PHYWE

Wimshurst Machine

07616-00

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Operating instructions

CE The unit complies with the corresponding EC guidelines.

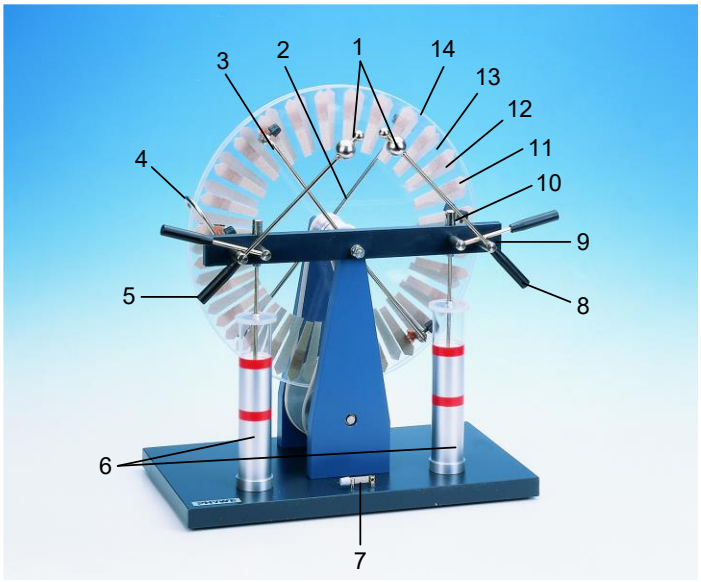

Fig. 1: 07616-00 Wimshurst Machine

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1 SAEFTY PRECAUTIONS

Caution!

- Carefully read these operating instructions before operating this instrument. This is necessary to avoid damage to it, as well as for user-safety.
- Do not start up this instrument in case of visible signs of damage to it.
- Only use the instrument for the purpose for which it was designed.
- The additional parallel conncection of external capacitors is forbidden

Caution!

- Endangered people (e.g. people with a cardiac pacemaker) must not linger near the instrument (system) when it is operating.

2 PURPOSE AND CHARACTERISTICS

The Wimshurst machine acts as a source of high direct voltage, e.g. for electrostatic experiments with the Set of Electrostatics Apparatus (07644-00).

3 FUNCTIONAL AND OPERATING ELEMENTS

Two round discs of Plexiglas (***13***) and (***14***) are situated parallel and close to one another on a horizontal axis with only a small distance between them. Both discs are independently joined to the drive shaft via drive belts and pulleys.

One of the belts has a twist so that the discs rotate in opposite directions when the crank handle is operated. A lateral conductor (***2***), (***3***), which can be adjusted by turning on the shaft, is located in front of each disc and the metal brushes are dragged over the conducting strips (***11***), (***12***). Combs (***4***), (***10***) for current collection are located at the ends of the insulated strip (***9***). In operation they are electrically connected to the electrode rods (***1***) and to the Leyden jar (**6**) by the switching levers (***5***), (***8***). The switch (***7***) is connected to the external strips of the Leyden jar and enables alternating current to be drawn. The switch is closed to draw direct current. The maximum sparking distance that can be achieved with this type of machine depends on the disc diameter. With this version,

depending on ambient conditions, a apark length of about 120 mm can be obtained. The short circuit current of the Wimshurst machine is about 30 μA.

3.1 Physical principle

An initial small charge on the metal strips is amplified during operation by exploiting electrostatic induction effects. If, for example, the metal strip (**11**) is positively charged opposite brush (**3**), then a negative charge is induced on the opposite metal strip (**12**) and a positive charge of the same magnitude flows via the brush (**3**) to the diametrically opposed metal strip (**12**). There, a corresponding negative charge is located on the opposing metal strip (**11**). Now the disc (**13**) is moved so that the first mentioned, negatively charged strip (12) is positioned opposite the brush (**2**). A positive charge is now induced on the strip (**11**) located here, whereas the corresponding negative charge is conducted via brush (2) to the diametrically opposite strip (***11***). Again, it causes a positive charge on the opposing strip (12). The movement of the disc (***14***) occurs in a corresponding manner and transports the positively charged strip (***11***) located under the brush (***2***) into the position opposite the brush (3). In fact, the two sequences of movements described here consecutively actually take place simultaneously. Positive and negative charges are induced on the plate (***14***) under the brushes (***2***) as a result of the influence of charges on plate (***13***). After they have passed the opposing brush (***3***) and have been able to induce negative and positive charges on the corresponding strips on the plate (***13***), the charges are passed until they can transfer their charges to the collector brushes. A corresponding process occurs simultaneously on the plate (***13***).

4 HANDLING

4.1 Bringing the induction machine into service and handling of it

The Wimshurst machine is supplied ready for use. The best position for the lateral conductors (***2***) and (***3***) occurs when they cross and the angle with respect to the insulation strip (**8**) is about 45°. The electrical energy discharged by the flashover is increased without increasing the sparking distance by switching in the Leyden jars (***6***) with the levers (***5***) and (***9***). The polarity of the Wimshurst machine can be found by charging an Electroscope (07120-01) via an electrode. If the electroscope can be discharged when contacted with a rubbed Ebonite Rod (06200-01), then the electrode that is used is positive – the ebonite rod becomes negatively charged when rubbed with Felt, natural hair (06204-00). If further charging takes place, the electrode is negative. A change of polarity does not occur with the machine in operation. Polarity can only change after longer periods of operation. To obtain the alternating current through the terminals (***7***), the electrodes (***1***) must be brought together so closely that only a small spark can flash over.

4.2 The experimental area

The instrument is only to be operated in technical rooms of training, research and teaching facilities under the supervision of qualified personnel. The person entrusted with the supervision of experiments and demonstrations must take all necessary measures (e.g. screening, short connecting cables, brief operating times) to ensure that there is no impairment to the intended function of instruments that are being operated outside of the technical room or direct vicinity of the electromagnetic environment. The spark jumping that occurs during discharging can result in interference up to a distance away of some hundreds of meters. Further to this, the instrument must not be operated in the vicinity of electronic equipment such as computers, as these could be destroyed by the high voltage of the instrument.

5 NOTE

After longer usage the copper brushes will slightly divert from the disk and then it is necessary to push them into home position. If the Wimshurst machine only works when turned to the left, then either the lateral conductors (***2***) and (***3***) are positioned the wrong way round or the belts have been fitted incorrectly. If the brushes (***2***) and (***3***) are well worn, then a little material can be cut off their ends so that they again present a clean metal surface. Where the performance is restricted as a consequence of insulation defects, it is recommended that any dust is removed and the Wimshurst machine is subjected to the hot air from a fan heater for about 10 minutes. To completely discharge the Leyden jars, both electrodes must be electrically connected. The odour generated when operating the machine is due to the sparks causing a chemical conversion of the oxygen in the air to ozone.

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6 LIST OF EQUIPMENT

The following equipment has been found to be very useful in conjunction with the Wimshurst machine:

Ebonite Rod	06200-01
Felt, natural hair, 10 x 10 cm	06204-00
Electroscope, Kolbe type	07120-01
Set of Electrostatics Apparatus	07644-00
Foil Bunch	EG051085

7 NOTES ON THE GUARANTEE

We guarantee the instrument supplied by us for a period of 24 months within the EU, or for 12 months outside of the EU. Excepted from the guarantee are damages that result from disregarding the Operating Instructions, from improper handling of the instrument or from natural wear.

The manufacturer can only be held responsible for the function and technical safety characteristics of the instrument, when maintenance, repairs and alterations to the instrument are only carried out by the manufacturer or by personnel who have been explicitly authorized by him to do so.

8 WASTE DISPOSAL

The packaging consists predominately of environmentally compatible materials that can be passed on for disposal by the local recycling service.

Should you no longer require this product, do not dispose of it with the household refuse.

Please return it to the address below for proper waste disposal.

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