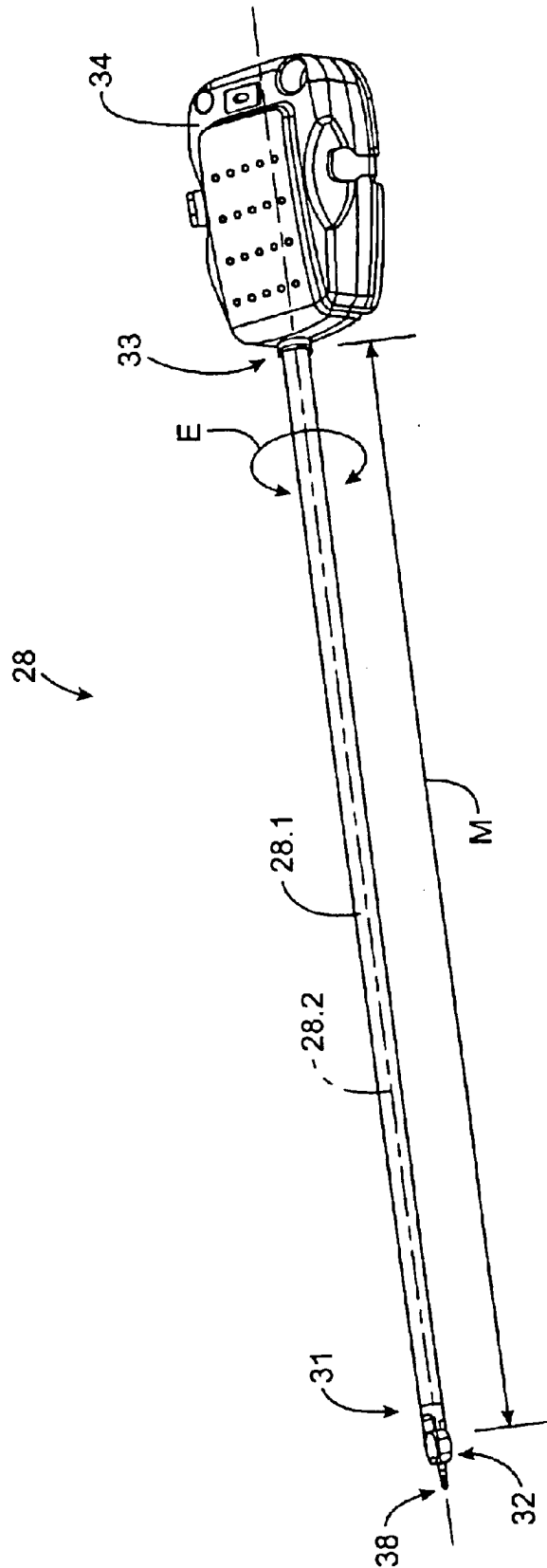
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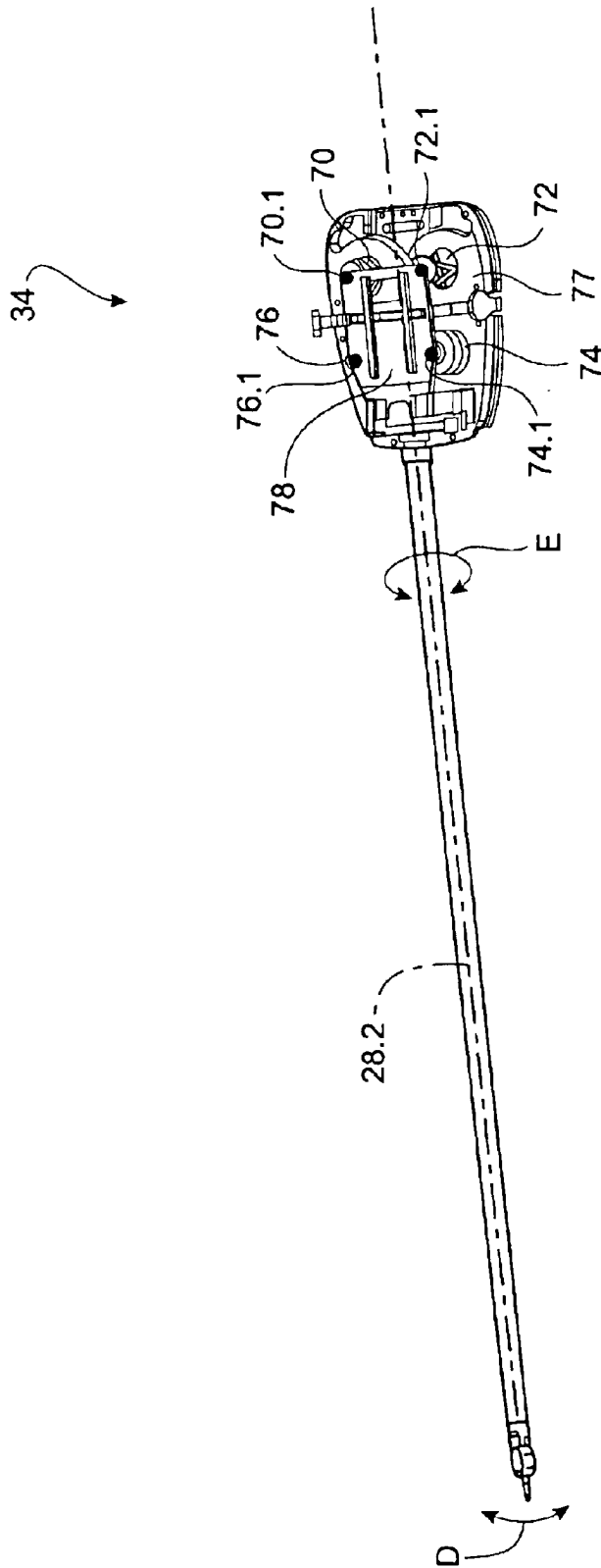


FIG. 3

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