No. 769,581. PATENTED SEPT. 6, 1904.

W. F. ARNOLD.

PHOTOTHERAPEUTIC APPARATUS.

APPLICATION FILED FEB. 20, 1904.

NO MODEL.

Fig. 2.

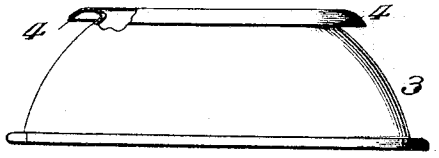


Fig. 3.

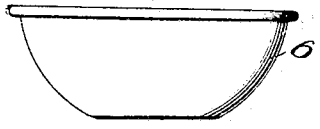


Fig. 4.

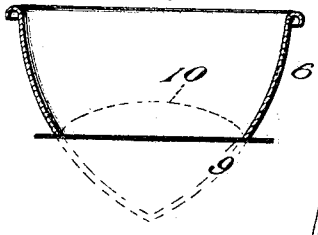


Fig. 1.

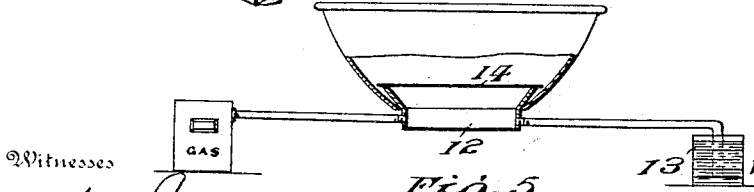


Fig. 5.

Witnesses

Frances E. Maguire

Inventor.

Will Ford Arnold.

by, J. Stetson Dill,

Attorney

No. 769,581. Patented September 6, 1904.

UNITED STATES PATENT OFFICE.

WILL FORD ARNOLD, OF THE UNITED STATES NAVY.

PHOTOTHERAPEUTIC APPARATUS.

SPECIFICATION forming part of Letters Patent No. 769,581, dated September 6, 1904.

Application filed February 20, 1904. Serial No. 194,599. (No model.)

To all whom it may concern:

Be it known that I, WILL FORD ARNOLD, of the United States Navy, have invented certain new and useful Improvements in Phototherapeutic Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The object of this invention is to provide improved means for securing the safe and efficient application of light to the treatment of infectious affections of the skin and deeper tissues and organs and also of bones, so that, if necessary, the concentration of the light-rays will tend to be below the superficies.

A further object is to avoid calorific injury to the tissues by the heat of the light-rays; and a further object is to additionally protect the skin by means which will immediately indicate the presence of too great a degree of heat—that is, such as would tend to injure tissues which may be already inflamed or irritated.

In the accompanying drawings, Figure 1 is a view in perspective, showing in conventional form means for carrying out my invention. Fig. 2 is a view of the reflector. Fig. 3 shows the concentrator detached. Fig. 4 is a transverse sectional view of a concentrator whose truncation is beyond the point of principal focus. Fig. 5 shows means for removing and neutralizing the heat-rays.

In carrying out my invention I seek to concentrate the light-rays as evolved by an electric-arc lamp or else by the Nernst lamp upon the affected part or parts, the heat-rays being removed by currents of air induced either by a blower or by a suction-pump, or both removed and neutralized by utilizing the refrigerating principle of the expansion of compressed gas or gases, which latter may also be availed of for their combining proclivities under the influence of strong light to form useful disinfectants and parasiticides and for the formation of organic peroxids and cognate chemical substances which are powerful disinfectants, deodorants, and bleaching agents. I preferably employ either a small arc-light or a Nernst lamp, (which latter I have found generally most desirable for my purpose,) whose arc crater or glower, as the case may be, is at the principal focus. The light-rays and the ultra-violet and other rays generated by the lamp are concentrated at a point at varying depths below the surface by the use of properly-truncated concentrators in the form of hollow paraboloids with silvered inner surfaces, ordinarily called "parabolic" reflectors, and cut perpendicular to their axes near to the principal focus, but beyond it toward the open end, or it may be exactly at its focus, so that when cut off at the focus it will reflect every ray that it receives at its focus upon the skin or tend to concentrate them deeper on the affected part if truncated higher up. If the truncation be made variously but mostly within or above the point of focus, concentration will be directed toward a point variously situated in different cases below the superficies, as already stated. The advantage of this in operating upon tuberculosis of bone, &c., that is frequently deeply seated, is apparent. The light-rays are reflected from the lamp by a truncated or suitably-slotted paraboloid of the same characteristics as the concentrator, the two being in axial line with and facing or looking toward each other.

The third point in my invention resides in the protection of the part to be operated upon by the use of sheets of gelatin of proper thinness and transparency supplemented in appropriate cases with oil, &c., for excluding from the skin atmospheric air and so constituted that they will immediately melt when the temperature reaches 100° Fahrenheit, affording reliable indication as to the presence of even innocent but undesirable quantities of heat, thereby avoiding calorific injury to the tissues.

To the end that my invention may be clearly understood I have indicated in Fig. 1 a phototherapeutic apparatus by which it may be carried out.

1 designates a Nernst lamp suitably mounted on a stand 2 and to which is secured a parabolic reflector 3. The reflector may be of any desired size and is preferably equipped with a rim 4, designed to be engaged by screws 5,

by which the shade or globe is ordinarily held. This reflector is shown as truncated, the truncation being perpendicular to its axis at its principal focus. Such truncation is not, however, essential to all reflectors, as it depends upon the accessibility of the source of light. A second paraboloid, serving the office of a concentrator 6, which must always be truncated, is secured in direct axial line with the reflector 3, so that by facing the latter it will concentrate the parallel rays at its principal focus. The whole circle, or bottom of the concentrator, will be illuminated both by the rays (which from the appreciable size of the light source lack exact parallelism) from the reflector 3 and by the divergent rays proceeding directly from the lamp itself—that is to say, those which have not undergone reflection. The concentrator may be held in direct line with the reflector by a skeleton frame 7 or other suitable means. I have also indicated at 8, Fig. 1, a power-actuated fan for forcing a stream of air so as to remove the undesirable heat from the light-rays on the part being operated upon. This is accomplished by directing a current of air into the concentrator; but in lieu of a fan a blower driven by electricity or by water or by other source of power may be employed. In fact, it is preferable. With low-powered lamps it will be sufficient to exhaust continuously the air from the concentrator by using some convenient form of water-pump, such as are daily employed for producing vacua, &c., or, again, compressed gases may be directed into the concentrator or upon the part or parts undergoing treatment, as stated above, as shown in Fig. 5, wherein 12 indicates a short tubular member inserted in the concentrator into which the mixed gases are supplied from a storage-tank, such gases passing off into a cup of mercury, (indicated at 13.) The film of gelatin is shown as resting upon the tubular member 12 and is marked 14 in this figure. The lower edge of the tubular member contacting with the limb of the person being operated upon, all gases will pass from the source of supply outwardly into the cup of mercury.

Across the focal end of the concentrator—that is, between the latter and the member to be treated—is placed a film of gelatin 9, (see Figs. 1 and 4,) which should be usually at the point of greatest heat and is capable of being melted at a temperature of about 100° Fahrenheit. This film, while being of sufficient thinness and transparency to permit of the passage of the light-rays, affords valuable indication as to the presence of any injurious degree of heat. For the further purpose of excluding atmospheric air, of avoiding undesirable pigmentation effects upon the human skin, and for securing certain chemical results mentioned herein I may use oils and allied substances in or on the bottom of the concentrator, inclosed or not, as may seem desirable. In lieu of the film of gelatin a capsule 10 (indicated by dotted lines, Fig. 4) may be employed.

In Fig. 4 I have indicated a concentrator wherein the truncation is made beyond the point of focus, so that subcutaneous concentration of light-rays and of other rays capable of reflection may be effected. The truncation of the concentrator is shown in Fig. 3 as being exactly at the principal focus.

The employment of a lamp for the purposes of my invention will not interfere with its ordinary use. After the usual ground or frosted glass shade or globe with which lamps of the power under consideration are always provided, but which are not used by me in my phototherapeutic apparatus, shall have been restored no inconvenience will result in using the lamp as customarily employed. It will also be noted that since the apparatus involves but few parts it may be readily transported, being of but little weight.

For operating the motor any metallic water-motor readily attachable to a faucet may be used or any other convenient form of power—*e. g.*, spring-motors, &c.—or in lieu of a motor a cylinder of compressed gas (see Fig. 5) or a tube of ethyl chlorid may be employed as the agency for neutralizing the heat-rays.

I claim as my invention—

1. A phototherapeutic apparatus comprising a source of light, a reflector therefor, a concentrator for the light-rays in axial line with and facing such reflector, and means for removing the heat-rays from the concentrated light-rays in proximity to the point of utilization.

2. A phototherapeutic apparatus comprising a source of light, a reflector therefor, a concentrator for the light-rays in axial line with and facing such reflector, such concentrator being in the form of a truncated parabolic reflector cut perpendicularly to its axis at or above the point of principal focus, and means for removing the heat-rays from the concentrated light-rays.

3. In a phototherapeutic apparatus, a light-concentrator in the form of a truncated paraboloid cut perpendicularly to its axis at or above the point of principal focus.

4. In a phototherapeutic apparatus, a light-concentrator and a transparent gelatinous substance intermediate the source of light and the object under treatment.

5. A phototherapeutic apparatus comprising a source of light, a reflector therefor, a concentrator for the light-rays in axial line with and facing such reflector, and a transparent gelatinous body in or near such concentrator.

6. In a phototherapeutic apparatus, in combination, an electric lamp, a truncated parabolic reflector secured thereto, a truncated parabolic concentrator in axial line with and

facing such reflector, means for holding such concentrator in line with such reflector, and means for removing or neutralizing the heat-rays of the light-rays, as set forth.

7. In a phototherapeutic apparatus, in combination, an electric lamp, a truncated parabolic reflector secured thereto, a truncated parabolic concentrator in axial line with and facing such reflector, means for removing or neutralizing the heat-rays of the light-rays, and a transparent gelatinous body in such concentrator.

8. A phototherapeutic apparatus comprising a source of light, a concentrator for directing the light-rays against the part or parts to be treated, and a chemical agency within the rays of the concentrated light for forming organic peroxids and cognate chemical substances.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

WILL FORD ARNOLD.

Witnesses:
J. E. WARNER,
FRANCES B. ARNOLD.