

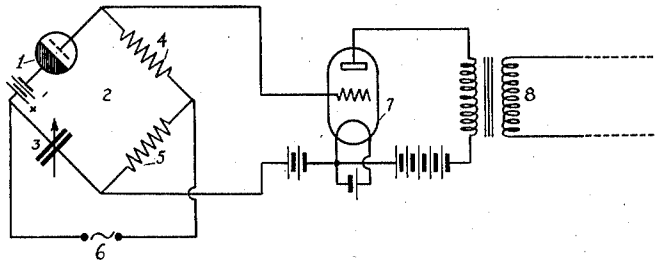
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CIRCUIT ARRANGEMENT FOR THE OPERATION OF PHOTO ELECTRIC CELLS

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CIRCUIT ARRANGEMENT FOR THE OPERATION OF PHOTO-ELECTRIC CELLS

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An application for this invention filed in Germany September 29, 1926.

The invention relates to the use of photo-electric cells of all kinds, whether of the high vacuum or gas filled kind, for the conversion of light variations into electrical actions, for instance, for the purpose of picture transmission and related arts. According to former practice it has been customary to produce initial amplification of the photo-electrical cell currents, which vary with the illumination, by means of a direct current amplifier arrangement, that is to say, the photo-electric cell was connected in series with a direct current source and ohmic resistance, and, due to the fluctuations of the cell currents produced by varying intensities of light reaching the cell and causing varying voltage drops across the resistance, varying potentials were applied on the grid of an amplifier tube having its input circuit connected across the resistance member. Further above in the amplifier cascade arrangement there was generally introduced an alternating current potential of convenient frequency in the shape of a carrier wave, in order that the very wide frequency band of the current variations resulting from the picture exploration may conveniently and undistortedly be further amplified. The picture-point frequencies appear in this scheme as modulations of the carrier wave introduced into the cascade arrangement.

Now, in an arrangement of this kind, there resulted difficulties of manipulation of the amplifiers, and these were due to the fact that the sensitivity of present-day photo-electric cells is not quite constant. As a result, the value of the direct current grid potential corresponding to a definite illumination of the photo-electric cell was found to undergo changes at the amplifier tube whose grid direct current potential is superposed upon the carrier frequency, and this in turn results in alterations both of the amplitude as well as of the degree of modulation of the carrier oscillations. When these were used for controlling a radio transmitter, then similar fluctuations in both directions were caused also in the complete modulation of the trans-

mitter, with the result that difficulties usually arose in picture transmission.

The present invention obviates this inconvenience, by using an alternating current potential whose frequency at the same time governs the carrier frequency to be further amplified is used as a suction or anode potential at the photo-electric cell for the electrons released by the light. A pure alternating current potential must be used, or else the alternating current potential is superposed upon a constant direct current potential. Also an intermittent direct current potential obtained by the rectification of alternating current may be employed. To insure the desired effect either one of the said schemes is practicable. By virtue of the fact that an alternating current potential is used as the suction or anode potential of the electrons, the current of this carrier frequency in the absence of light will always be completely controlled, since the photo-electric cell is then impermeable. It is then also possible to apply a perfectly linear amplification even to the first amplifier tube, upon the grid of which the photo-electric cell currents are brought to act, and manipulation of the arrangement becomes free from such difficulties as usually arise in connection with the use of a pure direct current potential to act as the suction or anode potential of the photo-electric cell. The value of the alternating current suction potential, or the sum total of direct current and alternating current potential, may be so chosen in practice that in gas-filled cells the glow-discharge potential is nearly reached or even exceeded at the crest values of the alternating current potential. In this manner, a supplementary positive ionization is obtained, and thus a larger current effect in dependence upon the light. It is possible in this manner to push the cell currents in incipient glow, while quantitative control by the incident variable light is still possible, on the ground that because of the alternating current potential any incipient glow-discharge is invariably extinguished again upon the next minimum or change of the potential. The frequency of the alternating current potential must be chosen in proper proportion

to the maximum picture-point frequency which is to be transmitted, in other words, it should be correspondingly higher than the latter.

5 In order that in a method as hereinbefore disclosed the harmful action of electrode capacity of the photo-electric cell may be precluded, any alternating current as may flow across the cell by capacity action must be
10 compensated. For this object any suitable sort of compensation scheme may be used, for instance, a bridge arrangement of the kind shown in the drawing which forms a part of this specification.

15 Referring to the drawing, 1 is the photo-electric cell which conjointly with the variable compensating condenser 3 and the alternating current resistances 4 and 5 represents the arms of the bridge 2. At the terminals 6 the alternating current potential of convenient frequency and amplitude is introduced, while a suitable direct current potential may in addition be connected in series with the cell 1. When the alternating
20 current resistances 4 and 5 are equal, then the adjustable capacity 3 must be made equal to the electrode capacity of cell 1. Hence, in this arrangement any flow of current due to capacity across the cell is completely neutralized, since the capacity 3 provides that
30 no potential difference will result between grid and filament of amplifier tube 7. The alternating current potentials there arising are merely due to the electronic and ionic conduction current when cell 1 is illuminated, and they fluctuate in their amplitude in proportion to irradiation. Further amplification may then be effected conveniently by way of a transformer coupling 8 through which the
40 alternating current potentials are fed to additional tubes.

I claim as my invention:

1. An arrangement for modulating a carrier frequency in accordance with variations
45 in light intensity which includes, a bridge structure, a photo cell connected to form one leg of said bridge structure, a capacity forming a leg of said bridge structure adjacent said photo cell, said capacity being of the order of magnitude of the capacity of said
50 cell electrodes for conditions of minimum illumination on said photo cell, and a plurality of resistors connected to form the other two legs of said bridge, means for applying
55 a carrier frequency potential at opposite ends of the diagonal of said bridge structure between the point of connection of said cell and capacity at one end and the point of connection of the said resistors at the other end,
60 so as to provide by said carrier frequency potential a source of anode potential for said cell, and means connected across the second diagonal of said bridge for amplifying said carrier frequency when modulated by
65 light changes affecting said photo cell.

2. An arrangement for modulating a carrier frequency in accordance with variations in light intensity which includes, a bridge structure, a photo cell connected to form one leg of said bridge structure, a variable capacity forming a leg of said bridge structure
70 adjacent said photo cell, said variable capacity being adjusted to be of the order of magnitude of the capacity between said photo cell electrodes for conditions of minimum illumination on said photo cell and forming
75 a balance for said bridge, means for applying a carrier frequency potential at opposite ends of the diagonal of said bridge structure between said cell and capacity so as to provide by said carrier frequency potential a
80 source of anode potential for said cell, and means connected across the second diagonal of said bridge for amplifying said carrier frequency when modulated by light changes affecting said photo cell.
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3. An arrangement for modulating carrier frequencies in accordance with varying fluctuations in light intensities which includes, a bridge structure, a photo cell forming one leg of said bridge structure, a variable capacity forming a leg of said bridge structure adjacent said photo cell, and resistances of equal value forming the other two
90 legs of said bridge structure, said variable capacity being of such value that the capacity between the photo cell electrodes for minimum illumination on said photo cell is compensated and an unbalanced condition in said bridge structure is obtained only through
95 variations in the conduction current through said photo cell produced by varying light falling thereon, means for impressing a carrier frequency potential upon said cell in a manner to utilize said carrier frequency as
100 a source of anode potential for said cell by connecting the said carrier frequency potential across one diagonal of said bridge between said cell and said capacity at one end and between said resistances at the other
105 end, and an amplifying means connected across the opposite diagonal of said bridge for amplifying said carrier frequency when modulated by varying light values changing the conduction currents through said
110 photo cell.
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4. An arrangement for modulating a carrier frequency in accordance with varying intensities of light and shade, which includes, a bridge structure having a photo cell
120 arranged to form one leg thereof, a capacity forming an adjacent leg thereof, and a plurality of impedance members forming the other two legs of said bridge, said photo cell being subjected to varying intensities of light
125 and shade for producing therein a varying effective resistance to the flow of current therethrough, means for applying across the bridge diagonal between said cell and capacity at one end and the said impedance
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members at the other end a carrier frequency potential of a value such that the glow discharge potential of the cell is substantially reached when the carrier frequency alternating current potential has its crest value
5 across the said diagonal, and means connected across the second diagonal of said bridge for amplifying said carrier frequency potential as modulated in accordance with variations produced in said photo cell, the
10 variations in light and shade reaching the same.

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