Wimshurst machine

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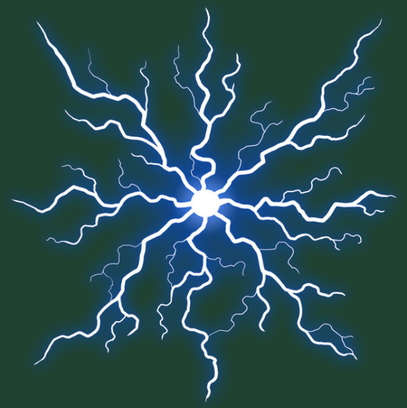
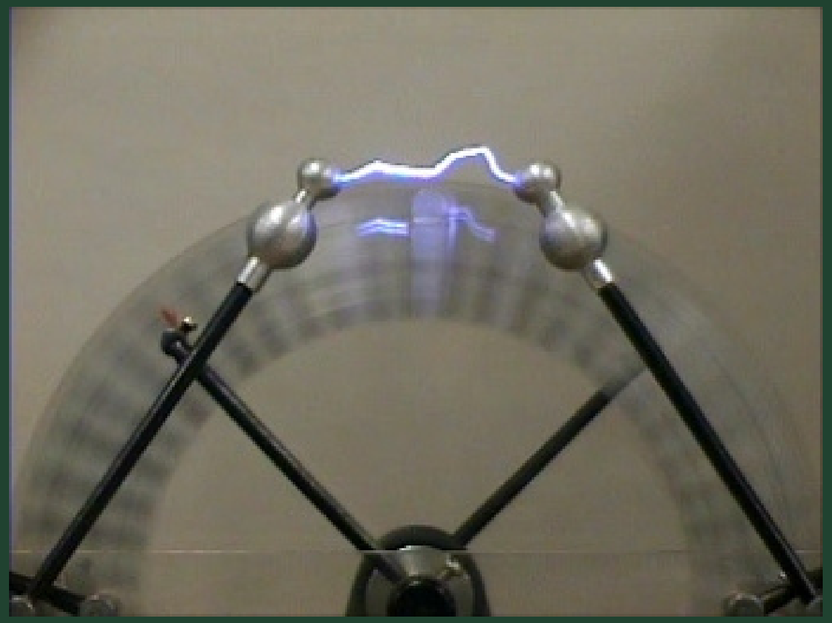
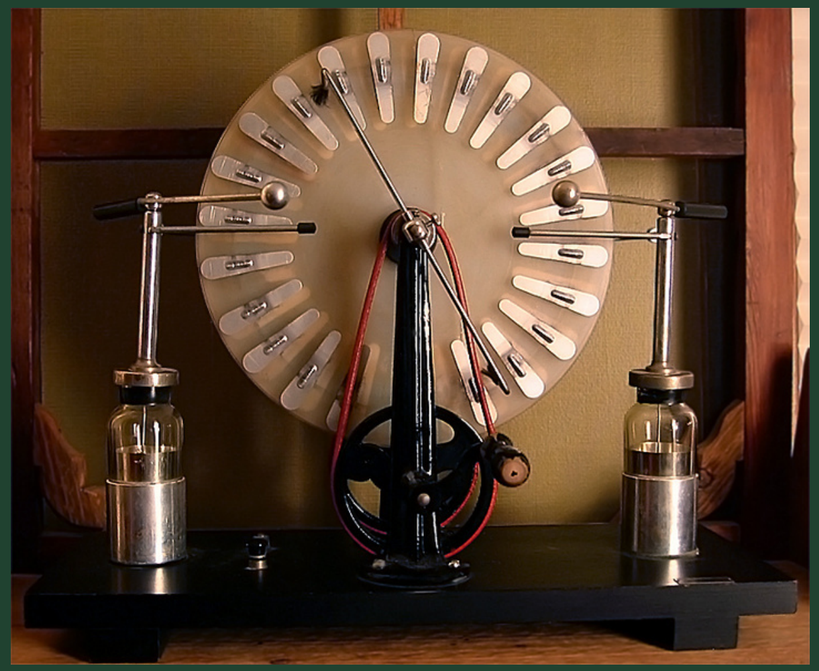
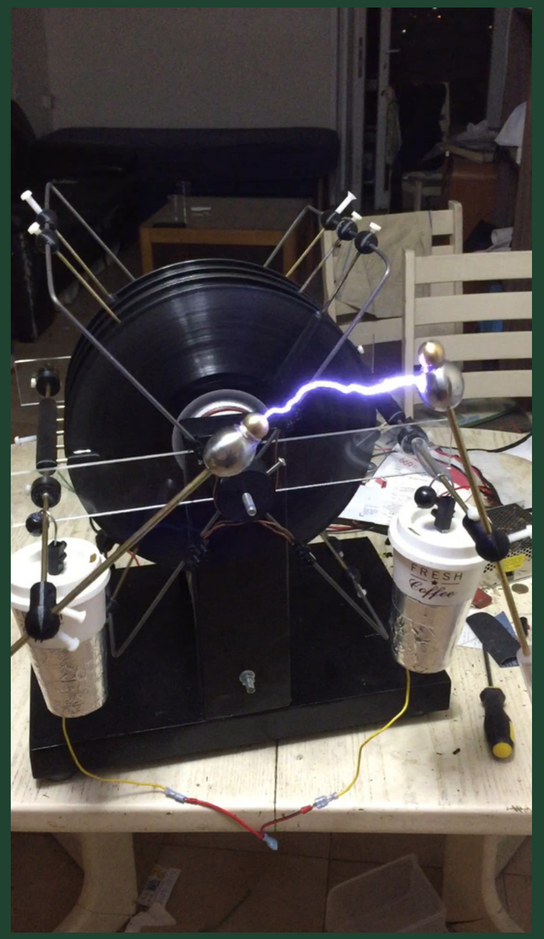
What is it?



The Wimshurst machine is a historical electrostatic generator that generates high voltages, developed in 1889 by the British inventor James Wimshurst (1832 - 1903).





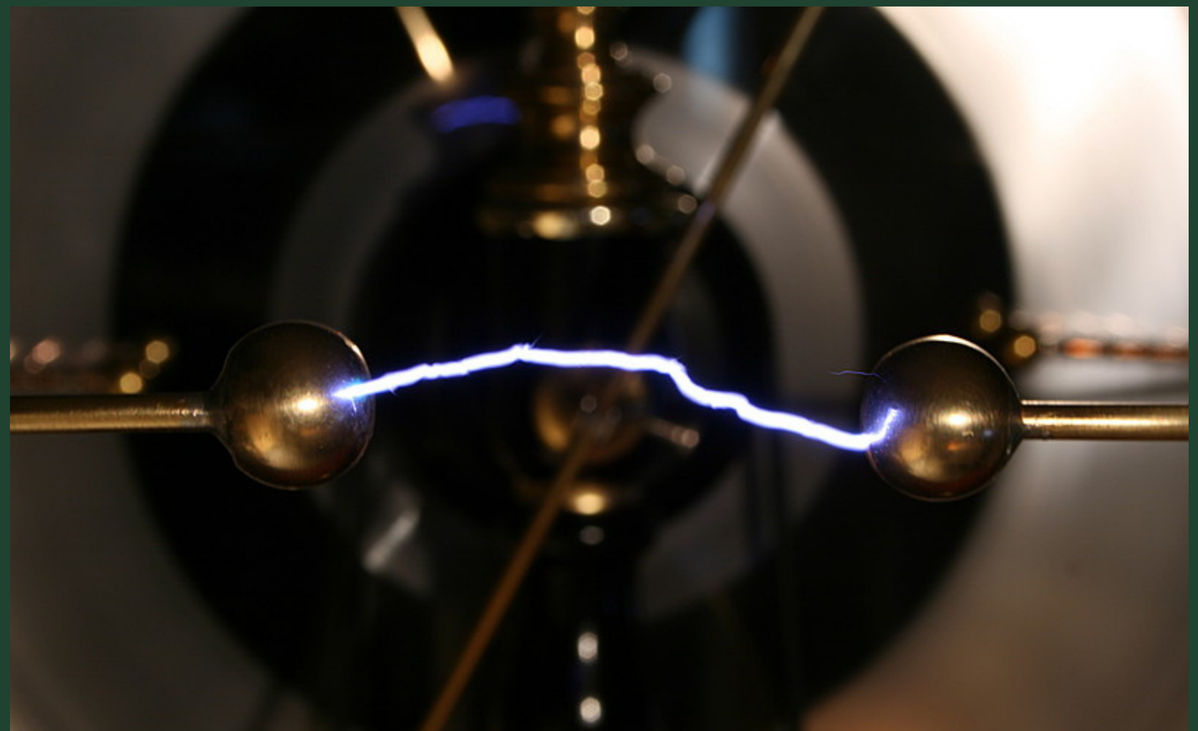


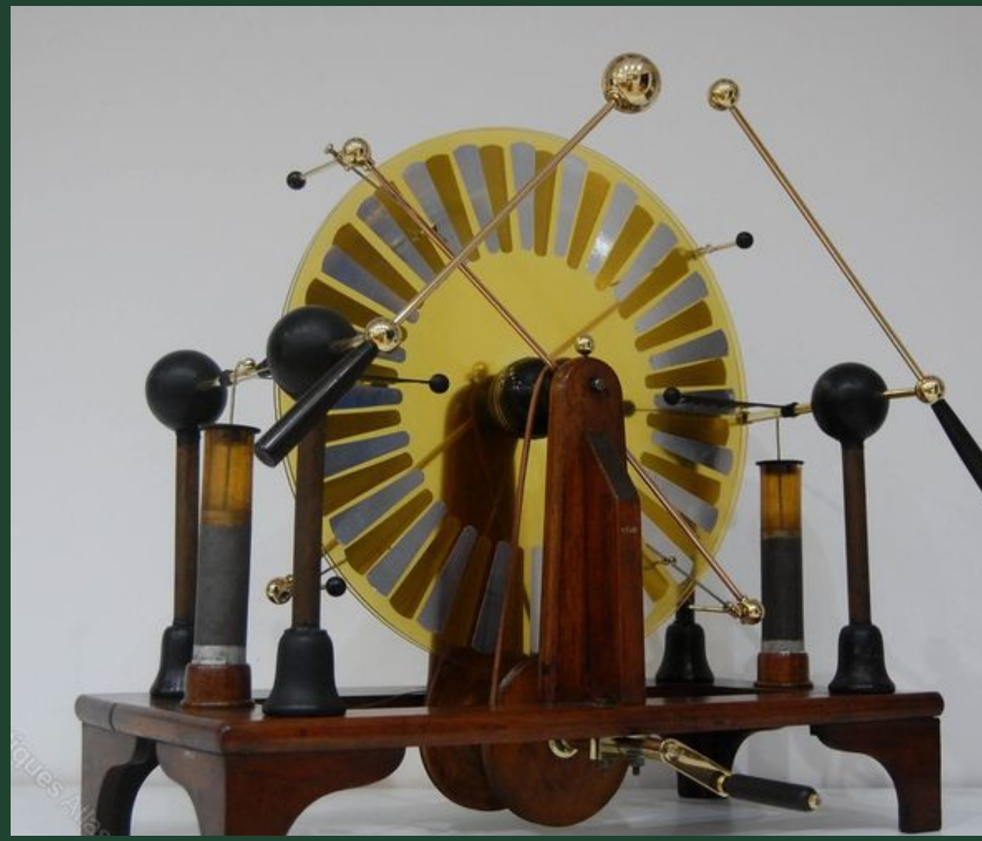
HISTORY

This induction machine, invented in about 1880 by the English engineer James Wimshurst (1832-1903), represents a modification compared to the Holtz induction machine. The operation is similar, but with the advantage of an automatic trigger as soon as the system is rotated.The Wimshurst machine historically represents the most powerful static electricity generator designed in the nineteenth century and was used as a source of high voltage for the first X-ray tubes; it is still used in many laboratories for educational purposes.

Function

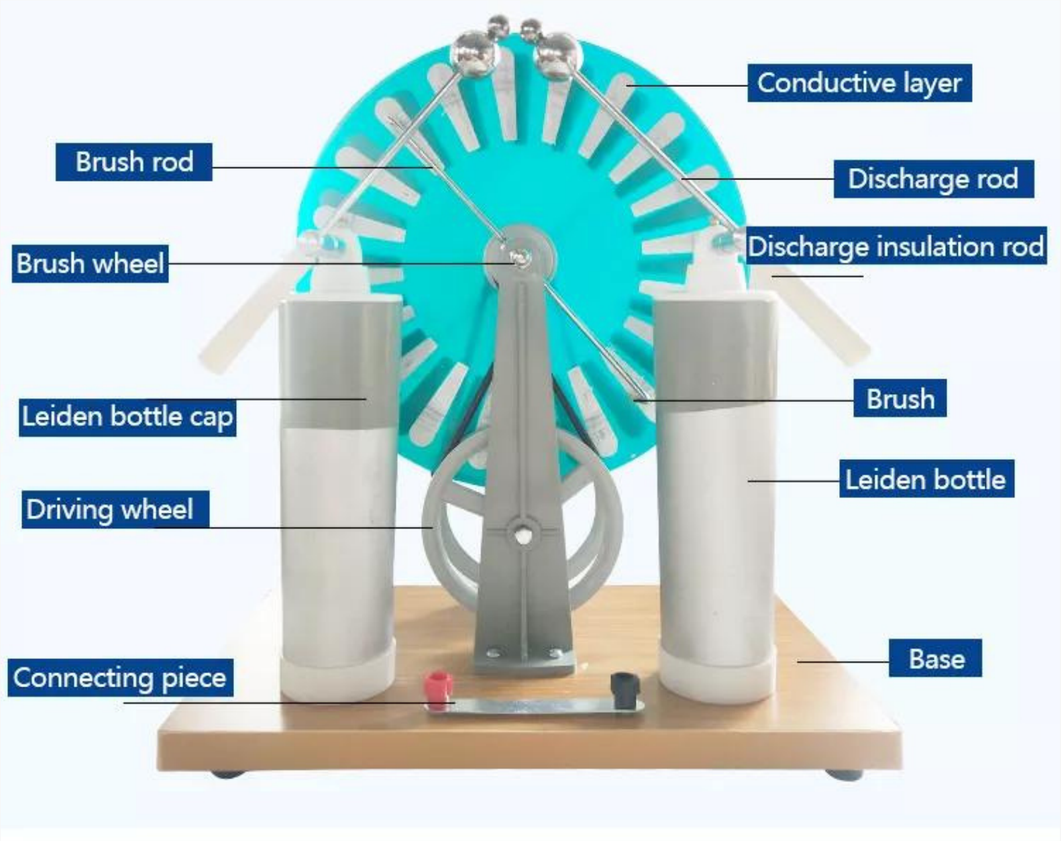
Induction electrostatic generator for high laboratory voltages





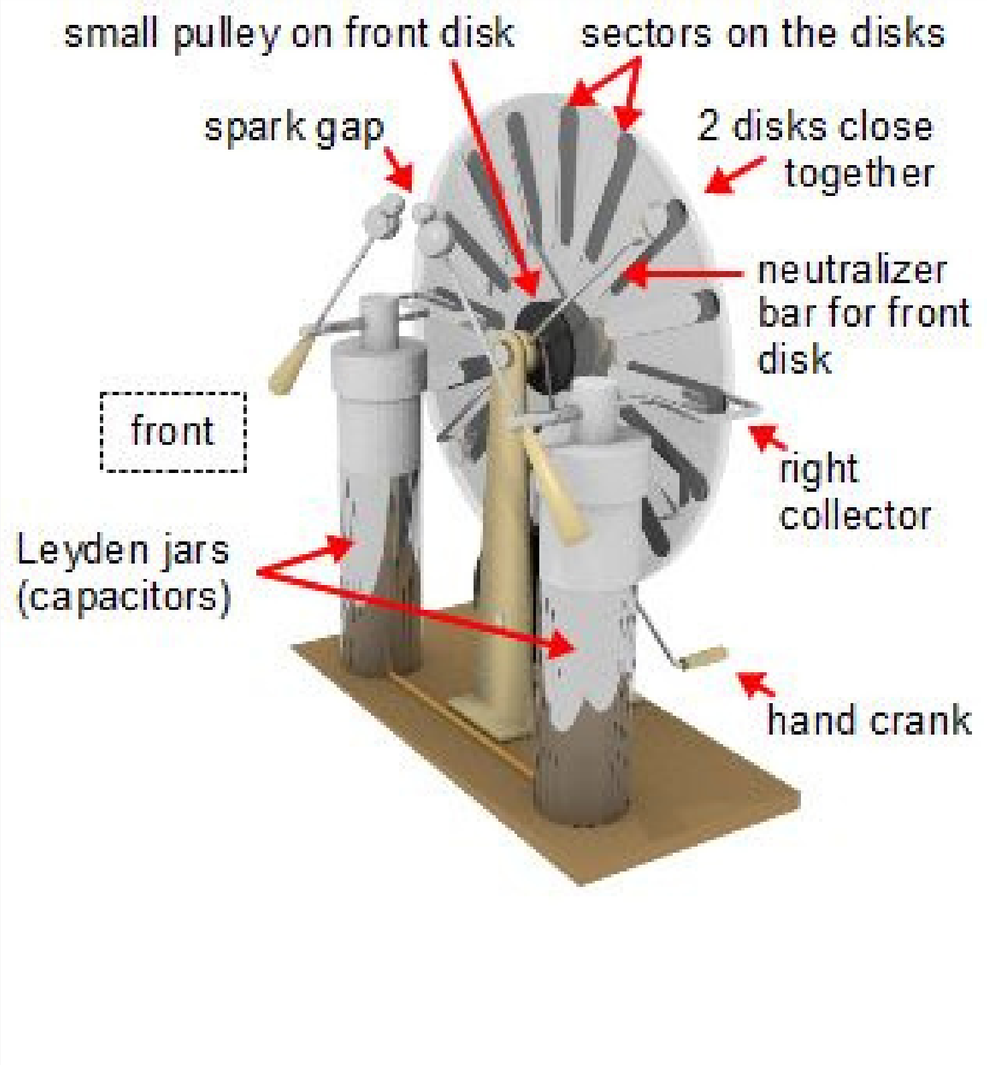
How is it made?

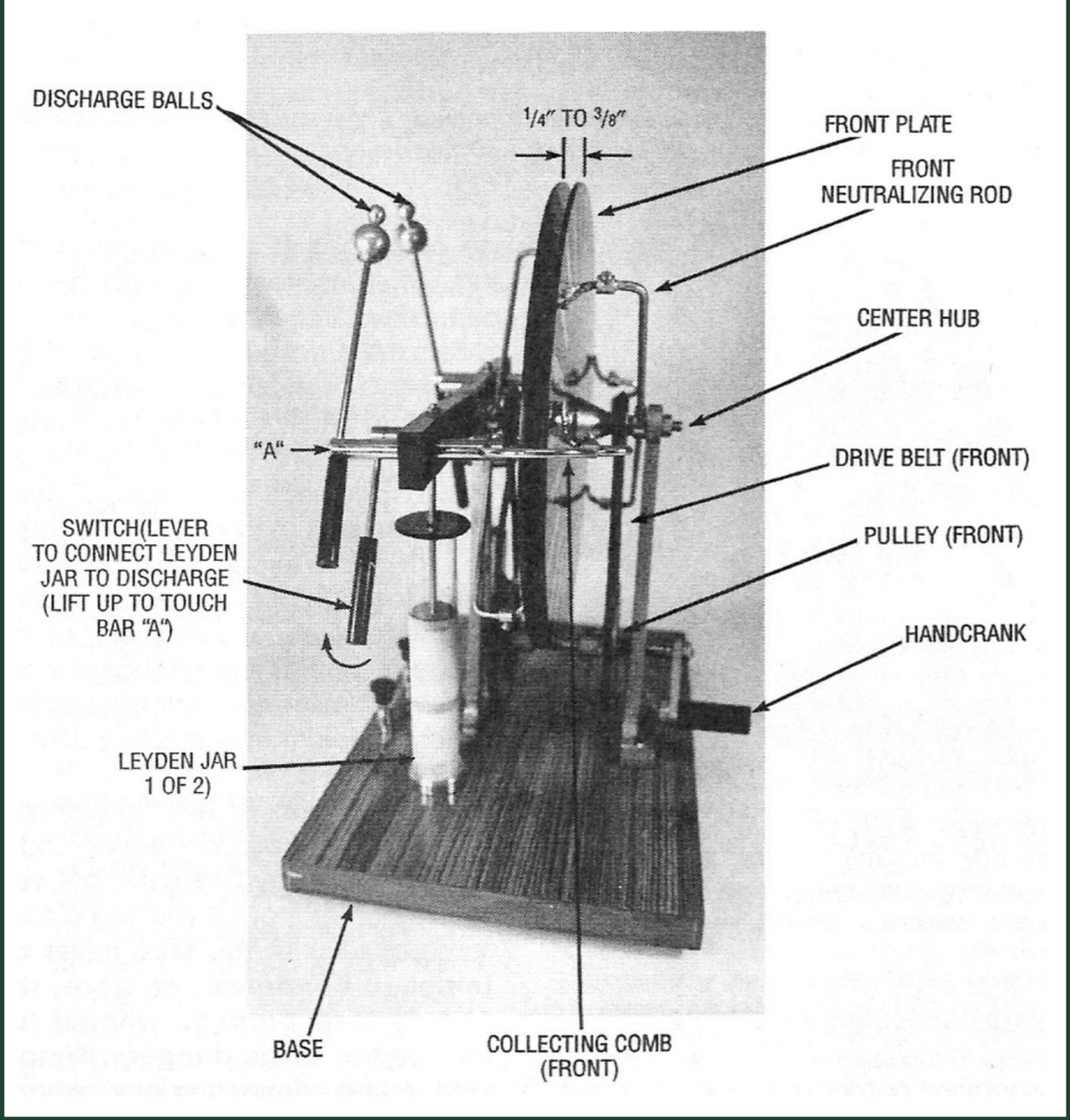
It consists of two equal plexiglass discs, placed vertically at a relatively small distance.
These discs rotate around the same horizontal axis, but in the opposite direction, thanks to a system of belts and pulleys driven by a crank, placed on the side at the base of the machine.
Radially, along the outer edge of the two discs, are arranged small metal sectors. During the rotation the sectors of each disc slide under a pair of copper brushes, supported by an inclined conductor support and of a length equal to the diameter of the discs;

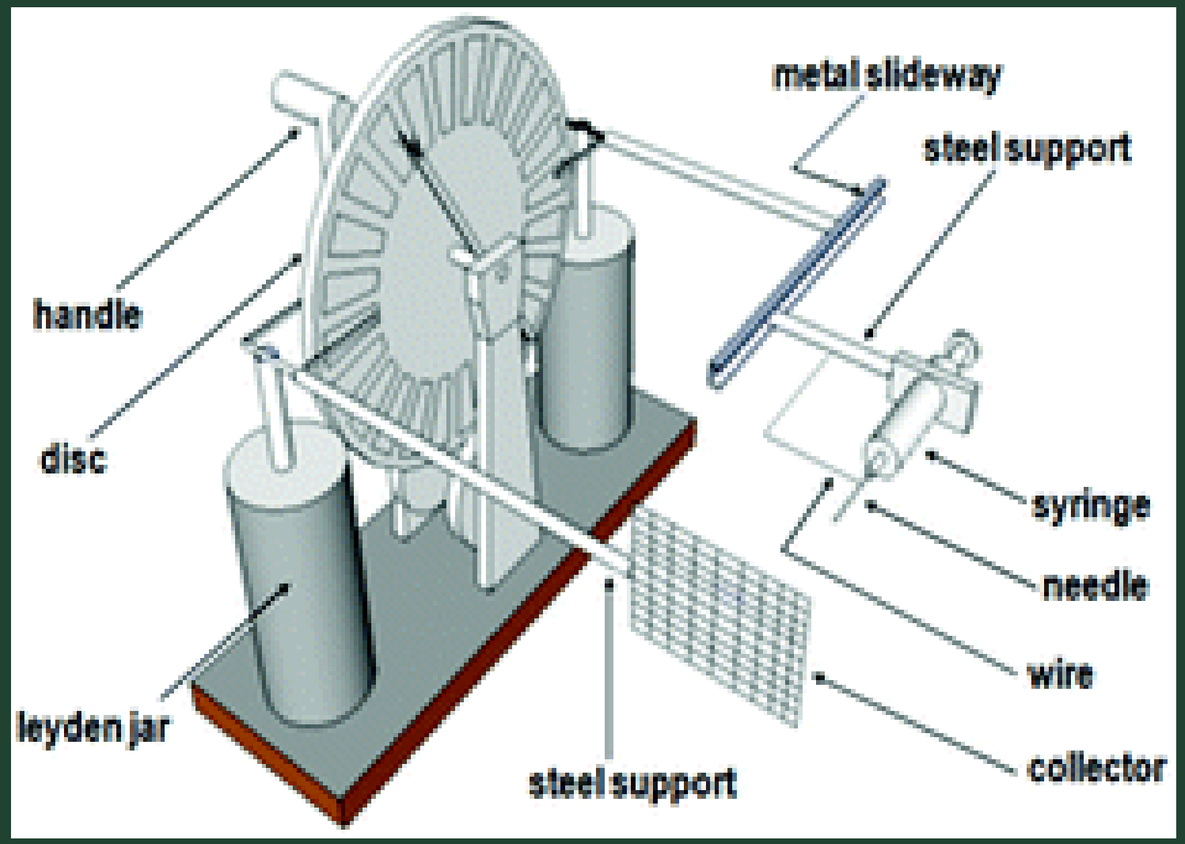


How is it made?

the brush holders on both sides are inclined towards each other. Two metal points face a disc at opposite ends of a horizontal diameter; these points are connected to the internal armour of two cylindrical capacitors (reproduction of the historic Leyda bottle) Each of these armatures is connected to one of the balls of a spark gap, the distance of which is adjustable.



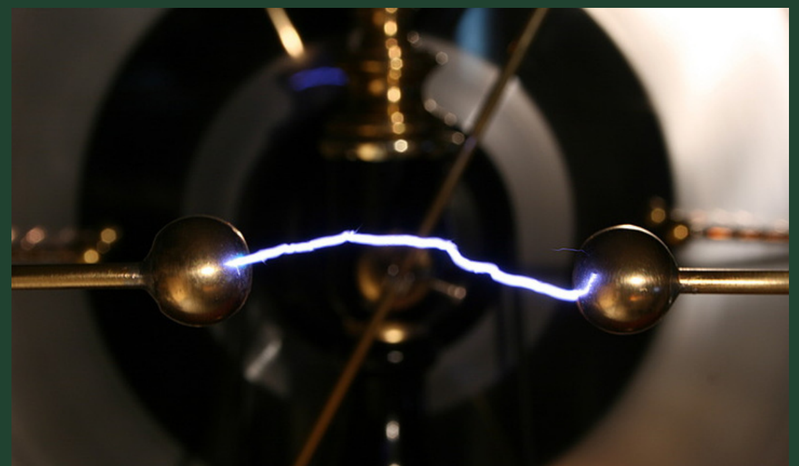

DISCHARGE BALLS
1/4" TO 3/8"
FRONT PLATE
FRONT NEUTRALIZING ROD
CENTER HUB
"A"
DRIVE BELT (FRONT)
SWITCH(LEVER TO CONNECT LEYDEN JAR TO DISCHARGE (LIFT UP TO TOUCH BAR "A")
PULLEY (FRONT)
HANDCRANK
LEYDEN JAR 1 OF 2)
BASE
COLLECTING COMB (FRONT)


metal slideway
steel support
handle
disc
syringe
needle
wire
leyden jar
steel support
collector

How does it work?

During the opposite rotation of the discs, a charge, initially present on one sector, passing in correspondence of the sector that on the other disk is in contact with the brush, induces on this a charge of opposite sign and a charge of equal sign on the sector in contact with the other brush supported by the same support. The two sectors thus loaded leave the brushes and bring the respective charges close to the tips, where - because of the effect of the tips - they are transferred to the internal reinforcements of the two capacitors that are then charged with opposite sign;

With these the spark plug balls are loaded and when the d.d.p. is sufficiently high (of the order of 10 kV for every centimeter of distance) a spark strikes in the air.



Here’s a short youtube video where we can see how it works:

https://youtu.be/hSBKEZg37wQ

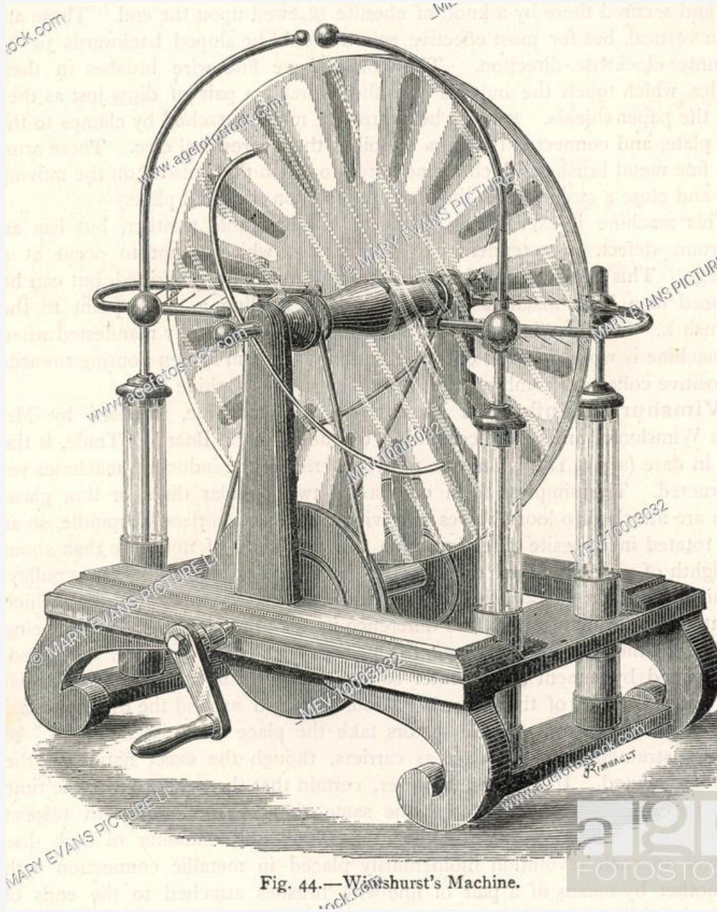
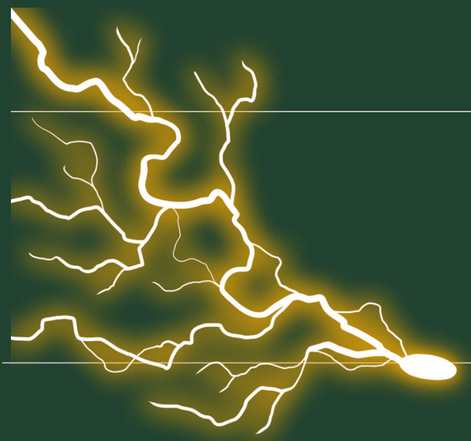
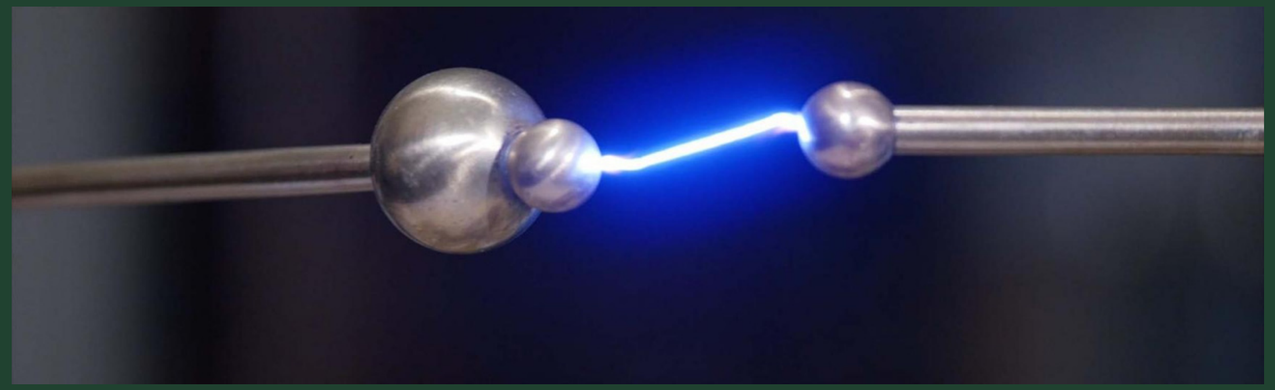


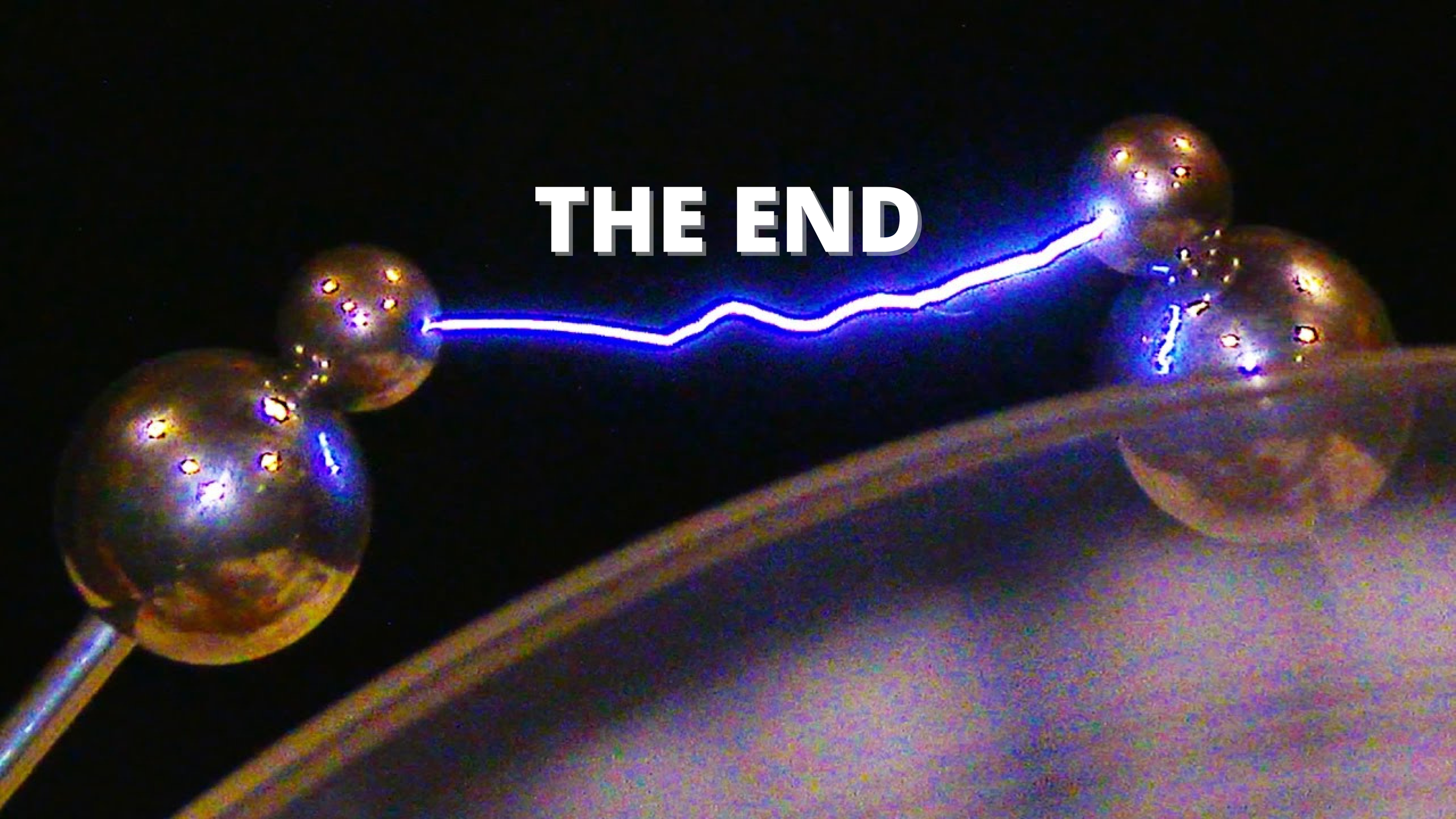
Fig. 44.—Wimshurst’s Machine.



Curiosities

In addition to the interest that this invention has in physics, it has been possible to adapt its
results to experimental medicine, such as electrotherapy in the nineteenth century. In the
early 20th century, such an electrostatic device could have been used to produce X-rays,
which Röntgen discovered in 1895.

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