Capital X: Designing and Testing a Procedure for Building an Inexpensive X-ray Generator.

In this project, a procedure for building an x-ray generator was developed and tested. This procedure uses inexpensive or common materials for the X-ray tube and power source. This generator consists of three main components: the vacuum chamber, the electrodes, and the power source. The vacuum chamber and the electrodes make up the X-ray tube, and an AC circuit generator generating up to 19kV supplies power to the X-ray tube. The vacuum chamber is attached to a vacuum pump to allow for changes to be made to the electrodes without destroying the x-ray generator. The electrodes use a hot or cold cathode filament and a metal target. The power source uses an automotive ignition coil along with a capacitor and dimmer switch to increase input voltage. The vacuum chamber allows the input, or accelerating, voltage to generate arc flashes between the electrodes which in turn generate X-ray radiation when striking the metal target. Radiation is detected using a Geiger counter, radiation badges, and/or x-ray film. Safety precautions include minimizing the duration of exposure and maximizing distance and shielding. A radiation safety official has approved the safety of this project. Testable variables include target material, cathode type, thickness of shielding on front of detector, or arcing distance. This project has applications in research, medical diagnoses, and affordable science.