

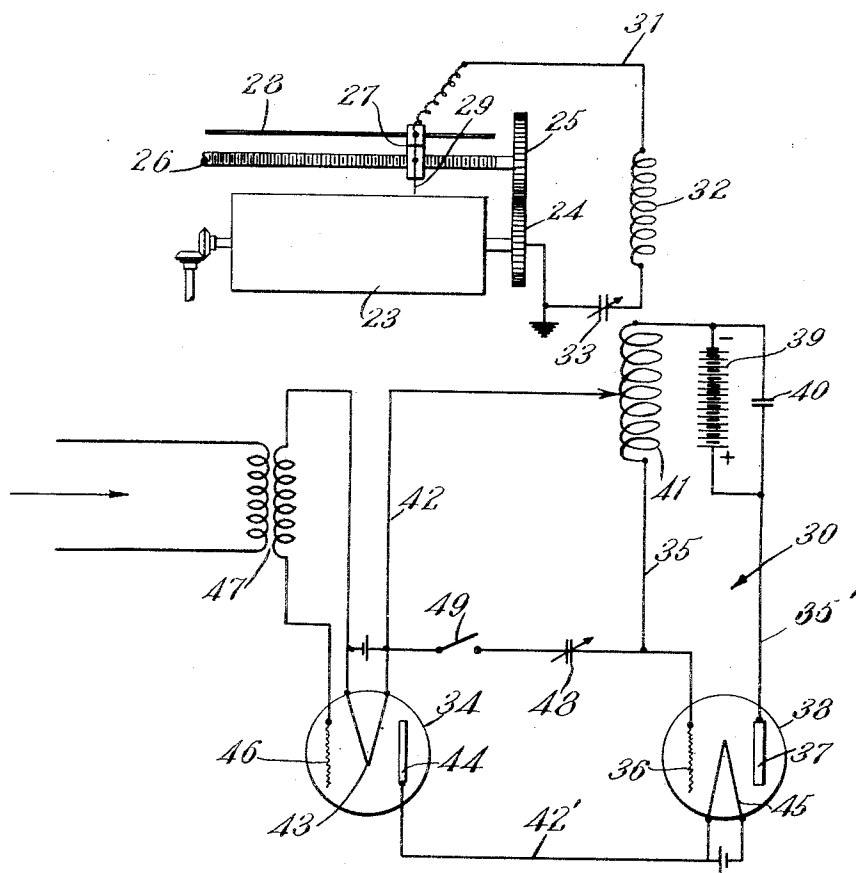
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PHOTOGRAPHIC RECORDING BY ELECTRIC DISCHARGE

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UNITED STATES PATENT OFFICE.

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PHOTOGRAPHIC RECORDING BY ELECTRIC DISCHARGE.

Application filed December 11, 1924. Serial No. 755,339.

This invention relates to photographic reproduction in accordance with printed matter, pictorial representations, or other photographic or image likeness, and has for its principal objects to simplify the reproducing process, to increase the speed of reproduction, directly to produce a half-tone effect suitable for reproduction by mechanical printing process, simultaneously to make a plurality of reproductions, to enable the process to be performed in a lighted room, to improve the quality of the contrast gradations throughout the high-light, half-tone and shadow areas, and generally to improve the art of photographic reproduction. The invention is particularly applicable to the art of photo-telegraphy, either by wire or radio, this application of the invention being disclosed in copending application Serial No. 755,336, filed on even date herewith.

The invention consists in modulating high-frequency oscillations in accordance with the photographic subject matter, or other subject matter such for example as printed matter, and effecting the photographic exposure upon an ordinary photographic emulsion or other suitable receiving or reproducing medium with an electric discharge produced by the oscillations. Relative movement may be produced between the discharge and the receiving or reproducing medium, in any suitable manner. For example, the reproducing medium may be rotated on a drum or disk and the electrical discharge caused to trace over the medium along parallel lines constituting a spiral. The electrical discharge is preferably in the form of a corona discharge which pulsates at a predetermined frequency, either ceasing entirely between beats or decreasing to an intensity so low as to affect the reproducing medium little if any, thereby forming a succession of dots or short dashes on the medium. The beats, which are modulated in accordance with the subject matter, are preferably impressed upon high-frequency oscillations which are adapted to produce the corona effect without disruptive discharge.

For the purpose of illustration one concrete embodiment of the invention is illustrated in the accompanying diagram in which the sensitized paper or other recording medium is carried upon a rotatable drum 23. Connected to the drum through gears 24 and 25 is a threaded shaft 26 along which

travels a head 27, the head having an opening to receive stationary rod 28 which restrains the head from turning with the shaft. Head 27 carries a needle 29 for directing an electronic discharge to the sheet wound on drum 23. This discharge is produced by an oscillating circuit 30 feeding into circuit 31 containing coil 32 and condenser 33, the oscillating circuit being controlled by a suitable transmitting station such as disclosed in the aforesaid application.

The oscillation circuit 35—35'—42—42' contains a modulating audion 34, an oscillating audion 38, battery 39 bridged by condenser 40, and an inductance coil 41 connected at one end to grid 36 of the oscillating audion and at the other end, through battery 39, to the anode 37 of the oscillating audion. The cathode 43 of the modulating audion is connected to an intermediate point of coil 41 and the modulator anode or plate 44 is connected to the oscillator cathode or filament 45. The potential on the modulator grid 46 may be controlled in any suitable way as for example through transformer 47. A condenser 48 may be connected between the conductors 35 and 42 by switch 49 but ordinarily this condenser may be dispensed with.

With this arrangement the cathode-anode or plate circuit 42—42' of the modulating audion is in series with a part of the oscillating circuit and variation in the effective resistance of the modulator 34, produced by variation in the potential of grid 46, produce opposite variation in the amplitude of the oscillations. That is, increase of modulator resistance decreases the amplitude of the oscillations.

By virtue of the aforesaid series connection of the modulating audion the oscillations may be varied from maximum amplitude to zero amplitude, it being possible entirely to suppress the oscillations if desired by adjusting the potential of the grid (free grid potential) so that at one limit of grid potential variation the effective resistance of the modulating audion is high enough completely to stop the oscillations. A secondary advantage of the series arrangement is that the single battery 39 serves the plate circuits of both audions without losing appreciable power in the modulating circuit.

The oscillating circuit 30 is preferably adjusted to generate oscillations of high-frequency

quency and high-potential adapted to produce an electronic discharge (e. g. a corona discharge) from needle 29 when above a predetermined intensity higher than that existing between successive impulses, the intensity of the discharge depending upon the excess of oscillation intensity above the predetermined intensity, whereby an electronic discharge is emitted from needle 29 during each impulse (except perhaps while recording a white or an extremely light representation on the receiving paper). Thus, in transmitting a half-tone, a dot (or short dash) is recorded on the receiving paper at each impulse, the dot varying in intensity in response to variations in the intensity of said impulses, and in transmitting extreme contrasts such as the black and white of printed matter, at each impulse during passage of black or white (depending upon the adjustment of the transmitting apparatus as above described) past the point of incidence of the light from source 9.

The recording paper may be of the type requiring development subsequent to exposure by the electronic discharge to convert the latent image into a patent image or it may be of the type in which a patent image is produced without development, the latter type having the advantage of displaying the image as it is recorded. The electronic discharge produces the exposure as a result of its light and/or heat and/or electronic bombardment of the photographic emulsion. If the recording medium is of the type adapted to be affected by the electronic discharge independently of the light produced thereby the paper may be enclosed in an opaque envelope or turned over and the process performed in a lighted room, or a plurality of superposed sheets may be exposed simultaneously; and if the recording medium be of the type which is sensitive to the electronic discharge but insensitive to light the process may be carried out in a lighted room without protecting the medium with an opaque covering.

I claim:

1. The art of photographic reproduction

which comprises tracing a sensitive surface with a corona discharge, and concomitantly varying the discharge in accordance with the subject matter transmitted.

2. The art of photographic reproduction which comprises spirally tracing a cylindrical surface with a corona discharge, and varying the discharge in synchronism with the subject matter transmitted.

3. Photographic reproduction apparatus comprising an electrical discharge device, a high-frequency oscillator for producing a corona discharge device from said device, means for varying the amplitude of said discharge in accordance with the subject matter to be reproduced, a support for the reproducing medium, and means for producing relative movement between said device and support so that the modulated discharge traces parallel paths across said medium.

4. Apparatus of the character described comprising an electrical discharge device, means for continually producing a corona discharge from said device, means for varying the intensity of corona by the received impulses, a support for the receiving medium, and means for producing relative movement between said device and support so that the variable corona discharge moves over said medium in a predetermined manner.

5. In a photographic transmission system wherein the instantaneous values of propagated energy represent the various shades of the original impression and wherein reproduction is effected by local oscillations on a sensitized surface, the method of affecting the amplitude of the oscillations to produce a corona of variable intensity at the sensitized surface whereby the tone color of the photograph is faithfully reproduced.

6. Apparatus for electrical reproduction comprising a substantially non-conducting reproducing medium, and means for producing a corona discharge in the medium to effect ionization in the medium by electronic action without disruptive discharge.

Signed by me at Boston, Massachusetts, this 24th day of November, 1924.

AUSTIN G. COOLEY.