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MOUSE BALL-ACTUATING DEVICE WITH FORCE AND TACTILE FEEDBACK

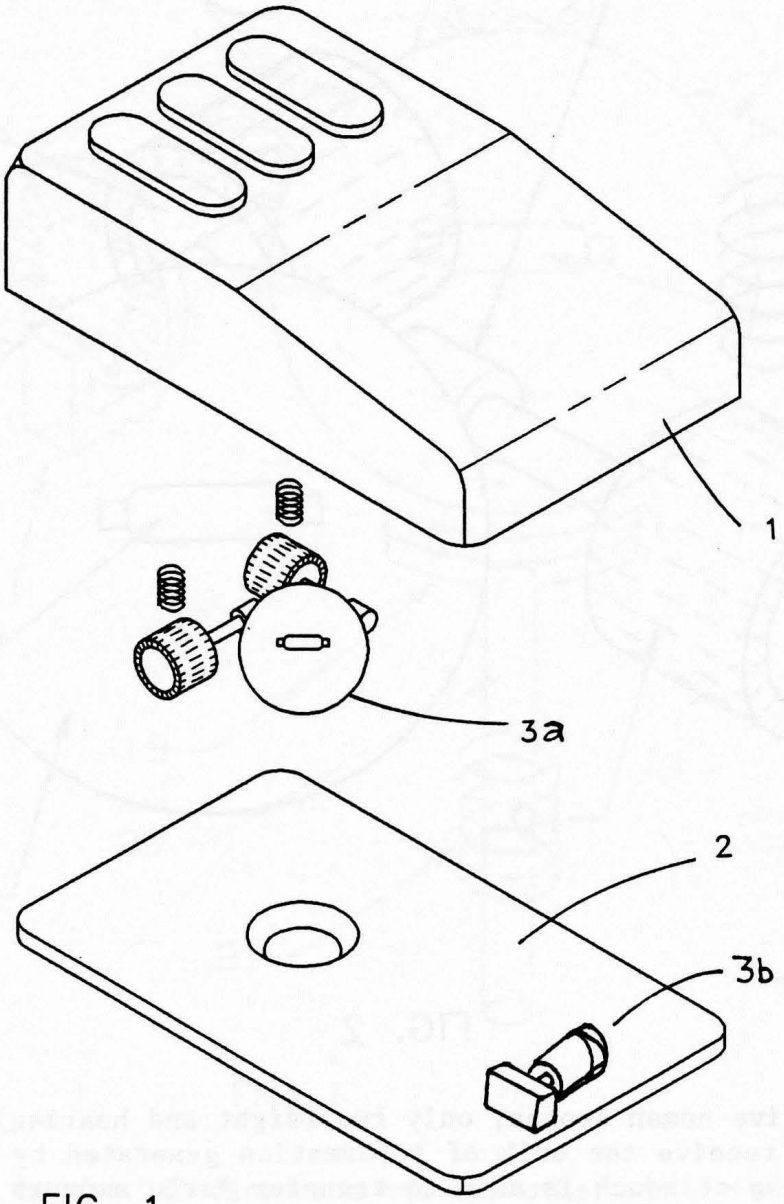

FIG. 1

A technique is described whereby a mouse ball-actuating device, used with personal computers to actuate a cursor, provides orthogonal movement so as to allow variations in resistive force and tactile feedback to the user.

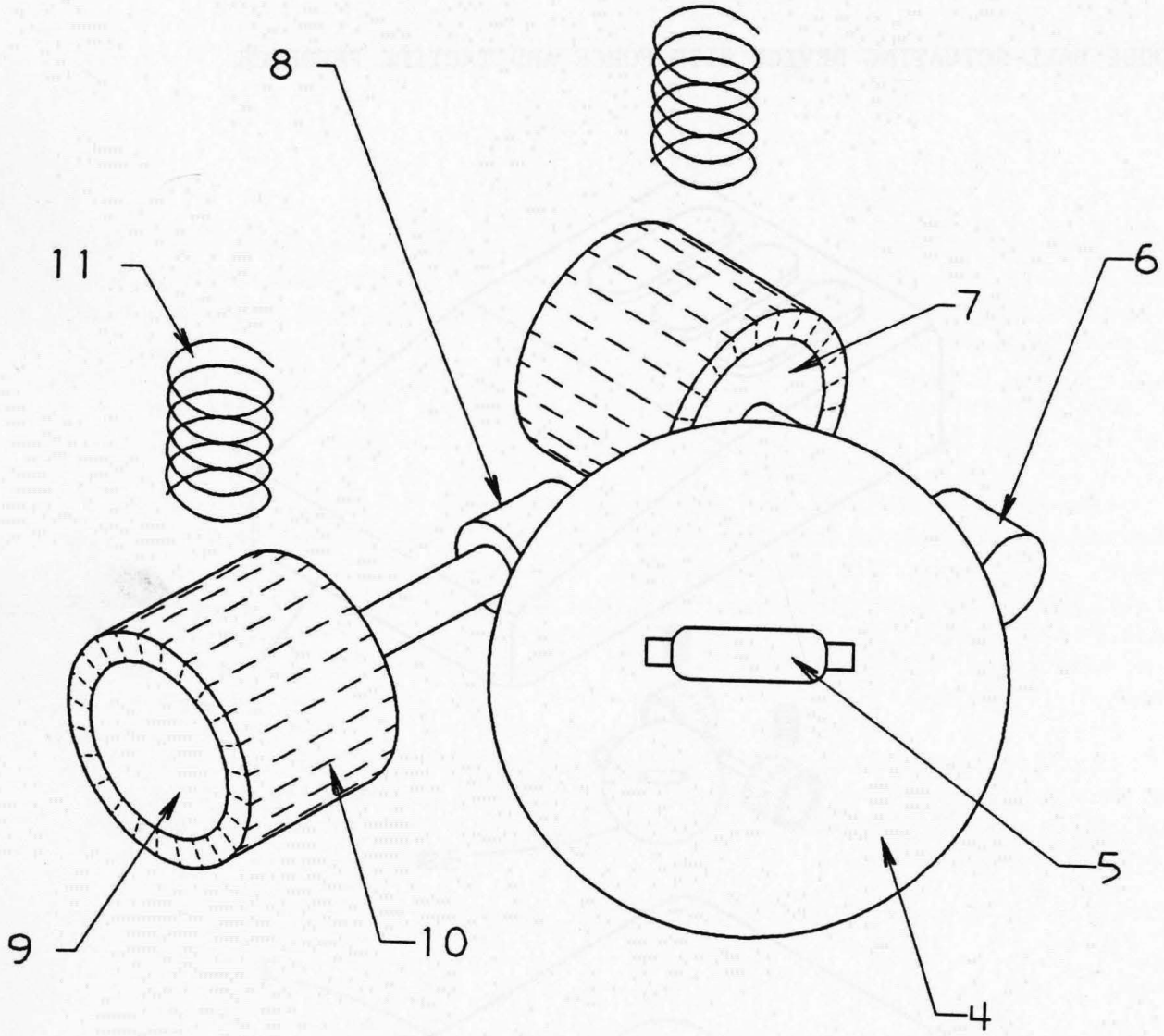

FIG. 2

Of the five human senses, only two (sight and hearing) are generally used to receive the bulk of information generated by a computer. The human sense of touch is able to transfer large amounts of information to the brain, as exemplified by the Braille system. The concept described herein attempts to include the sense of touch to the human computer interface relationship, specifically used within mouse designs. Two primary implementations of this concept are described herein: resistive force feedback and tactile feedback. These implementations may be used individually or in combination.

To provide resistive force feedback, the mouse utilizes a ball that rotates (rubs against) two shafts orthogonal to each other. One

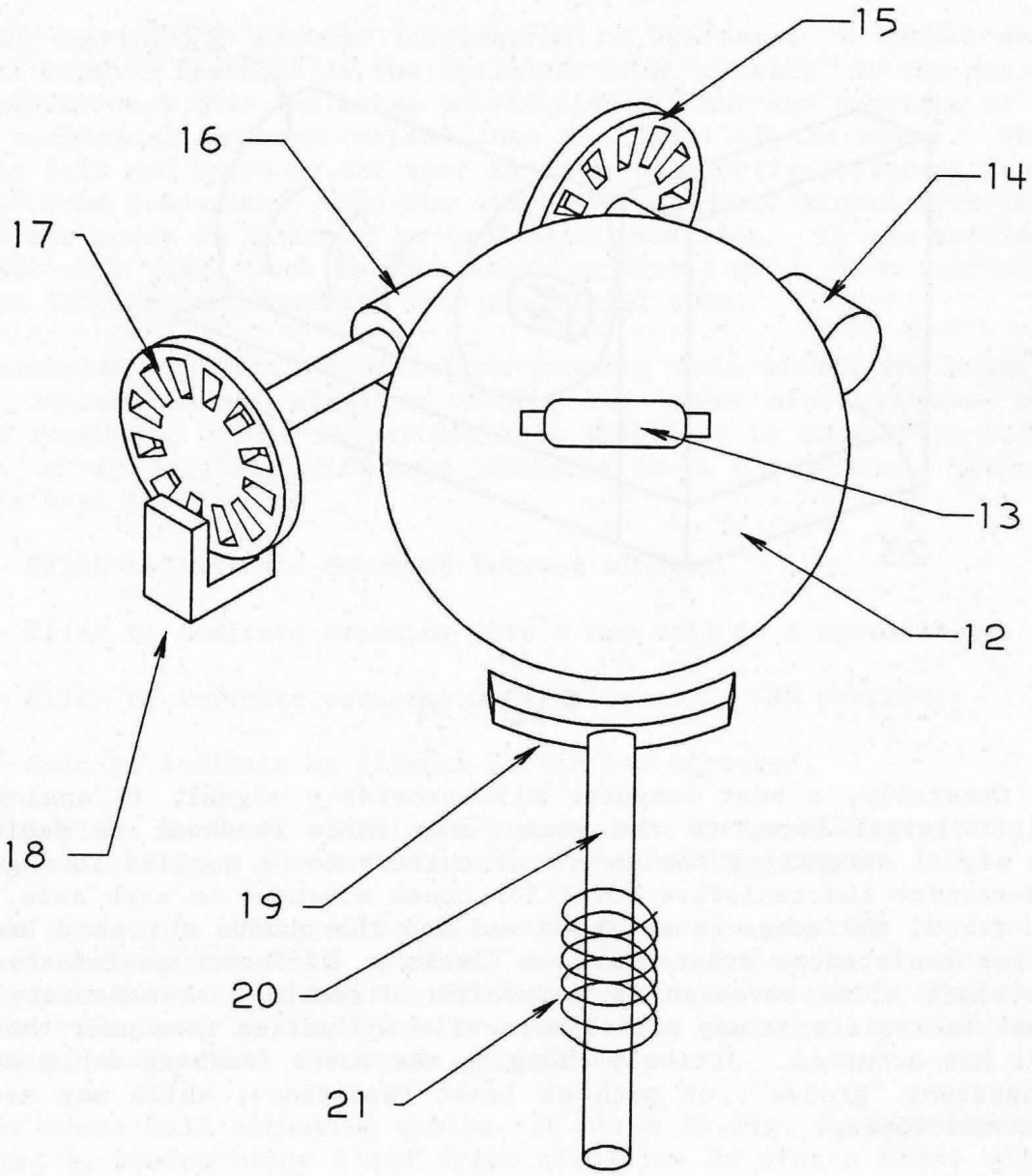

FIG. 3

shaft rotates in the "X" direction and the other shaft rotates in the "Y" direction. Each shaft is attached to a disk with magnets along its perimeter and is used for both position sensing and force feedback. Two electromagnets are used to provide force feedback. The force feedback shafts are independent of the motion-sensing rollers in the mouse.

With the mouse utilizing two balls, it is considered practical to apply the feedback to the second ball, leaving the primary sensing ball "free rolling". A feedback ball added to an optical mouse utilizes this same idea.

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