June 30, 1931. R. H. RANGER 1,811,895

LIGHT CONTROL SYSTEM

Filed Oct. 31, 1928

Fig. 1

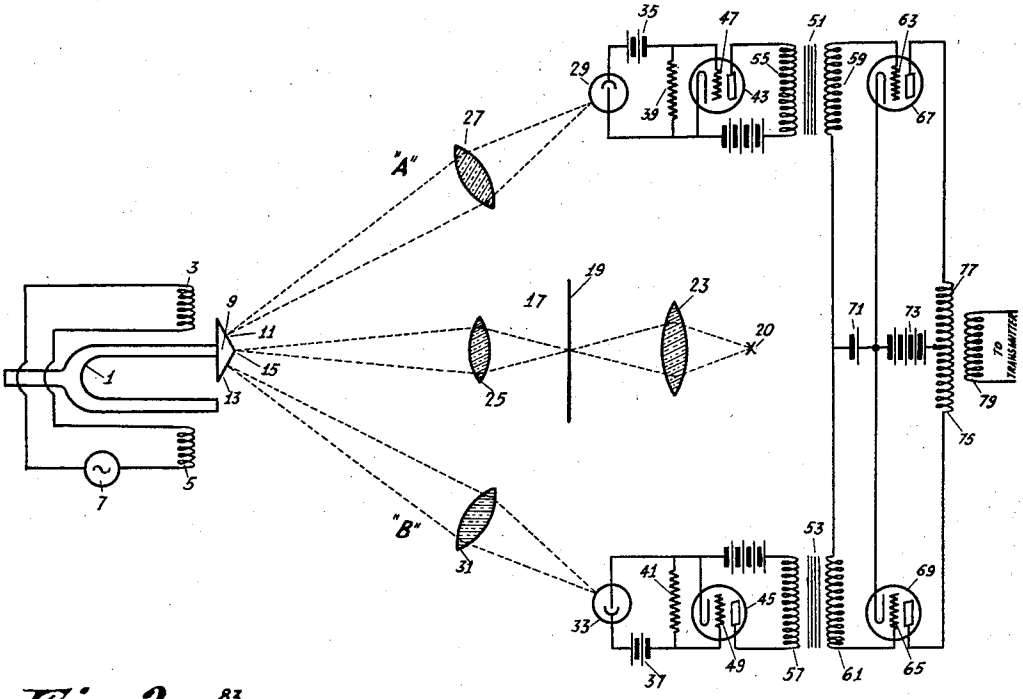


Fig. 2

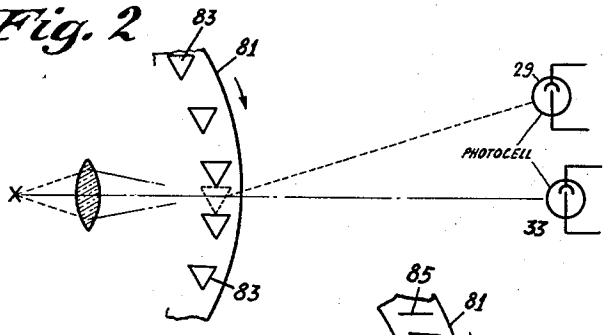
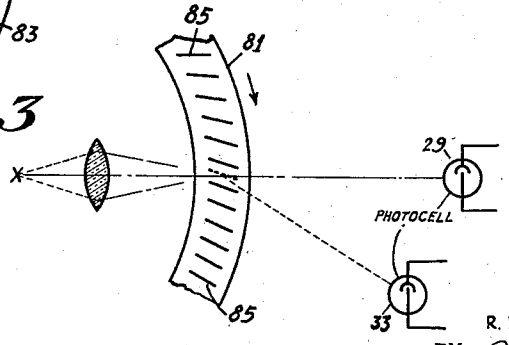


Fig. 3



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UNITED STATES PATENT OFFICE

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LIGHT CONTROL SYSTEM

Application filed October 31, 1928. Serial No. 316,157.

The present invention relates to a method and means for controlling light and is especially adapted to the transmission of pictures and the like for facsimile and television work. By the term pictures, of course, I mean the transmission of views printed matter, checks, finger prints, photographs, motion picture film with or without sound accompaniment, and the like, and, in fact, all types of communication wherein a visual or sound representation of the subject matter transmitted is reproduced at a receiving point.

In the prior art, so far as I am aware, it has been customary to "chop" the light from a picture which is to be transmitted prior to the time that the light from the picture reaches the photo cell. It has been customary, in arrangements of this type, as is readily shown by the prior art, to produce this chopping action by means of rotating disks and the like which are provided with a series of holes through which the light may pass and, also, by means of disks provided by slots through which the light may pass. According to these arrangements of the prior art it will be seen that there are certain objectionable features occasioned, in that half of the light from the light source is lost or thrown away and is unusable.

It is, therefore, an object of my present invention to provide a means whereby the objectionable features of losing or throwing half the light away may be avoided and in order to accomplish this end I have found that the utilization of the deflection of light is suitable. In accordance with the utilization of the deflection principle I may utilize the light source for substantially the total amount of the time of transmission and in so doing considerably increase the efficiency of the transmitting system.

Other objects and advantages of the present arrangement will at once be apparent from a consideration of the following specification and claims when read in connection with the accompanying drawings wherein the various figures thereof represent in a convention manner, the principle covered by my present invention.

Fig. 1 illustrates an arrangement wherein a tuning fork provided with a reflecting surface is utilized for alternately directing the light beams in a pair of paths at a rate corresponding to the vibration period of the fork and further illustrates an amplifying scheme for amplifying electrical currents produced through the action of light beams reaching each of a plurality of photo cells.

Fig. 2 conventionally illustrates a modification of Fig. 1 wherein a disk with prismatic lenses mounted thereon is provided for controlling the direction of the light; and,

Fig. 3 represents still a further modification wherein I have utilized a disk provided with a series of mirrors for deflecting and controlling the light beams and switching from one to another of the photo cells.

In each of Figs. 2 and 3 the system of amplifying the photoelectric currents is not illustrated since it is to be understood that this may be substantially a duplicate of that shown by Fig. 1.

Now making reference to the accompanying drawings, and particularly to Fig. 1 thereof, a tuning fork or other appropriate vibrating instrumentality 1 may be driven electrically by means of the windings 3 and 5 energized from any suitable source 7. On one of the tines of the fork I may supply a wedge shaped member, generally designated 9, which is provided with angular reflecting surfaces 11 and 13 which meet each other at a point 15 directly at the focus point of a lens system 17, to be hereinafter described. As shown by Fig. 1 the surfaces 11 and 13 may be silvered, or they may be highly polished metal. While I have above stated that the tuning fork is to be driven electrically it is also within the scope of this invention that the fork may be driven by an air drive means, for example, a drive of the character disclosed in my copending application Serial No. 169,620, filed February 19, 1927, and, also, that the fork may be driven from a master oscillator of any suitable type.

In connection with the transmission of facsimiles motion picture films, and the like, the record 19 to be transmitted may be in

the form of a continuously moving film, or, of a picture negative wrapped around a drum for transmission, or, may be of any other character, such as, a completed picture or newspaper clipping, or the like, from which light is either reflected or passed directly through. In the present disclosure I have, however, illustrated a system wherein light issuing from a source 21 is directed by means of a lens 23 so as to pass through the negative (or positive, if desired) to be transmitted, assuming that the scheme is one adapted for this type of transmission. In this case it is, of course, apparent that the light from the source which is permitted to pass through the negative (or positive) varies in direct proportion to the varying intensities of light and shade making up the picture surface. I have so arranged the point where the light from the source 21 passes through the negative being transmitted that this point will come at the focus of the light beams issuing from the lens 23 toward the picture surface. Light passing beyond the picture surface 19, and governed in intensity in accordance with the intensity of light and shade in the picture surface, is directed to a second lens member 25 which is of the condensing type and which has its focus point arranged at the point 15 where the reflected surface 11 and 13 of the wedge member 9 meet each other.

From the above, it is seen that with tuning fork 1 in a position of rest the light issuing from the optical system 17 comprising the source 21 and the lenses 23 and 25 will not be deflected in either direction since it will issue as a point source and be protected against the point 15. However, with the fork 1 being vibrated in any desired manner it is at once apparent that with the tine carrying the vibrating wedge swung to a position so that the light from the source 21 which passes beyond the picture surface focused upon the reflecting surface 11, the light beams will be reflected in a path, designated as "A", and by means of the lens member 27 may then be directly applied to a photo cell 29 forming a portion of an amplifying system for photoelectric currents produced from the cell 29 in accordance with the light beams passing beyond the picture surface 19. In a similar manner it is apparent that with the varying tine carrying the wedge member 9 being vibrated to its opposite position light will be directed to the reflecting surface 13 and will then follow a path, designated as "B", and by means of the lens 31 will be impressed upon the photo cell 33 in a similar manner to the light following path "A" being impressed upon the cell 29.

From the above it is apparent that the light issuing from the source 21 and passing through the picture surface will be broken up by means of the vibrating wedge 9 attached to the tuning fork 1 in such a manner that the output from the two photo cells 29 and 33 will be of the same frequency as that which has been chosen for the fork and, at the same time, will provide a means wherein the total amount of light from the source 21 which is capable of passing through the picture surface 19, in accordance with the intensity of light and shade thereof, will be broken up in such a manner that the full benefit of the light is obtained.

The output of the photo cells 29 and 33 may be amplified in the usual manner and I have herein disclosed a scheme which is a substantial duplicate of that disclosed for a single photo cell by Nicolson Patent, 1,470,696, and includes the potential source 35, 37 connected in series with the cells 29 and 33 respectively and each associated with a resistor 39 and 41 connected across the input circuit of a vacuum tube amplifier 43 and 45 and in series with the photo cells. It is thus seen that when light is applied to the photo cells a voltage drop occurs in the resistors 39 or 41 and controls the potentials of the control electrodes or grids 47 and 49 of the amplifiers 43 or 45 respectively. Under these conditions more or less current will flow in the output circuit of the amplifiers 43 or 45 depending upon the amount of light impressed upon the photo cells associated with each of these amplifiers. The output circuit of each of these amplifiers 43 and 45 includes transformer couplings 51 and 53, having their primary windings 55 and 57 connected with the output circuit of the amplifiers 43 and 45 respectively. The secondary circuit of the transformers 51 and 53 is a secondary winding 59 and 61 respectively which have one terminal in common and the other terminal connected to the grid or control electrode 63 and 65 of the amplifiers 67 and 69. These amplifiers 67 and 69 are connected in "push-pull" fashion and have the biasing battery 71 for controlling the potential of the grid members 63 and 65 and a common source of plate potential 73. The output circuit of the tubes 67 and 69 is arranged to form the primary winding 75 of a transformer 77 whose secondary member 79 is connected with a transmitter in any desired manner. The transmitter forms no essential part of my invention only in so far as it adds to the combination of the elements herein above set forth and I have, therefore, not attempted to illustrate any particular type thereof.

Now referring to Fig. 2 of the drawings, a rotary disk 81 provided with a plurality of small glass wedges 83 for bending the light rays issuing in a manner similar to that in Fig. 1 from the picture surface has been illustrated. It is seen from the showing

of Fig. 2 that the light is alternately switched from photo cell 29 to 33 and back again in a manner quite similar to that shown by Fig. 1.

Fig. 3 shows still a further modification of the system above described and particularly a modification of Fig. 2 thereof, wherein, a similar disk 81 is provided with a plurality of veins of reflecting material 85 for controlling the light beam. In one position as shown the light from the source or the picture surface corresponding to that of Fig. 1 is directed straight through to a photo cell 29 but upon rotation of the disk in the directions shown by the arrow light is bent by the reflecting surface from the path by which it would reach cell 29 and is directed toward cell 33.

The above disclosed invention is also especially adopted to multiplex operation and in this connection there may be a plurality of signalling channels of the character above illustrated and a plurality of controlling forks or other suitable vibrators to which wedges of a similar character to the wedge 9 are attached. However, for multiplex operation it is obvious that it will be desirable to use forks of different frequency or pitch for each separate signal channel and to control all forks from a single master oscillator of any desired character.

While I have above illustrated the above invention in only one of its preferred forms, it is obvious that I may make such modifications threrein as would readily suggest themselves to a person skilled in the art to which the invention relates and I, therefore, do not wish my invention to be especially limited to the apparatus disclosed but believe that I may make such modifications as fall fairly within its spirit and scope as defined in the following claims.

I claim:

1. In a picture transmitting system, a picture to be transmitted, a light source for directing light to said picture, means for directing the light issuing beyond said picture along a predetermined path, a plurality of photoelectric elements for translating light energy into electrical energy, an amplifying means associated with each of said photoelectric elements, and means for continuously shifting the said light to switch the light issuing from said picture from one to another of said elements and utilizing substantially the entire amount of light available.

2. In a facsimile system, a picture to be transmitted, a light source for directing light upon said picture, means for directing the light passing beyond said picture along a predetermined path, means for chopping the light issuing along said path from said picture, a plurality of means for translating the light energy issuing from said source and varied in intensity by varying intensities of light and shadow of elemental areas of said picture into electrical energy, and means for causing the chopped light to alternately influence each of the light translating means so as to utilize substantially the full amount of said light.

3. In a facsimile system, a picture to be transmitted, a light source for directing light upon the picture surface and redirecting the light therefrom along a predetermined path, a plurality of photo cells for changing varying light intensities into electrical current variations, and means for continually switching the light beam from one to another of said photo cells sequentially at a predetermined rate whereby substantially the full amount of light issuing from the light source is available for actuating the photo cells.

4. In a picture transmission system, the combination of a pair of photoelectric elements for converting varying intensities of light and shadow on elemental areas of a record surface into varying strength electric current impulses, means for directing a beam of light varied in intensity in accordance with the varying intensities of elemental areas of the record surface along a predetermined path and means for alternately supplying and interrupting the light supply to each of the said photoelectric elements for producing a light chopping action so as to share the light between the photoelectric elements and utilize substantially the entire amount of light available for conversion into electric current impulses.

5. In a facsimile system, the combination of a pair of photoelectric elements for converting varying light intensities into varying electric current intensities, means for directing light of an intensity corresponding to the intensity of light and shadow of elemental picture areas along a predetermined path and a vibratory light chopping means for alternately subjecting said photoelectric means to varying intensities of light whereby the photoelectric means are successively energized and substantially the entire amount of availabe light is utilized.

6. In a picture transmitting system, the combination of a pair of photoelectric elements adapted to convert varying intensities of light and shadow corresponding to elemental areas of a transmitted picture into electric current impulses, means for projecting light issuing from a source and varied in its intensity by the picture subject along a predetermined path toward said photoelectric elements, and a vibratory light chopping means in the said light path for alternately subjecting the said photoelectric elements to the influence of said picture modulated light so as to utilize substantially the entire amount of light available in the con-

version thereof into electric current impulses.

7. In a picture transmission system, a pair of photoelectric elements for converting varying intensities of light and shadow on elemental areas of a picture surface into varying strength electric current impulses, a pair of push-pull connected amplifiers coupled with the output of said photoelectric elements for amplifying currents resulting therefrom upon the application of light thereto, and a vibratory light chopping element for continually switching the light beams from one to the other of said photoelectric elements so as to utilize substantially the entire amount of light issuing from the light source for actuating the photoelectric elements.

8. In a picture transmission system, a pair of photoelectric elements for converting varying intensities of light and shadow on elemental areas of a picture surface into varying strength electric current impulses, a pair of push-pull connected amplifiers coupled with the output of said photoelectric elements for amplifying currents resulting therefrom upon the application of light thereto, and a vibratory reflecting surface for continually switching the light beams from one to the other of said photoelectric elements so as to utilize substantially the entire amount of light issuing from the light source for actuating the photoelectric elements

9. In a picture transmission system, a pair of photoelectric elements for converting varying intensities of light and shadow on elemental areas of a picture surface into varying strength electric current impulses, a pair of push-pull connected amplifiers coupled with the output of said photoelectric elements for amplifying currents resulting therefrom upon the application of light thereto, and a tuning fork provided with a wedge-shaped reflecting surface at the end of one tine thereof for continually switching the light beams from one to the other of said photoelectric elements so as to utilize substantially the entire amount of light issuing from the light source for actuating the photoelectric elements.

10. In a picture transmission system, a pair of photoelectric elements for converting varying intensities of light and shadow on elemental areas of a picture surface into varying strength electric current impulses, and a tuning fork provided with a wedge-shaped reflecting surface at the end of one tine thereof for continually switching the light beams from one to the other of said photoelectric elements so as to utilize substantially the entire amount of light issuing from the light source for actuating the photoelectric elements.

11. A picture transmission system comprising a plurality of photoelectric cells, means for directing a beam of light varied in intensity in accordance with the intensity of light and shadow of elemental record areas along a predetermined path, and means for continuously redirecting the said beam to one or the other of said photoelectric cells sequentially, whereby substantially one hundred percent of the available light is utilized and a light chopping action is produced in the light suppiled to the photoelectric cells.

RICHARD HOWLAND RANGER.

CERTIFICATE OF CORRECTION.

Patent No. 1,811,895. Granted June 30, 1931, to

RICHARD HOWLAND RANGER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, lines 38 and 39, for "especially" read specifically; same page, line 109, claim 5, after the word "means" insert the words in the path of said picture controlled light; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 3rd day of May, A. D. 1932.

M. J. Moore,
Acting Commissioner of Patents.

(Seal)