PHOTO-ELECTRIC PROBES FOR DETERMINING THE DENSITY OF BODY TISSUE FOR X-RAY PURPOSES

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ABSTRACT

An internal probe to be inserted in the mouth and an external probe to be positioned externally of the mouth in alignment with the internal probe, said probes projecting in substantially parallel relation from a handle member, the internal probe terminating in a photoelectric cell and the external probe terminating in a light source optically aligned with said photocell so as to project light through the mouth tissue to said photocell to activate a meter, the reading of which is proportionate to the opacity of the density of the intervening tissue so as to provide means for determining in advance the apparatus exposure time necessary to obtain an acceptable X-ray picture of the intervening tissue.

6 Claims, 6 Drawing Figures
PHOTOELECTRIC PROBES FOR DETERMINING THE DENSITY OF BODY TISSUE FOR X-RAY PURPOSES

This invention relates to means for determining in advance the proper X-ray camera exposures to be used to produce the most effective photographic results in a given situation. Since X-ray films are produced by the passage of rays through intervening tissue and since the density of the tissue of course affects the passage of the rays it is difficult to assume in advance the correct exposure that will be required in the many different situations encountered in actual practice. It is usually a case of "trial and error." This often requires additional time and film to correct the overexposed and underexposed trials.

The principal object of this invention is to produce a relatively simple, easily used exposure meter for X-ray photographs which will enable the user to readily and accurately determine in advance the exposure time that will be required to obtain the best result in each specific case so as to avoid the loss of time and materials occasioned by the present trial and error methods.

While the invention is similarly useful in many X-ray problems it is particularly adaptable, but not limited, to use by the dental profession where rapid X-rays are required to further the work being performed while the patient remains in place in the dental chair.

Other objects and advantages reside in the detail construction of the invention, which is designed for simplicity, economy, and efficiency. These will become more apparent from the following description.

In the following detailed description of the invention, reference is made to the accompanying drawing which forms a part hereof. Like numerals refer to like parts in all views of the drawing and throughout the description.

In the drawing:
FIG. 1 is a side view of the probe of this invention illustrating in broken line the relative position of a patient upon which the probe is being used;
FIG. 2 is a front view of the probe;
FIG. 3 is a cross-sectional view looking downwardly on the line 3--3, FIG. 1;
FIG. 4 is a fragmentary longitudinal section taken on the line 4--4, FIG. 2;
FIG. 5 is a top view of the probe; and
FIG. 6 is a circuit diagram suggesting how the probe may be combined with amplifying and metering circuits.

Briefly, the probe comprises a handle block 10, preferably formed of molded plastic, from the upper extremity of which a light stem 11 and a tubular metallic photocell stem 12 project in substantially parallel relation. The light stem 11 terminates in a relatively wide hollow lamp head 13 having a removable lens bezel 14 which supports an elongated projection lens 15 thereon. The photocell stem 12 terminates in a substantially cylindrical cup-shaped cell head 16 having a removable lens bezel 17 which supports an elongated light receiving lens 18 thereon. The stems 11 and 12 are so contoured that the lenses 15 and 18 face each other in axial alignment.

A suitable, conventional photoelectric type incandescent lamp 19 is mounted in the lamp head 13 so as to project a light beam "A" through the lenses 15 and 18 and into a hermatically sealed photocell 20, of the light-controlled variable resistor type, which is mounted in the cell head 16. The lower extremity of the tubular photocell stem 12 is fixedly mounted in a suitable receiving socket 21 in the top of the handle block 10. The lower extremity of the tubular light stem 11 is fixedly mounted in a socket 22 in the top of a vertically elongated shiftable socket element 23 positioned in a vertical cavity 21 in the handle block. The shiftable socket element 23 is preferably substantially square in cross section and is positioned between the side walls of the cavity 23 which is transversely wide enough to allow the lateral shifting of the socket element in the handle block for varying the distance between the lamp head 13 and the cell head 16. The socket element 23 is slidable mounted on, and maintained vertical in the cavity 24 by, two horizontal, vertically spaced guide rods 25 which pass through the handle block and are rigidly mounted therein by means of terminal clamp screws 26.

The socket element 23 can be shifted along the guide rods 25 in any desired manner. As illustrated, the shifting is accomplished by fixedly mounting a rotary type potentiometer 27, having a threaded shaft 28, in one side of handle block between the guide rods 25 and extending its shaft 28 across the cavity 24 and through a threaded hole in the socket element so as to terminate in a knurled adjusting knob 29 at the other side of the handle block. It can be seen that reciprocal rotation of the knob 29 will cause the socket element to reciprocity travel along the guide rods.

For the purpose of clarity the conventional wiring and connections have been omitted from the sectional views of the drawing and are shown diagrammatically in FIG. 6 of the drawing in which a conventional photoelectric power supply is indicated at 30 fed from the 110 v. house circuit as indicated at 31. The power supply furnishes the correct voltage through lamp leads 32 to properly illuminate the lamp 19, and also receives the output of the photocell 20 through photocell leads 33 and amplifies the same to actuate a suitable milliammeter 34. The lamp leads 32 and the photocell leads 33 are enclosed in a suitable flexible multiple cord 35 leading from the handle block to the power supply 30.

It will be noted that the potentiometer 27 is connected in series with the lamp leads 32 so that the rotation of the potentiometer shaft 28 serves a double purpose. It provides means for clamping the lenses 15 and 18 snugly against the opposite sides of the intervening tissue and it provides means for automatically and proportionately varying the lamp intensity in correspondence with the varying separations between the light source and the photocell. The potentiometer 27 and the threads on its shaft 28 are accurately pre-positioned so as to maintain the intensity of the light impinging upon the photocell uniform at all possible separations between the lamp and the cell so that the variation of the readings of the meter 34 will be unaffected by the separations, so as to be an index of tissue density only.

For dental use, the stems 11 and 12 are separated and the cell head 16 is positioned within the mouth at the point of operation and the lamp head 13 is positioned against the face above the lip, as shown in FIG. 1. The knob 29 is then rotated to bring the lenses 15 and 18 and their bezels 14 and 17 against the tissue so as to shield against external light. The meter 34 is then read to obtain the desired index for proper X-ray exposure.

While a specific form of the invention has been described and illustrated herein, it is to be understood that the same may be varied within the scope of the appended claims, without departing from the spirit of the invention.

Having thus described the invention what is claimed and desired to be secured by Letters Patent is:

1. A photoelectric probe for determining the density of body tissue for X-ray purposes comprising:
   a. a handle element;
   b. a first stem mounted in and projecting from said handle element;
   c. a second stem mounted in and projecting from said handle element adjacent to said first stem;
   d. a photoelectric cell supported by said second stem;
   e. a light source supported by said first stem so as to project a beam of light against said photoelectric cell;
   f. means for supplying electrical power to said light source;
   g. meter means connected with said photoelectric cell and acting to indicate the electric alterations caused by the incidence of said beam upon said cell;
   h. means in said handle element for adjusting the distance between said light source and said photoelectric cell;
   i. means in said handle element for varying the intensity of said beam;
the means for varying the intensity of said beam is connected to and actuated by the means for varying the distance between said light source and said photoelectric cell whereby the intensity of said light source decreases as the distance between said light source and said cell decreases; and

3. A photoelectric probe as described in claim 2 in which the means for maintaining said socket member aligned comprises:
   a. a pair of parallel guide rods extending across said cavity through said socket member in the plane of said stems, said socket member being slidably fitted on said rods so as to be maintained vertical thereby.

4. A photoelectric probe as described in claim 3 in which the means for shifting said socket member comprises:
   a. shaft-supporting means fixedly mounted in said handle element at one side of said cavity between said guide rods;
   b. a rotatable threaded shaft extending from said shaft-supporting means across said cavity parallel to said rods, said socket member being threaded upon said shaft so that reciprocal rotation of the latter will impart reciprocal movement of said socket member along said rods.

5. A photoelectric probe as described in claim 3 in which the means for shifting said socket member comprises:
   a. a rotary-type potentiometer fixedly mounted in said handle element at one side of said cavity between said guide rods;
   b. a threaded potentiometer-actuating shaft extending from said potentiometer across said cavity parallel to said rods, said socket member being threaded upon said shaft so that reciprocal rotation thereof of the latter will impart movement of said socket member along said rods.

6. A photoelectric probe as described in claim 5 in which:
   a. the potentiometer is connected in series with the power supply to the light source so that rotation of said shaft simultaneously shifts the socket element and varies the intensity of the light source.