

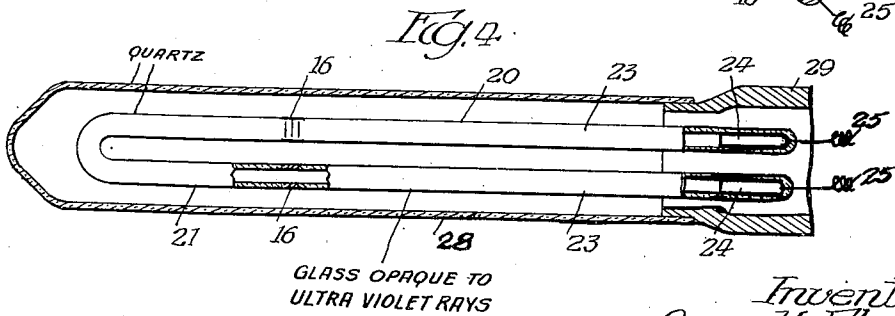
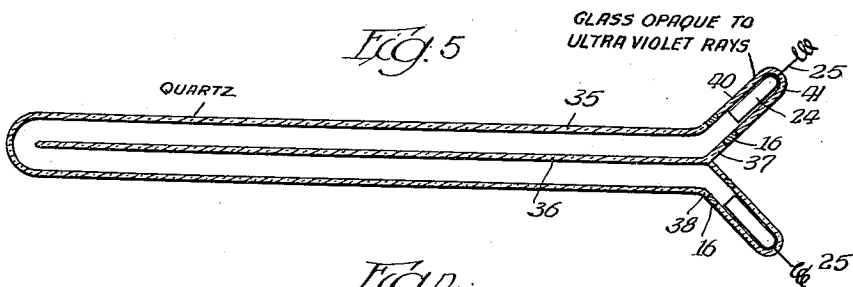
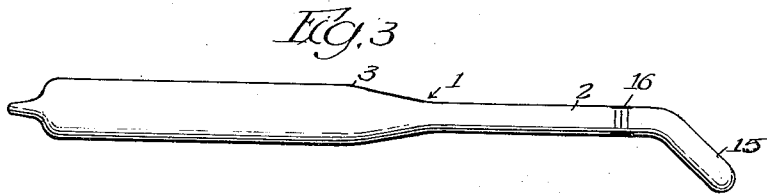
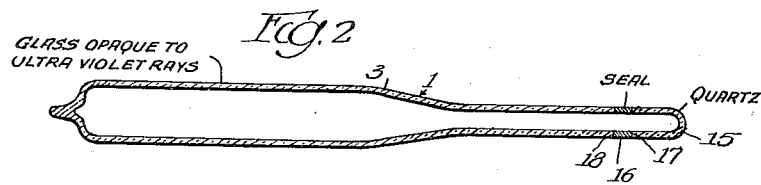
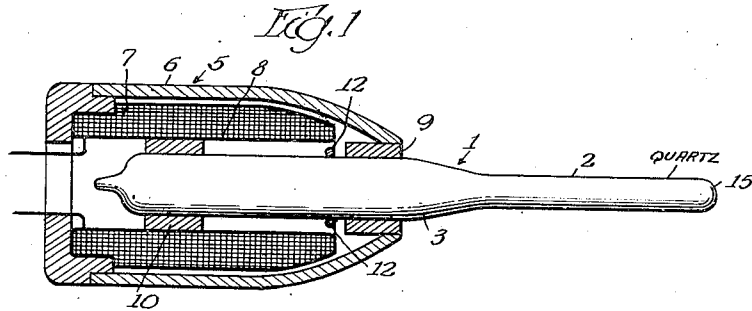
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ULTRA VIOLET RAY APPLICATOR

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UNITED STATES PATENT OFFICE

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ULTRA VIOLET RAY APPLICATOR

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1 Claim. (Cl. 176—1)

This invention relates to applicators for generating ultra violet rays such as are useful for medicinal purposes. Such applicators generally comprise a tube having an evacuated atmosphere in which an electric discharge may be produced, the atmosphere within the tube being such as to produce ultra violet radiations.

Tubes of the above mentioned type are generally made of quartz or other glass-like material which is transparent to ultra violet rays. In the applicators of the prior art the entire length of tube emits ultra violet radiations. In many instances only the ultra violet radiations from the tip of the applicator are used. The radiations from the rest of the tube constitute a potential source of danger to the operator and to the patient, in that they can burn the operator or the patient. A common corrective heretofore applied is to slip over the tube a flexible cover which is opaque to ultra violet radiations. This method of protection is a nuisance at its best and is seldom completely sanitary. Furthermore, there is always a layer of air, no matter how thin, between the cover and the applicator. This layer of air is subjected to ultra violet radiations, with the resulting generation of ozone. In the case of an applicator that is to be inserted into the mouth, or into the nose, the ozone generation is exceedingly obnoxious. This is particularly true in view of the fact that all of the ozone, which is generated is generated right within or adjacent to the interior of the nose or mouth and therefore is particularly effective. In many patients it tends to produce gagging.

Another method of preventing ultra violet burns from the portion of the applicator not being used is to paint those portions of the applicator where ultra violet radiations are not desired with paint that is opaque to the rays. After each use the applicator must be boiled to sterilize it. Such boiling will, in a short time, remove parts of the paint. Wherever the paint is removed the tube emits ultra violet rays. This soon becomes a major part of the originally painted surface. Furthermore, a very slight removal of the paint may not permit the escape of ultra violet radiations in an amount sufficient to burn the patient but in an amount which is sufficient to cause the generation of enough ozone in the mouth or nose to be highly obnoxious.

It is one of the objects of the present invention to provide an applicator which can be inserted into an orifice in the human body and which will emit ultra violet rays only at the place where such emission is desired. As a result I eliminate

not only the possibility of ultra violet ray burning of the patient or of the physician but also eliminate the generation of ozone, a feature which is of considerable importance with applicators intended for use in the mouth or nose.

In one embodiment of the present invention this result is obtained by making only a part of the applicator of material which is transparent to ultra violet rays and the rest of the applicator of material which is opaque to ultra violet rays. Both of the materials are, preferably, of glass-like appearance, that is, transparent to ordinary visible light. Both of the materials are fused together to form one continuous tube. When the ultra violet ray transparent portion of the tube is quartz and the rest of the tube is glass which is opaque to ultra violet rays, it is desirable to use a graded seal between the quartz portion and the rest of the seal. Such applicator may be subjected to repeated boiling, for sterilization, without in any way adversely affecting the applicator.

It is a further object of the present invention to provide an applicator which is entirely devoid of electrodes and devoid of connections which must extend through the tube wall. This permits a simple manufacture of a quartz applicator. In the manufacture of quartz applicators heretofore considerable difficulty was encountered in making a seal between the quartz and the conducting wire that extends through the tube to the electrode within the tube. These difficulties are eliminated, in accordance with the present invention, by eliminating the electrodes entirely.

It is a still further object of the present invention to provide an applicator of the type which includes electrodes and includes a quartz body and yet the electrode conductors do not extend through the quartz. In this embodiment of the present invention the electrodes are preferably mounted in a very short tube of glass-like material which is opaque to ultra violet light and which is open at one end and closed at the other. The conductor to the electrode extends through the closed end of the short tube. A graded fused seal is provided between the short glass tube that contains the electrode and the quartz tube.

I have found that in a tube which is operated by radio frequency waves applied from outside the tube the exciter portion of the tube should be of larger diameter than that used in the rest of the tube. I have found that the ratio of the diameter of the orificial part of the tube to the exciter part of the tube should preferably be in the ratio of less than one to two, that is, in a tube wherein the orificial part is of an outside diam-

eter of 6 mm., the barrel should be of an outside diameter of the order of 13 mm. for optimum results.

The attainment of the above and further objects of the present invention will be apparent from the following specification taken in conjunction with the accompanying drawing forming a part thereof.

In the drawing:

Figure 1 shows a transverse section through an applicator holder with an applicator of the present invention inserted therein;

Figure 2 is a longitudinal cross section through the applicator of Figure 1;

Figure 3 shows a modified form of applicator; and

Figures 4 and 5 are longitudinal sections illustrating still other modifications of the present invention.

Reference may now be had more particularly to Figure 1. The applicator of the present invention, illustrated at 1, is in the form of a tube which includes an orifice portion 2 and an exciter portion 3 constituting one continuous tube sealed and evacuated and containing an atmosphere of the type which, when subjected to radio frequency electromagnetic waves, will produce a glow or arc emanating ultra violet rays. A suitable atmosphere for the inside of the tube is a gas such as argon, neon, krypton, xenon, or a mixture of two or more of the same, plus a small globule of mercury. The entire tube is of a circular cross section having a smooth exterior surface.

A source of concentrated radio frequency electromagnetic waves, referred to as a burner, is indicated at 5. The burner 5 is circular in cross section to facilitate holding of the same in the hand, and includes a casing 6 having an electric coil 7 mounted therein, which coil is wound on a tubular non-magnetic form 8. The form 8 is open at both ends and has a non-metallic ring 9 at one end and a similar ring 10 adjacent the other end. The coil 7 may be connected to a source of alternating current of radio frequencies such as a frequency of the order of 10 million to 150 million cycles per second, a frequency of the order of 100 million cycles per second being the preferred frequency. The exciter 3 of the applicator 1 is adapted to be removably inserted into the rings 9-10 which frictionally engage the applicator. A spring 12 in the form 8 is expanded by the exciter 3 and exerts a yielding pressure against the same to hold it snugly but removably in place. The high frequency electromagnetic waves produced by the coil 7 cause a glow in the applicator 1, which glow extends through the full length of the applicator, including the orifice portion 2. The glow emits ultra violet rays, the major part of which is of a frequency of the order of 2537 Angstrom units. The applicator 1 may be removed from the burner by merely pulling the applicator out, and may be replaced by merely pushing it in, there being no electrical connections through the applicator.

The entire applicator may be made of glass which is transparent to ultra violet rays such as, for instance, of quartz. It is to be noted that the interior of the applicator contains no electrodes and that there are no wire connections that must extend through the wall of the applicator. This is of particular importance in the case of a quartz applicator, since it eliminates the difficult operations of making a vacuum tight

seal between the quartz and the conducting wire that must extend therethrough.

The orifice portion 2 of the applicator may be inserted into an orifice in the human body for therapeutic treatment. Where this is the prime purpose of the applicator the tip portion 15 is the part that is most effective in the treatment. Ultra violet rays from the remaining part may be not only ineffective but objectionable, when the applicator is put to such use. It may be objectionable because the ultra violet radiations may cause burns in adjacent tissues in the patient's mouth or nose and also because the ultra violet radiations produce ozone which, to many people, is highly obnoxious. When this is the case only the tip portion 15 is made of quartz. The remaining part of the tube is made of glass or glass-like material which is opaque to ultra violet rays. The quartz portion is joined to the rest of the tube by a seal 16 which is preferably a graded seal. This seal is fused to the quartz at 17 and is fused to the rest of the applicator at 18. The fusion is preferably mutual fusion of the sealing material with the adjacent part of the applicator at 17 or 18 as the case may be. The seal 16 comprises one or a series of different glasses so that the portion of the seal adjacent to 17 has a temperature coefficient of expansion and contraction close to that of the quartz and the portion of the seal adjacent to 18 has a temperature coefficient of expansion and contraction similar to that of the adjacent glass. While the seal 16 has been illustrated in Figure 2 as being clearly visible, this is not the case in the actual construction, since the sealing glass as well as the quartz and the rest of the applicator is transparent to visible light and the unions at 17 and 18 are by fusion which renders the seal 16, quartz part 15 and the remaining glass part one integral unitary structure. The seal may be located anywhere along the orifice portion 2 so that the quartz part 15 of the applicator occupies a greater or lesser part of the total length of the orifice portion 2.

I have found that for optimum results there is a definite relationship between the diameter of the exciter portion 3 and the diameter of the orifice portion 2. The optimum results were obtained when the exciter portion was of an outside diameter of approximately 13 mm. and the orifice portion 2 was of an outside diameter of approximately 4 mm. to 7 mm. The thickness of the applicator wall was of the order of or slightly less than 1 mm. The orifice portion 2 is of approximately the same length as that of the exciter portion 3 and is joined to the portion 3 by a smooth gradual taper free of sharp corners.

In Figure 3 I have shown a construction similar to that of Figure 2 except that the tip portion 15 is at an angle to the rest of the orifice portion 2. The graded seal is located at the place indicated in Figure 3, the tip portion 15 being of quartz and the rest of the tube being of material opaque to ultra violet rays. This applicator is particularly useful for treatment of the back of the mouth, and the throat.

The applicator 1 constitutes a sealed unit free of any cementitious joints and may therefore be sterilized by boiling without any damage to the applicator. This is not true where a cementitious joint is used, since cementitious joints are likely to develop leaks when subjected to repeated boilings. The elimination of a lead-in wire extending through the wall of the applicator serves further to reduce the possibility of developing leaks

in the applicator when the same is subjected to repeated boilings. Even the slightest leak in the applicator will destroy the high vacuum therein and render the applicator useless.

In treating diseased female tissues it is difficult to use an applicator as small as the applicator 1. It is customary to use a spreading device for spreading and smoothing out the tissue walls. This is illustrated in Figure 4. The applicator of Figure 4 comprises a continuous U-shaped tube 20 to the distal end 21 of which is of quartz or other material transparent to ultra violet rays and the rest of which is of material opaque to ultra violet rays, such as ordinary glass, the quartz part being joined to the glass by graded seals 16. Since the arms 23 of the U-shaped portion of the applicator are of ordinary glass it is possible to mount the usual electrodes 24 therein to which a high voltage may be applied by conductors 25 to produce a glow through the tube, the conductors 25 being sealed in the glass, and the glass tube being evacuated and containing an atmosphere similar to that of the applicator 1. Since only the tip portion 21 is transparent to ultra violet rays only that part will be effective in the treatment and therefore there is no danger of burning the adjacent body tissues. The entire applicator is mounted in any desired manner in a tube 28 of material transparent to ultra violet rays, such as quartz, which tube 28 has a handle 29 secured thereto in any desired manner. Since the tube 28 is not evacuated it is not necessary to have a sealing joint between it and the handle 29.

In Figure 5 the principles of the present invention are shown applied to an applicator in many ways similar to a standard applicator now on the market. This applicator is in general of a construction such as is shown and described in the United States patent to Bristow, No. 2,123,709, of July 12, 1938, and comprises a tube 35 divided into two communicating circular chambers by a partition 36, the tube wall and the partition being both of material transparent to ultra violet rays such as quartz. This applicator differs from the one described in the above mentioned patent in that each of the two chambers are spread apart at one end, as indicated at 37 and 38, and joined by a graded seal 16 to a tubular member 40 which is closed at 41 and has an electrode 24 therein. By providing the seal at 16 I overcome the diff-

culties otherwise inherent in making a tight seal between the lead-in conductor 25 and the surrounding glass wall.

In the present description where I speak of material transparent to ultra violet rays, quartz is the preferred material, but quartz is not the only such material. There are known glasses which have considerable transparency to ultra violet rays and which may be used in lieu of the quartz. A graded seal between the ultra violet transparent glass and the ultra violet opaque glass is used when the two glasses are of considerably different temperature coefficients of expansion. Where the difference is not great it is not necessary to provide a graded seal, since the two glass parts may be fused directly together.

The term "glass" is herein used in its broadest sense to include any type of material which is glass-like in appearance and is transparent to ordinary visible light.

In compliance with the requirements of the patent statutes I have here shown and described a few preferred embodiments of my invention. It is, however, to be understood that the invention is not limited to the precise constructions here shown, the same being merely illustrative of the principles of the invention. What I consider new and desire to secure by Letters Patent is:

An ultra-violet ray apparatus comprising a tubular handle portion open at at least one end for receiving an applicator, a high frequency coil within the handle and extending axially thereof, a non-metallic applicator holding ring secured within the coil with its axis coincident with that of the coil, a sealed applicator tube one end of which is removably inserted through the open end of the handle portion and is held in the handle portion by frictional engagement with said non-magnetic ring, said tube having a rarefied atmosphere adapted to be excited by high frequency electromagnetic waves to produce ultra violet rays, the portion of the applicator within the handle being of glass-like material which is opaque to ultra violet rays whereby none of the rays are emitted within the handle portion, the outside tip of the applicator tube being of material transparent to ultra violet rays and being joined to the rest of the tube by mutual fusion.

OSCAR H. FLOYD.