

- [73] Assignee: **Carnegie Mellon University,**
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- [58] Field of Search **364/578; 606/86,**
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[57] **ABSTRACT**

Apparatuses and methods are disclosed for determining an implant position for at least one artificial component in a joint and facilitating the implantation thereof. The apparatuses and methods include creating a joint model of a patient's joint into which an artificial component is to be implanted and creating a component model of the artificial component. The joint and artificial component models are used to simulate movement in the patient's joint with the artificial component in a test position. The component model and the joint model are used to calculate a range of motion in the joint for at least one test position based on the simulated motion. An implant position, including angular orientation, in the patient's joint is determined based on a predetermined range of motion and the calculated range of motion. In a preferred embodiment, the implant position can be identified in the joint model and the joint model aligned with the joint by registering positional data from discrete points on the joint with the joint model. Such registration also allows for tracking of the joint during surgical procedures. A current preferred application of the invention is for determining the implant position and sizing of an acetabular cup and femoral implant for use in total hip replacement surgery.

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24 Claims, 11 Drawing Sheets

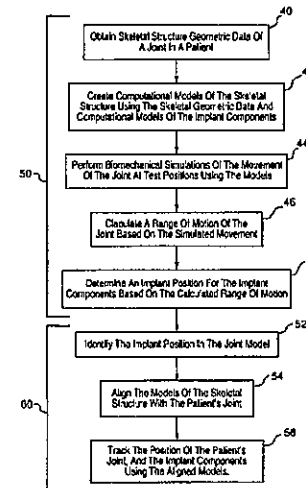


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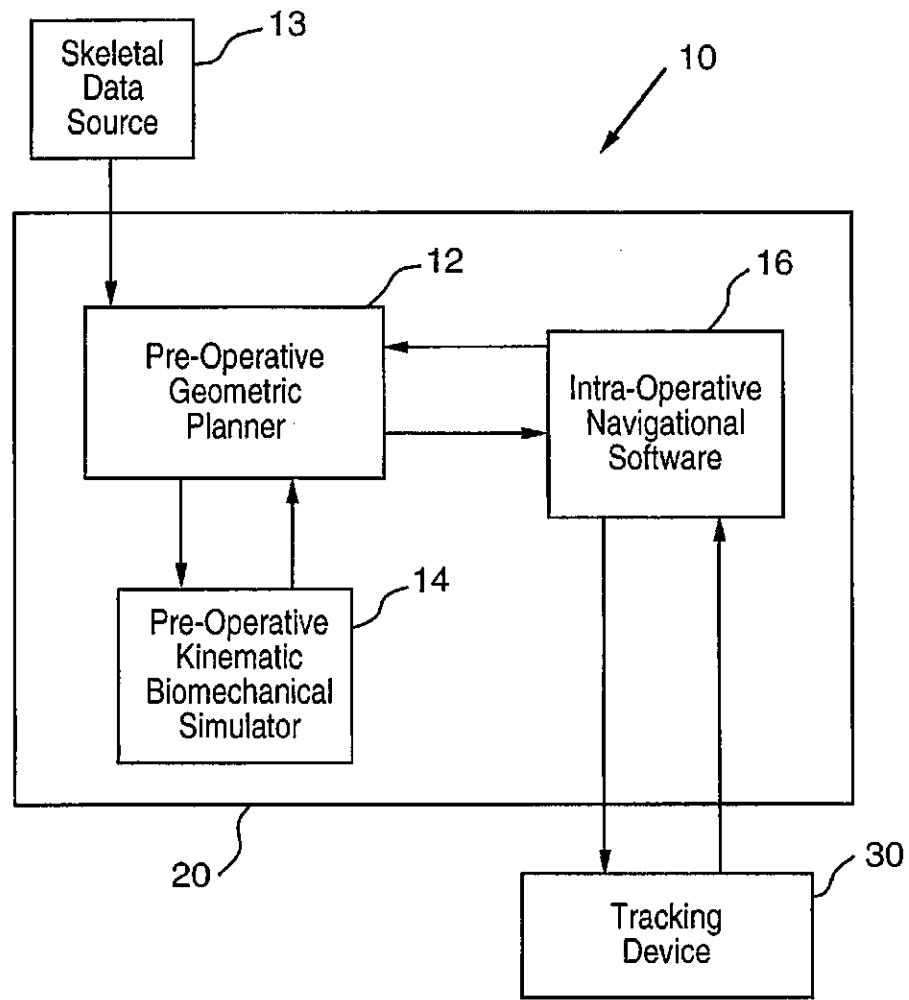


FIG. 1

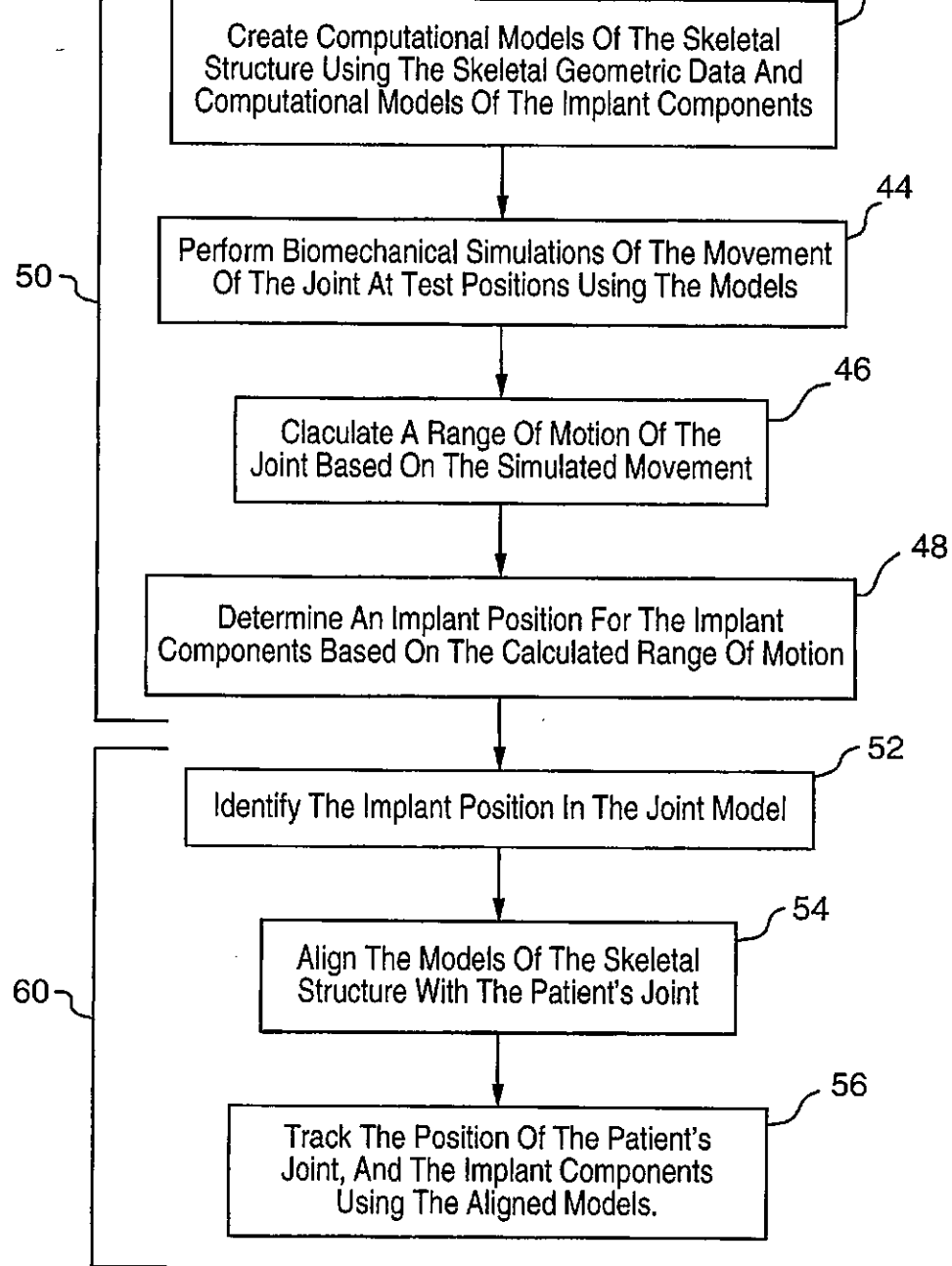


FIG. 2

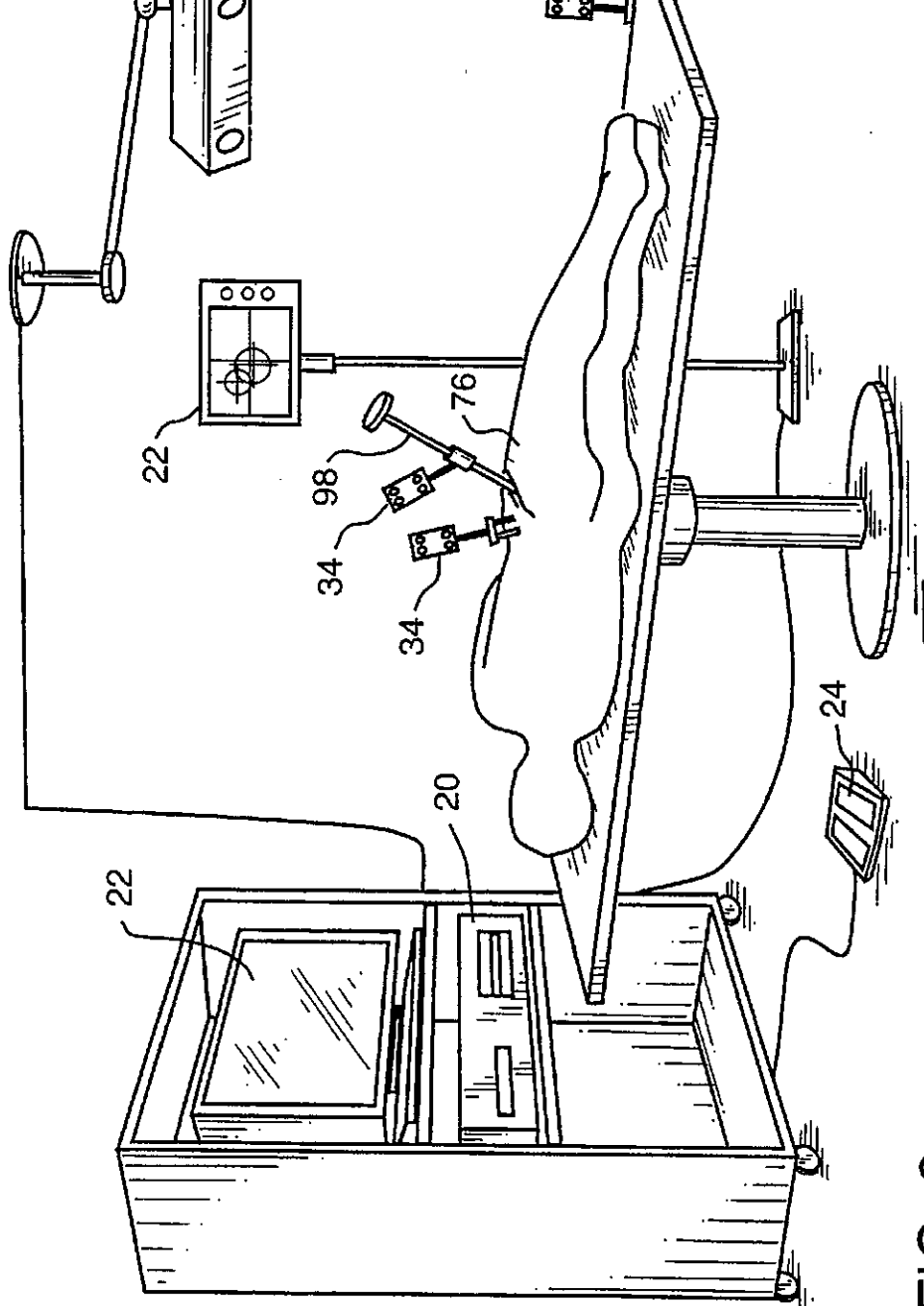


FIG. 3

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