June 11, 1940. R. MÖLLER 2,204,427

SYNCHRONIZING METHOD

Filed April 2, 1936

Fig. 1.

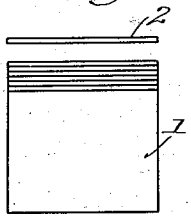


Fig. 2.

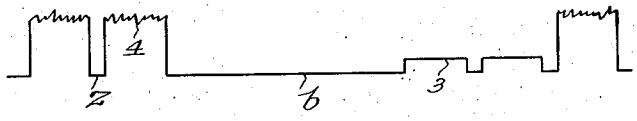


Fig. 3.

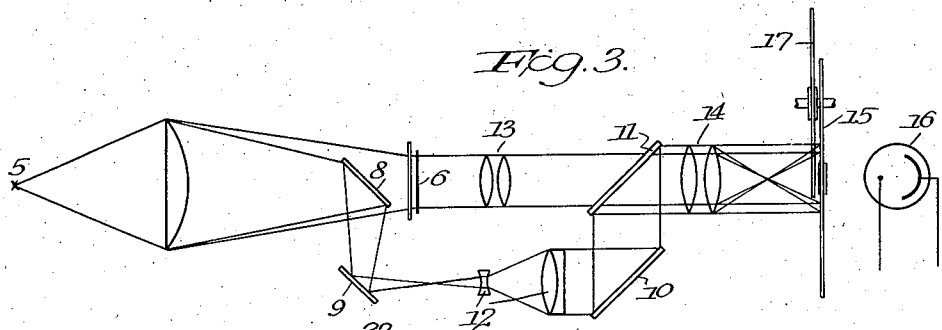


Fig. 4.

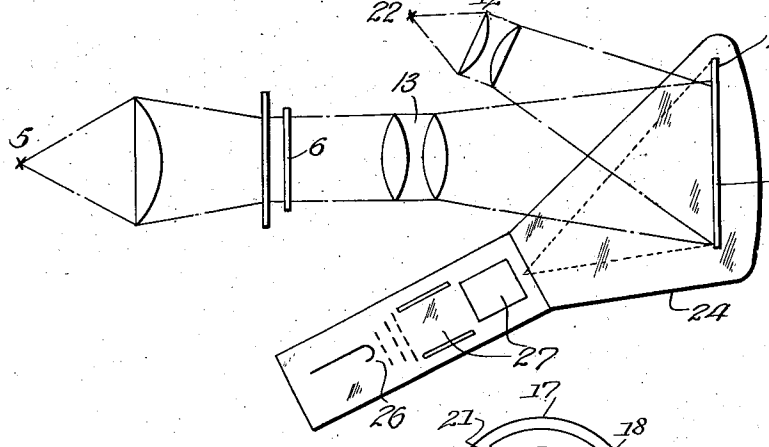
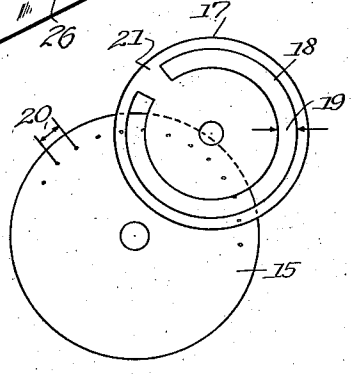


Fig. 5.



Inventor

Rolf Möller

By Hoffmann & Baldwin

Attorneys

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SYNCHRONIZING METHOD

Rolf Möller, Zehlendorf, near Berlin, Germany, assignor to the firm of Fernseh Aktien-Gesellschaft, Zehlendorf, near Berlin, Germany

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In Germany April 10, 1935

1 Claim. (Cl. 178—69.5)

The present invention relates to a synchronizing method for television purposes and deals more particularly with the production and transmission of electrical impulses by means of which corresponding receiving devices may be synchronized.

It is known to apply the synchronizing impulses in the gaps of the image impulses provided between the lines or images and to give them either an amplitude exceeding that of the image impulses or to keep the amplitude zero, or to use an amplitude of algebraic sign opposite to that of the image impulse, so as to effect separation of the synchronizing signal from the image signals in an unobjectionable manner at the receiving end.

In order to produce synchronizing signals which extend from the zero line to the opposite side of the image signals or in which the amplitude is equal to zero, two or more photo-electric cells have hitherto been used connected in opposition relation and of which one delivered, e. g., positive image impulses while the other produced, e. g., negative impulses by being correspondingly illuminated during the occurrence of the line or image gaps. The impulses of the various photo-electric cells were thereupon, after being suitably amplified, combined and produced an oscillation from which the synchronizing signal could readily be separated at the receiving end from the image signals, for example, by means of amplitude filters.

In accordance with the present invention the production of the synchronizing impulse or the oscillation composed of the image impulses and the synchronizing impulses is simplified by eliminating the use of supplementary photo-electric cells and succeeding amplifiers. In accordance with the invention this is achieved by providing supplementary illumination of constant value for the photo-emissive surface of the image pick-up tube which, however, is only effective during the duration of the image signals and which is ineffective during the period of the synchronizing impulse.

The invention is described in conjunction with the examples illustrated.

Fig. 1 shows the scanning area of a light ray scanning transmitter.

Fig. 2 is a diagrammatic representation of the course of the image and synchronizing signals.

Fig. 3 shows an optical system which for example may be used for linear scanning of an image in accordance with the invention by means of a perforated circular disk.

Fig. 4 illustrates a modification of the invention in which an image pick-up tube of the mosaic screen type is employed.

Fig. 5 is a view of the perforated circular disk with one of its cooperating rotating diaphragms.

In using a light ray scanning transmitter, the supplementary illumination is produced for example by means of a separate light source which so illuminates a surface lying outside the scanned field that the reflected light passes into the photo-electric cell. For this purpose a strip 2 may be disposed above or adjacent the surface 1 traversed by the point of light (see Fig. 1) and illuminated rhythmically by the movement of the light ray. During the scanning movement of the light ray this invariable supplementary illumination produces a constant basic current in the photo-electric cell, on which the image impulses are superimposed. The supplementary light is obturated between the lines and/or the images, so that synchronizing impulses are created, the amplitude of which are smaller than those of the darkest portion of the image. In this manner the wave shape of the image and synchronizing signals shown in Fig. 2 is obtained.

If the image light and the supplementary light are obturated by a diaphragm, the resulting signal has zero amplitude. As soon as the supplementary illumination is turned on, but while the image per se is black, the photo-electric cell delivers a signal of the amplitude indicated by 3 in Fig. 2. The lighter and more transparent portions of the image are produced by the amplitude indicated by 4 in Fig. 2. In this manner a signal is produced in which the synchronizing impulse is furnished by a zero value of the current or a carrier wave. The duration of obturation of the supplementary light as well as that of the image light is preferably so chosen that between successive lines the amplitude of the signal for a fraction of a line is equal to zero and succeeding images it amounts to the duration of several lines. Line impulses which are indicated by "a" and image alternation impulses indicated by "b" (Fig. 2) are thus produced. By suitably choosing an initial voltage the zero line may be so displaced that it becomes for example as high as amplitude 3; for this purpose the initial voltage is chosen to correspond with the amplitude produced by the supplementary illumination. Synchronizing signals are thus obtained, the algebraic sign of which is opposite that of the image signal.

The arrangement used for interrupting the supplementary light is preferably formed of a

diaphragm device and is coupled with the device used for producing the movement of the light ray (e. g., a perforated disk or a mirror wheel) so that the synchronizing impulse always retains the correct phase relation with respect to the image impulse.

In lieu of supplementary illumination exterior to the field scanned by the light ray, a uniform general illumination of the whole scanned surface may be used which is likewise interrupted in relation with the line frequency and the image alternation frequency.

The device shown in Figs. 3 and 5 for line scanning of a film uses a light source 5 by means of which a slit-like opening, disposed in front of film 6 is illuminated. A portion of the light strikes an obliquely positioned strip-like mirror 8 disposed in front of the opening and is branched off thereby as well as by a system of mirrors 9, 10 and 11 and a lens system 12 and after detouring around the place where the image is being decomposed, is again combined with the light passing through the film. The light behind the film traverses two lenses 13 and 14 and passes to the perforated disk 15. The unmodulated light which originates from mirror 8 likewise passes through lens 14, after striking mirror 11 and is thrown onto the perforated disk where it supplies the supplementary illumination. The photoelectric cell 16 is located behind the perforated disk 15.

In order to render the supplementary illumination ineffective at the required instant, a rotating diaphragm 17 is provided in the embodiment under discussion which is positively coupled with the perforated disk. The diaphragm 17 has a transparent portion 18 in the form of an annular strip interrupted at one point and is otherwise opaque. The width 19 of strip 18 is so proportioned that it is somewhat less than the distance 20 of two adjacent holes in the perforated disk. The supplementary light thus passes through during the production of the image signal, but upon the transition from one line to the succeeding one a short complete obturation occurs in order to create the synchronizing impulse for the line frequency. After a given number of lines, required by the analyzing system have been covered, as by the travel of the given number of holes of the perforated disk, the image alternation impulse *b* (Fig. 2) is produced in the form of a longer dark period; during this period is produced, in addition to obturation of the image light, a prolonged obturation of the supplementary light by the part 21 of the diaphragm. If, for example, the perforated disk has 60 holes, and a speed of 6000 R. P. M. then, at 25 images per second, a 240 line picture will be produced. The obturating diaphragm disk 17 is then allowed to run at 1500 R. P. M. and the image alternation impulses will be obtained for each fourth rotation of perforated disk 15.

The obturation may also be effected by an oscillating or intermittently moved diaphragm.

In this case also, an independent light source may be used, the light of which falls on the photoelectric cell during the production of the image impulse. The light of this source may likewise be controlled by a diaphragm or an intermittent light source may be used which only emits light during the production of the image impulse.

When using the arrangement of the invention in a transmitter which cooperates with an electron-ray tube containing a mosaic of photo-emissive cells as illustrated in Fig. 4, the supplementary illumination from the light source 22 is preferably so arranged that the image screen 23 of the cathode ray tube 24 attains a uniform supplementary illumination. The interruption of the supplementary illumination in cadence with the line or image alternation frequency is not effected by interrupting the light but rather by allowing a portion 25 along one side or the upper or lower edge of the mosaic 23 to remain free from supplementary light. The cathode ray beam, which is produced by a cathode ray gun 26, is deflected by the deflecting elements 27 of the tube and in scanning the mosaic screen 23 produces a train of picture signals of the type illustrated in Fig. 2. This permits retaining the advantage accruing from the use of a cathode ray type of image pick-up tube wherein no movable elements are required, and this also has the further advantage that separately produced synchronizing signals need not later be first combined with the image impulses but rather that the oscillations to be transmitted have the correct form at the outset.

I claim:

In a television transmitter utilizing a cathode ray scanning tube containing a mosaic of photo-emissive cells upon which the optical image is directed, the method of producing a synchronizing pulse which comprises directing in addition to said optical image an unmodulated light beam uniformly over all of said screen except one edge thereof scanning said mosaic with a cathode ray beam of elemental cross-section, and utilizing the difference in signal strength occurring when the edge portion of said mosaic not under illumination by said unmodulated light beam is scanned at this point by said beam to produce said synchronizing pulse.

ROLF MÖLLER.