THE UVIOL LAMP.

In addition to the visible radiation, all light contains also dark rays, not perceptible to the eye. These are known either as ultra-red or heat rays if their wave length is greater than that of visible light, or as ultra-violet, actinic, or chemical rays, when of shorter wave length than the visible spectrum. Within the last ten or twenty years, the development of physics and medicine has disclosed certain properties of this form of radiant energy, which are not only highly interesting from the point of view of pure science, but seem calculated to be of great service to mankind. In consequence, the demand has arisen for a practical and comparatively cheap form of apparatus for producing these ultra-violet rays, or as we may term them briefly, "uviol" rays.

The want has been supplied by a modification of the Hewitt mercury vapor lamp, the walls of which are made of a special glass.

The new lamp consists of a tube of suitable shape—usually straight—made of special glass transparent to uviol rays, 8 to 30 millimeters in diameter and 20 to 130 centimeters long. Platinum terminals are fused in through the glass at the two ends, and are tipped with carbon knobs, so that each pole may be used either as a positive or as a negative pole. The lamp contains 50 to 150 grammes of mercury, according to its size. This mercury not only furnishes the vapor necessary for the working of the lamp, but also serves for starting the luminous discharge and for cooling the negative pole. The dimensions are so calculated that the lamp can be connected up to leads of the usual tension of 220 or 110 volts without undue loss of current.

To light the lamp, it is not enough simply to connect it to the leads; the two poles must be for an instant joined by means of the mercury in the lamp, which for this purpose is tilted so as to allow the metal to flow from the one to the other. When once the discharge is started, it will continue after the mercury has fallen back to its normal position. The lamp being made with carbon poles, the ignition may be effected from the positive to the negative end, or *vice versa*, without injury to the lamp (through disintegration or fusion of the platinum terminals); the negative pole may even be laid bare for several seconds without harm while the lamp is being lighted. When, however, it is to run for a prolonged period, it is imperative that the negative pole be immersed in mercury.

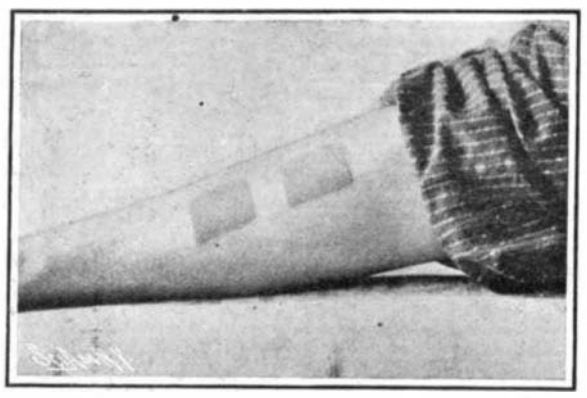
In order to obtain a maximum transformation of current into radiant energy with a difference of potential of 130 to 190 volts at the terminals (220 at the leads), the tube must be at least 130 centimeters long. Such a long tube is awkward to handle, especially in the operation of igniting the lamp. It may be shortened to one-half by giving it a U shape. This also broadens the field illuminated. The same form, on a smaller scale, is also very practical when internal cavities of the human body are to be exposed to uviol radiation. Two or three lamps of 50 to 60 centimeters length each may be connected in series, and arranged one above or behind the other as required.

The spectrum of the uviol lamp consists of a very large number of lines ranging in wave length down to 253 micromillimeters. From 405 downward these represent uviol rays, and this portion comprises about four-fifths of the whole compass of ultra-violet light which is transmitted for any considerable distance through air.

The light of the lamp displays all the properties characteristic of ultra-violet waves. Ozone can be detected by its odor. A negatively-charged electroscope is rapidly discharged by these rays. Great care must be taken to avoid continued exposure of the eyes to the light of the lamp, as it will cause inflammation.

It is difficult to form any idea as to the manner in which the light is produced in the tube. There seems to be some reason for supposing that the ultimate particles of mercury in the evacuated tube are hurled with great velocity by the electric current from the negative to the positive pole, thus acquiring a very high temperature, and emitting intense light. The rays of short wave length so produced render the mercury vapor conducting, thus establishing a path for the continuous electric discharge through the tube.

The uviol lamp has a remarkably deadly effect upon small insects. A common fly dies within one minute when brought to a distance of about 1½ centimeters of the lamp—a distance at which the heat cannot be sufficient to be harmful. Under a lamp which was suspended near an open window at night, in summer, thousands of small dead insects could be swept up in the morning. On smaller organisms also, on bacteria, the uviol lamp exerts a fatal action.



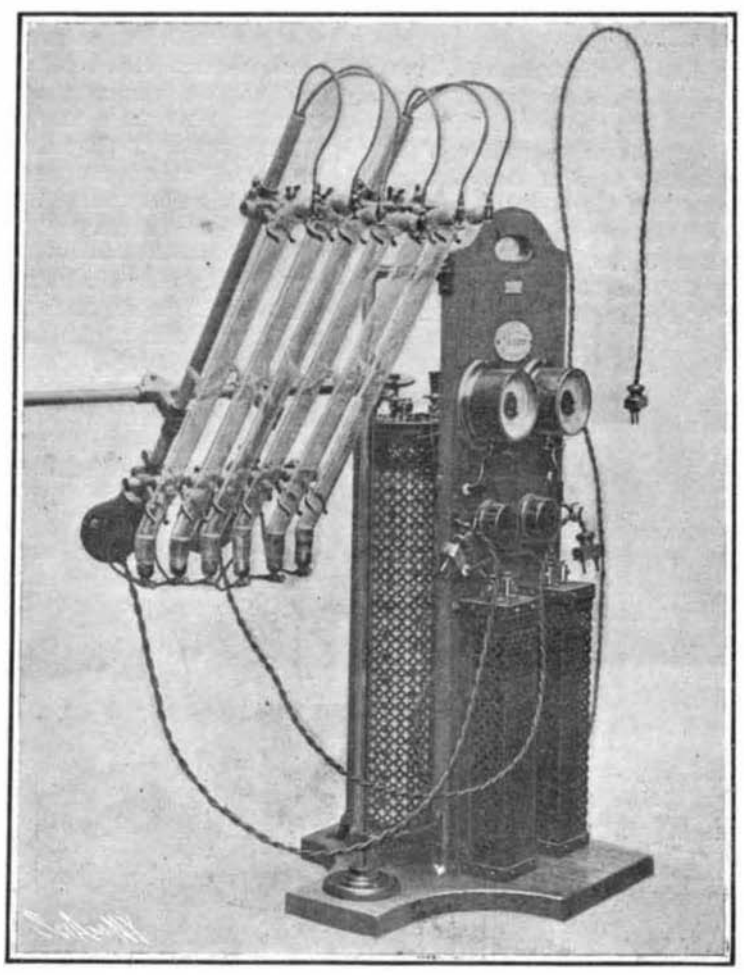
THE RESULT OF A FIFTEEN MINUTES' EXPOSURE TO THE RAYS OF THE UVIOL LAMP.

The most important and also the most interesting application of ultra-violet light is the use to which it has of recent years been put in medicine for the treatment of skin diseases. It was Finssen who, some twelve years ago, did the pioneer work, and created a sensation with his lupus cures. For his source of ultra-violet light he used the ordinary carbon arc lamp, fitted with water cooler and projecting piece. Although such a lamp sends out comparatively little radiation of short wave length, it was found possible to increase the proportion of the latter by increasing the dimensions and using large currents. From the nature of this arrangement it is plain that only a small patch can be treated at a time, and that hence frequent sittings are necessary for dealing with diseased areas of considerable dimensions. Besides, the large quantum of heat and light unavoidably emitted along with the ultra-violet rays is not only an irksome factor in this procedure, but also renders it rather costly.

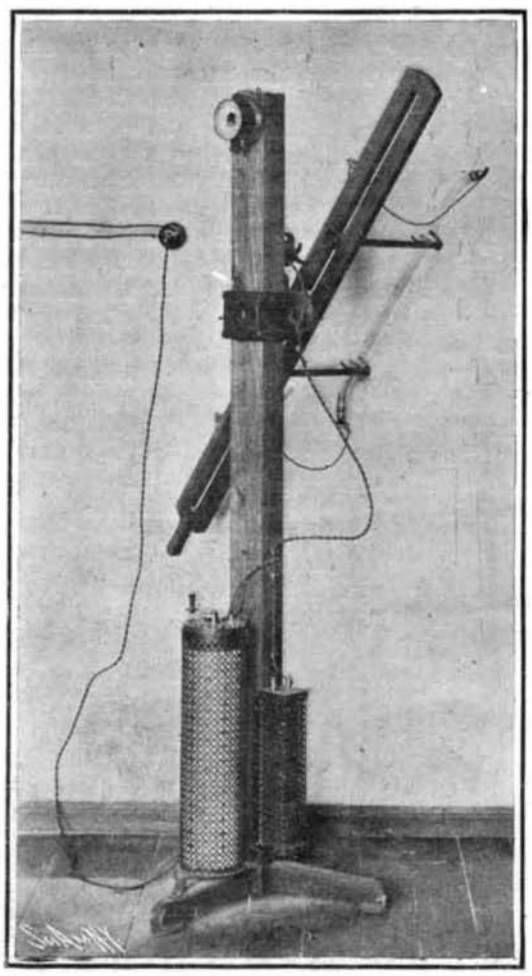
The case is very different with the uviol lamp. Owing to its expanded form, it furnishes a means for exposing large surfaces, ranging in area to 1,400 square centimeters, to intense radiation, and, owing to the small amount of heat emitted, it may be approached to within less than a centimeter.

If the normal, healthy skin is exposed for 5 to 15 minutes to the action of the uviol lamp at a distance of 1 to 3 centimeters, there is at first no visible change. It is only some hours after the exposure that a reddening appears, which continues to increase for about a day, at the end of which period it reaches a maximum. At this stage a slight burning sensation is felt, a few days later the patch of skin begins to itch and peels off, and the redness ultimately disappears in the course of two or three weeks.

When properly handled, the uviol lamp may be used for 1,000 hours without appreciably deteriorating.



UVIOL LAMP WITH RHEOSTATS AND MEASURING INSTRUMENTS.



UVIOL MERCURY LAMP CONSTRUCTED AT JENA.

A Concourse of Kites in France.

This year the Société Française de Navigation Aerienne is organizing its annual concourse of kites, which will be held on the same lines as last year's very successful contest. It will be managed by the aviation committee and the concourse will be held on the military maneuver grounds in the eastern suburbs of Paris, at Vincennes. There will be three general divisions for the trials of the kites and the observations will bear first upon the altitude; second, on the greatest weight which is lifted; third, deviation; fourth, transport of life-lines; fifty, aerial photography. Commencing on April first, the trials will be held on the following Sundays. Engagements are received up to March 22 at the office of the secretary, Civil Engineers' Building, 19 rue Blanche, Paris. The secretary will furnish a detailed set of rules for the contest.

Tunnel Ventilation.

In a paper read by M. C. Birault upon tunnel ventilation before the Société des Ingenieurs Civils, he speaks of the method used in the Paris subway, among others. The conditions of the air supply are known in a very exact manner from the analysis of the air and temperature tests, also water vapor measurements, made by M. Albert Levy, of the Montsouris Observatory, for some years past. Air is taken in each tunnel midway between the stations at 4 o'clock P. M. each day. The Vincennes-Maillot subway station, the first to be built, is entirely underground, except the open-air station at the Bastille. As was to be foreseen, it is in the western part of the tunnel that the air is the most vitiated, due to the length of the tunnel, 4.3 miles, and also because this part has the most traffic. The quantities of carbonic acid continue to increase as we proceed from the open-air station at the Bastille in either direction. Then a diminution is noticed toward the ends of the line. The atmosphere of the tunnels is always more humid than that of the outer air, and the water vapor figure varies about as the carbonic acid. As to the temperatures, they are not much influenced by the variations at the surface even when great. The action of the seasons has but little influence, and the mean temperature of the air in the tunnels is only about 3 deg. C. lower in winter than in summer. In a given day, the hourly variations of temperature follow a very regular law in all seasons. We observe a minimum at 4 o'clock A. M. and a maximum at 8 P. M. The thermometer falls in a noticeable manner from 12:30 A. M., when the traffic ceases and the station doors are opened in order to aerate the tunnel. In one section a series of observations were made. In summer the highest temperature is 21 deg. C. and the lowest is 22.5 deg. In winter we find 20 and 17.3 deg. respectively. Carbonic acid gas, observed during the night from 1 to 5 o'clock A. M., is found to be 48 liters per 100 cubic meters of air. From 4 to 10 o'clock P. M. it is 108 liters. The mean night temperatures are 17.5 and for the day 19.7. The present ventilation is therefore very good in lowering the amount of carbonic acid, but has no great effect on the temperature. In the later tunnel (line No. 2) which has air openings and a motor fan system, the amount of carbonic acid is lowered to 100 liters per 100 cubic meters. In line No. 3, which is of more recent construction and has a lighter traffic, the figure falls to 70 liters.