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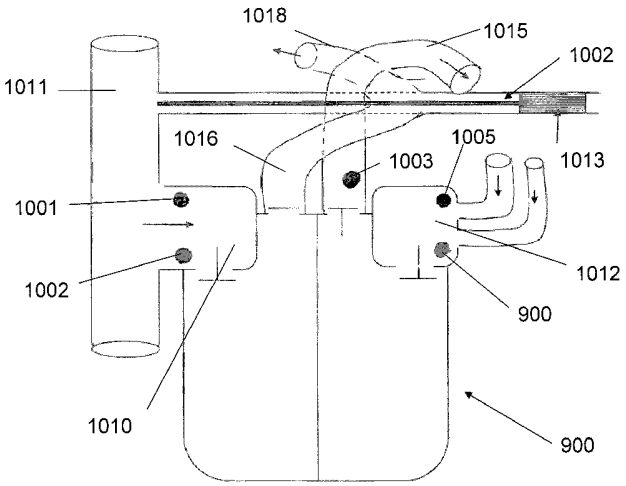
*[Continued on next page]*

(54) Title: IMPROVED USE OF ELECTRIC FIELDS FOR REDUCING PATIENT DISCOMFORT DURING DEFIBRILLATION

Fig. 10




(57) Abstract: Devices, systems and methods for reducing patent discomfort during defibrillation by delivering pulses to electrode configurations that create electric fields confined to and/or concentrated in an area of fibrillation are described. Embodiments provide for an implantable defibrillator having an electrode lead system having at least one electrode lead and at least one three electrodes, a controller for determining whether fibrillation exists and a voltage generator for discharging one or more defibrillation pulses to the at least three electrodes to create electric fields having different directions and high electric field concentrations in areas of the heart needing defibrillation and low electric field concentrations outside those areas.

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# IMPROVED USE OF ELECTRIC FIELDS FOR REDUCING PATIENT DISCOMFORT DURING DEFIBRILLATION

## CROSS-REFERENCE TO RELATED APPLICATIONS

**[0001]** The present application claims priority to U.S. Provisional Patent Application No. 61/400,128, filed on July 23, 2010 and entitled "*Implantable Atrial Defibrillator and Defibrillation Methods*," the disclosure of which is incorporated herein by reference in its entirety.

## FIELD

**[0002]** Devices, systems and methods relating to atrial defibrillation are described herein. Embodiments of the present disclosure more specifically reduce patient discomfort during defibrillation by delivering pulses to electrodes positioned in or around the heart that create electric fields confined to and/or concentrated in an area of fibrillation. In particular, the disclosed subject matter minimizes the magnitude of electric fields outside areas needing defibrillation by configuring the electric fields to intersect each other at different angles and/or using one or more electrodes to confine those fields to target defibrillation zones.

## BACKGROUND

**[0003]** Atrial Fibrillation ("AF") is the most common cardiac arrhythmia involving at least one of the left or right atrium of the heart. One way to defibrillate an atrium is by delivering electrical defibrillation pulses to the heart at specific times during the cardiac cycle. Systems and devices for delivering these pulses may be external to and/or implanted within the body. Atrial defibrillation using an implantable atrial defibrillator generally includes automatically detecting AF and automatically delivering one or more electrical pulses to the left and/or right atrium of the heart. Delivering an electrical pulse may be intolerably painful for a patient and discourage the use of automatic implantable atrial defibrillators, particularly when the energy delivered is too high. Conversely, delivering an electrical pulse having an energy that is too low will result in an unsuccessful defibrillation attempt. Atrial defibrillation should therefore be tolerable and effective and/or reduce patient discomfort.