

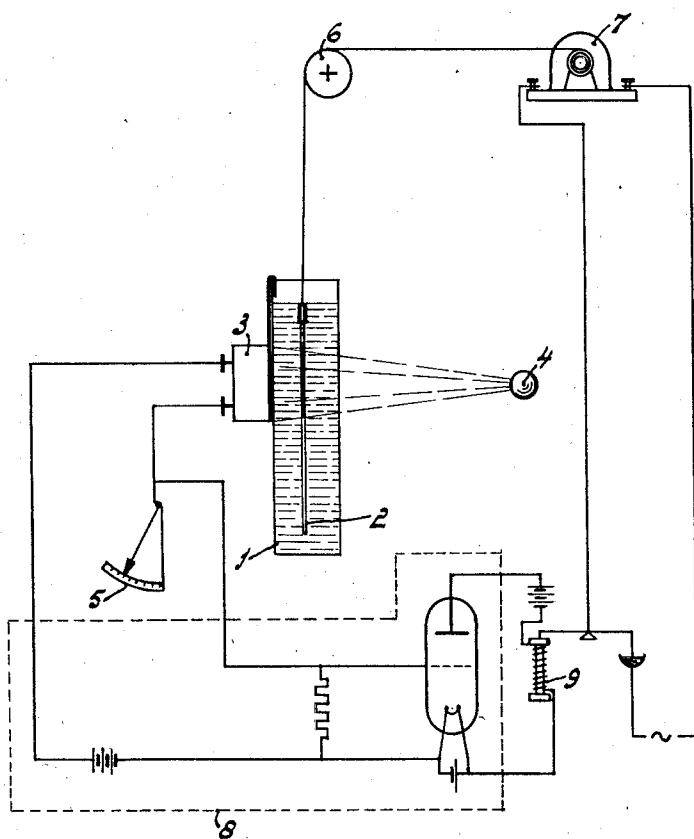
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APPARATUS FOR DEVELOPING LIGHT SENSITIVE LAYERS

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APPARATUS FOR DEVELOPING LIGHT-SENSITIVE LAYERS

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The good quality of a photographic negative depends, to a large extent, on the correct blackening of the image-producing portions. In order to consistently obtain these optimum proportions of blackening, it is necessary, assuming a rather correct exposure to light, to pay attention to various factors such as the concentration of the developer, the temperature, etc. It is surprising to find that even when paying the utmost attention to these known factors, one is not sure to obtain an absolutely uniform blackening of the negative material.

An arrangement which provides evenly blackened images is of particular importance for X-ray photography. It is extremely difficult to draw exact conclusions as to the syndrome from two radiographs which although having been equally long exposed to light have been blackened to different degrees by the developing process. Often the desired information can only be obtained from a comparison of such radiographs when both films have the same degree of blackening.

Among the usual developers must be distinguished essentially two kinds: first, the so-called rapid developers with which during developing all image portions appear simultaneously and with which in the further progress of development very dense parts increase in blackening in a considerably stronger measure relatively to the more translucent parts. The gradation of the image consequently alters during the developing process. Contrary to this group are those developers with the use of which the image portions of great density first appear and which to a large extent do not alter the gradation of the image during developing.

In the arrangement according to the invention use is made of this property of the last-mentioned group of developers. After once having determined by tests the most favourable blackening for example of a radiograph of the lungs, the progress of the development of all the subsequent exposures is controlled by an absorption measurement; that is, as soon as the film has obtained in the developer the desired blackening and consequently absorbs a certain amount of light, the end of development is indicated by an optical or acoustic signal. The development may also be interrupted automatically. The source of light utilized for this measurement of absorption emits light of a wavelength to which the layer of negative material is not sensitive, for example, dark-red light or infra-red light of short wavelength.

The arrangement according to the invention

will be explained more fully with reference to the accompanying drawing.

A developing tank 1 of suitable shape is filled with a developer working with an approximately constant gradation of the image. The tank should preferably consist of a material absorbing the visible light and being only transparent to the light utilized for the check measurement. For most cases it is sufficient to use dark-red glass. This film tank may be entirely closed so that the development need not take place in the dark. The material 2 to be developed, for example an X-ray film, is consequently introduced into such a tank. Opposite the spot which is most important for the production of the image and suspended, for example, directly from the wall of the developing tank, is arranged a light-sensitive cell 3 which responds to a wave-length which does not act on the light-sensitive layer. This light-sensitive cell may consist of a thermo-couple, a bolometer or other light-sensitive member. On the other side of the developing tank is arranged a corresponding source of light 4, for example an electric incandescent lamp. If the developing tank does not consist of dark-coloured glass, the source of light 4 must of course be screened by a corresponding light filter relatively to the light-sensitive material. The light-sensitive member 3 has connected to it an electric measuring instrument 5 which indicates deflections which decrease or increase in accordance with the degree of blackening. In the above-mentioned preceding tests, which give the most favourable degree of blackening of a film, one determined the deflection of the electric measuring instrument which corresponds to the said degree of blackening. By watching the indication of this measuring instrument, the developing process may be interrupted at the correct time or the measuring instrument may have connected to it a signal which indicates that the desired degree of blackening is attained. If desired, a conveying device 6, 7 may be actuated at the right instant by a relay 9 connected to the measuring instrument 5 and to a known valve amplifier 8, said conveying device transferring the film from the developer into the next bath.

What I claim is:

1. An arrangement for indicating the progress in the development of a light-sensitive layer comprising a tank and a developing bath therein in which the light-sensitive layer is immersed, a source of light disposed on one side of the layer, the rays of which are adapted to penetrate through said tank and through the developing bath and to be absorbed by the sensi-

tive layer in its progress of development, said rays being inactive relative to the light-sensitive layer, a light-sensitive device responsive to said light rays disposed at the side opposite to the source of light so as to be struck by the light rays penetrating through the sensitive layer, a relay switch energized by the current of said light-sensitive device, and a device connected to said switch and adapted to indicate the instant at which a predetermined degree of development is reached.

2. In an arrangement for developing films, a film, a developing bath in which said film is immersed, a source of light on one side of the film to radiate toward the film light rays which are inactive relative to the sensitive layer and which rays are absorbed by said layer at an increasing rate as the development progresses, a light-sensitive device disposed on the opposite side of the film and adapted to be struck by the rays of said source which penetrate through the sensitive layer, means to remove the film from the developing bath and an electric switch for operating said means, said switch being actuated by said light-sensitive device when the film has reached a predetermined light-absorbing capacity.

3. In combination, a tank for developing photographic films, a film adapted to be immersed therein, a source of red light disposed at one side of the tank so as to radiate the film when immersed in the tank, a light-sensitive cell disposed at the opposite side of the tank, a source of direct current and a resistance, an electric circuit comprising said cell, source of current and resistance, an electron discharge tube comprising a cathode, a grid and an anode, said resistance being connected across the cathode and grid of said tube, a second source of direct current and a relay switch having an operating coil, said second source being connected in series relation with said coil across said cathode and anode to supply the anode current to said tube when the grid is positively charged, and means including an electric motor for removing the film from the developing tank, said relay switch being connected in the supply circuit of said motor to close said circuit when the anode current of the discharge tube begins to flow under the influence of the grid potential.

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