ioniser

The ioniser produces a high concentration of negative ions in the surrounding atmosphere, which many people find stimulating and refreshing.

The state of the weather affects not only a person's psychological well-being, but also physical health. It has long been known that such basic factors as temperature, humidity and atmospheric pressure can have a profound effect upon physical well-being, but in recent years much attention has been given to the effect of ions present in the atmosphere.

Ions are positively or negatively charged molecules of the gases that make up the atmosphere, and their concentration depends on location and the prevailing weather conditions. It is believed that a preponderance of negative ions has a positive effect on physical well-being, while a preponderance of positive ions has a negative effect. The average concentration of ions of either polarity is normally fairly small, around 400 to 1500 ions per cc. of air, but in mountain resorts such as St. Moritz the concentration of negative ions is considerably higher, which may account in part for the salutiferous effect of such resorts. In contrast, the oppressive atmosphere that precedes the onset of a thunderstorm is associated with the approach of a front containing an excess of positive ions.

Scientists who have researched the effects of differing ion concentrations and polarities have claimed that an excess of negative ions can counteract such complaints as insomnia, irritability and being generally tired and run-down. One explanation that has been put forward for the effect is that negative ions have a beneficial effect on cell metabolism.

It would certainly appear that there is some truth in these claims, as ionisers that artificially increase the proportion of negative ions in the air are becoming quite popular. Readers can experiment for themselves by building the simple ioniser circuit shown in figure 1. This consists of a 27-stage voltage multiplier that steps up the 240 V mains to a DC voltage of approximately −7.5 kV. The negative output terminal of the multiplier is connected to an ordinary sewing needle. As many readers will be aware the electric field strength around a charged body is greatest where the curvature is greatest, i.e. around sharp

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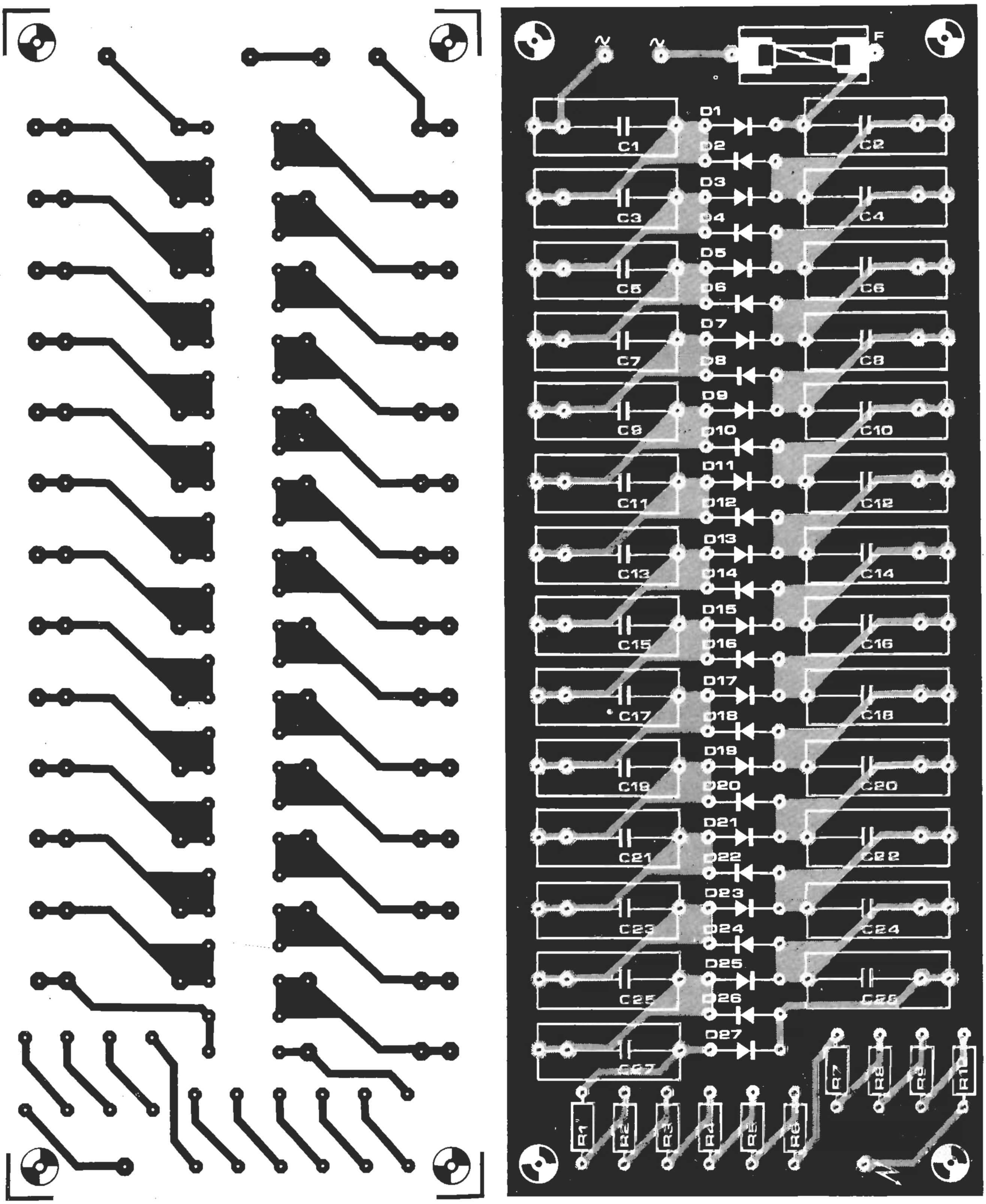
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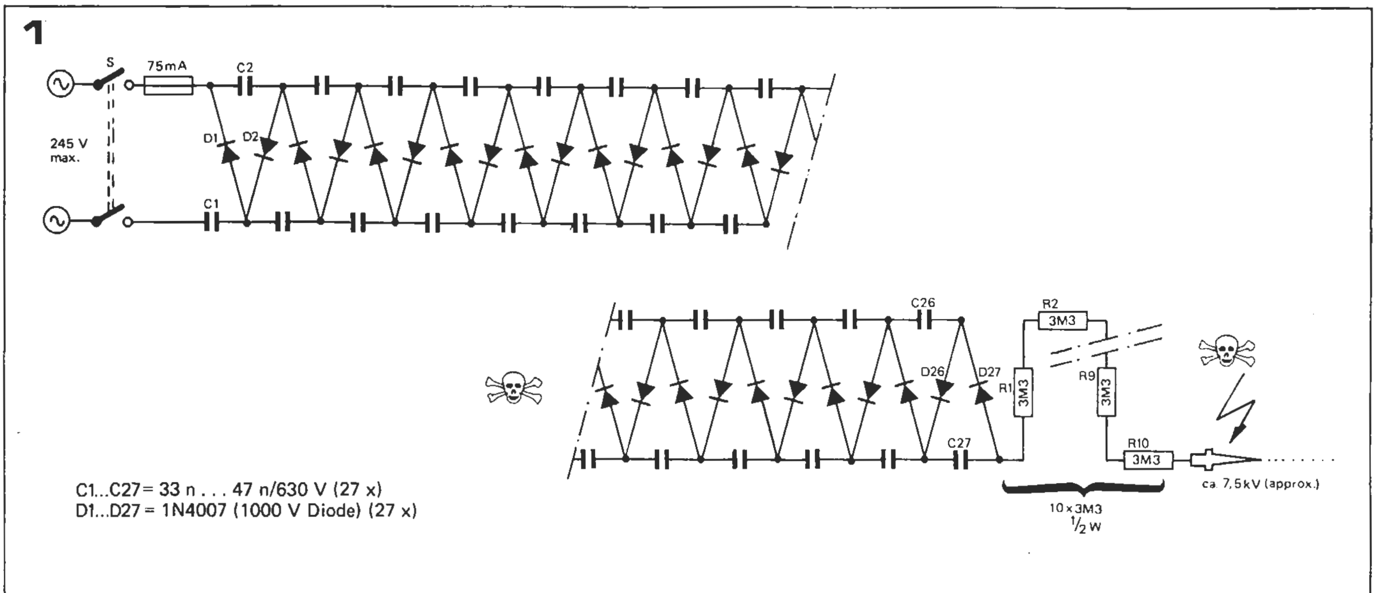

points. An intense field is thus present at the tip of the needle, and electrons from the tip of the needle are 'sprayed' onto the surrounding air molecules, turning them into negative ions. These ions are then repelled by the negative charge on the needle point, and other air molecules take their place and are ionised in turn, which means that a constant 'wind' of negative ions emanates from the needle point.

As the needle must be exposed to the air in order to generate the ion stream it is necessary to limit the current that can flow in the event of the needle being inadvertently touched, and this is the function of resistors R1 to R10. *Under no circumstances should these resistors be omitted or bypassed, as this could result in a fatal electric shock.*

Construction

A printed circuit board and component layout for the ioniser are given in figure 2. Assembly of the board requires little comment except to note that there should be no protruding wires or spikes of solder on the back of the board, especially towards the high-voltage end of the multiplier, as this could result in unwanted discharges. All joints should be smooth and neat.

When mounting the ioniser in a box the accent must be on safety. The p.c. board should be mounted on insulated spacers in an insulated box. The needle can be mounted through the side of the box (point outwards of course) and to prevent accidents it should be surrounded by a short length of 25 mm or 50 mm plastic pipe mounted coaxially with the needle. The connection between the needle and the output of the voltage multiplier should be made as short and as rigid as possible, so that in the event of the wire breaking there is no chance of it touching any other part of the voltage multiplier circuit.

After a period of use the needle point will become dirty and eroded, so it is a good idea to make the needle removable for cleaning and replacement.

Figure 1. Circuit of the ioniser. The resistors in series with the discharge needle limit the current to about 220 μA if the needle is accidentally touched.

Figure 2. Printed circuit board and component layout of the ioniser.

Parts list to figure 2.

Diodes:
D1 . . . D27 = 1N4007 or similar 1000 V diode.

Resistors:
R1 . . . R10 = 3M3 / ½ watt

Capacitors:
C1 . . . C27 = 33 n or 47 n, 630 V

Using the Ioniser

The ioniser can be tested by placing a wet finger a few cm from the needle to feel the ion 'wind'. In use the ioniser should be mounted in such a position that the ion stream is not obstructed by any objects in the room, as otherwise the object would acquire a large negative charge.

It is wise not to remain in the immediate vicinity of the ioniser nozzle for too long since, in addition to ionising the air, the ioniser als produces ozone (triatomic oxygen, O_3). This is highly reactive and if breathed in large quantities can cause irritation of the respiratory system, and for this reason *the ioniser is not recommended for use in the vicinity of asthma sufferers.* For safety reasons it is also not recommended to use the ioniser in humid conditions such as in the bathroom or kitchen. ◼