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A. B. CLARK ET AL

SYSTEM OF PICTURE TRANSMISSION

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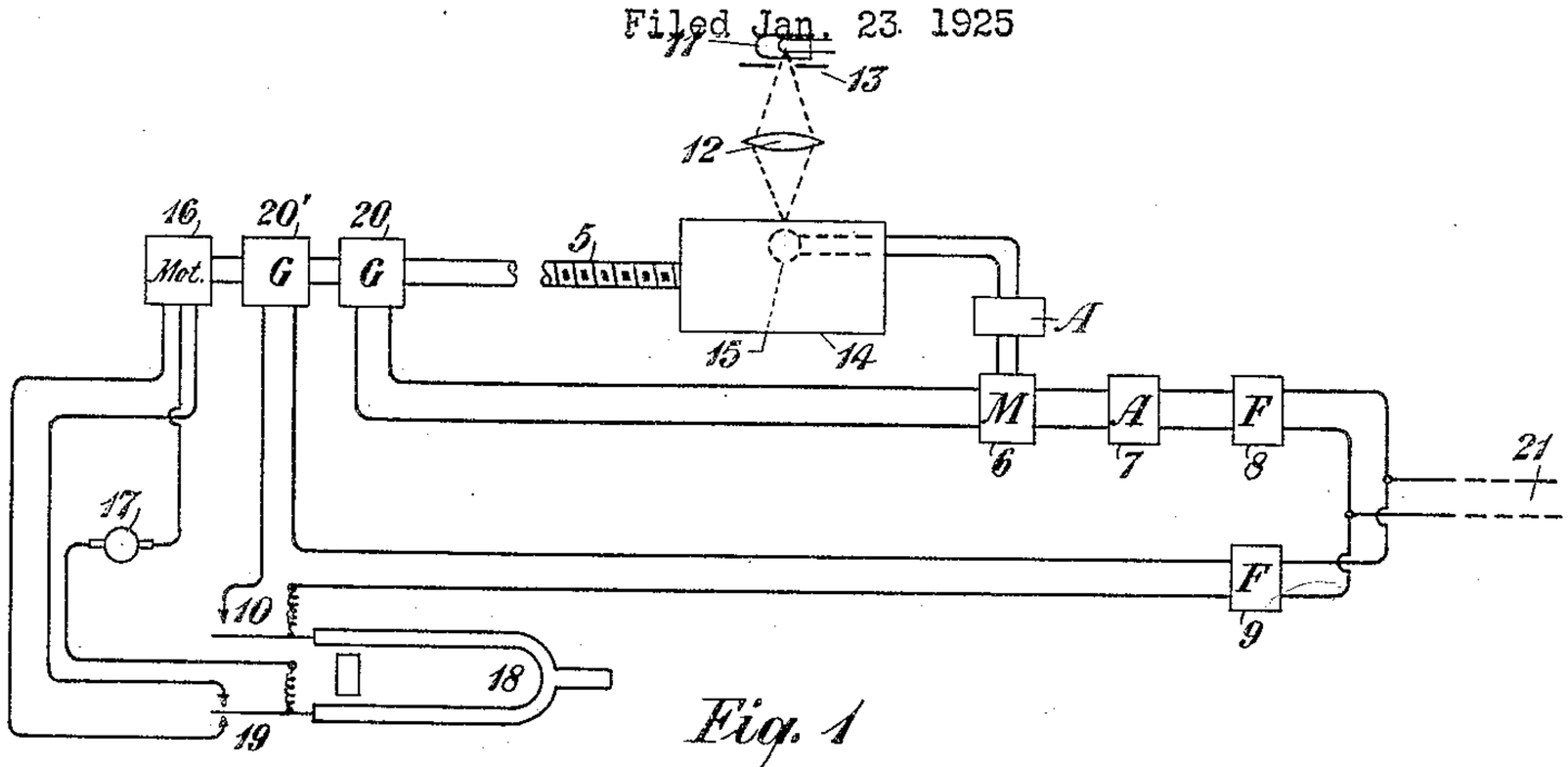

Fig. 1

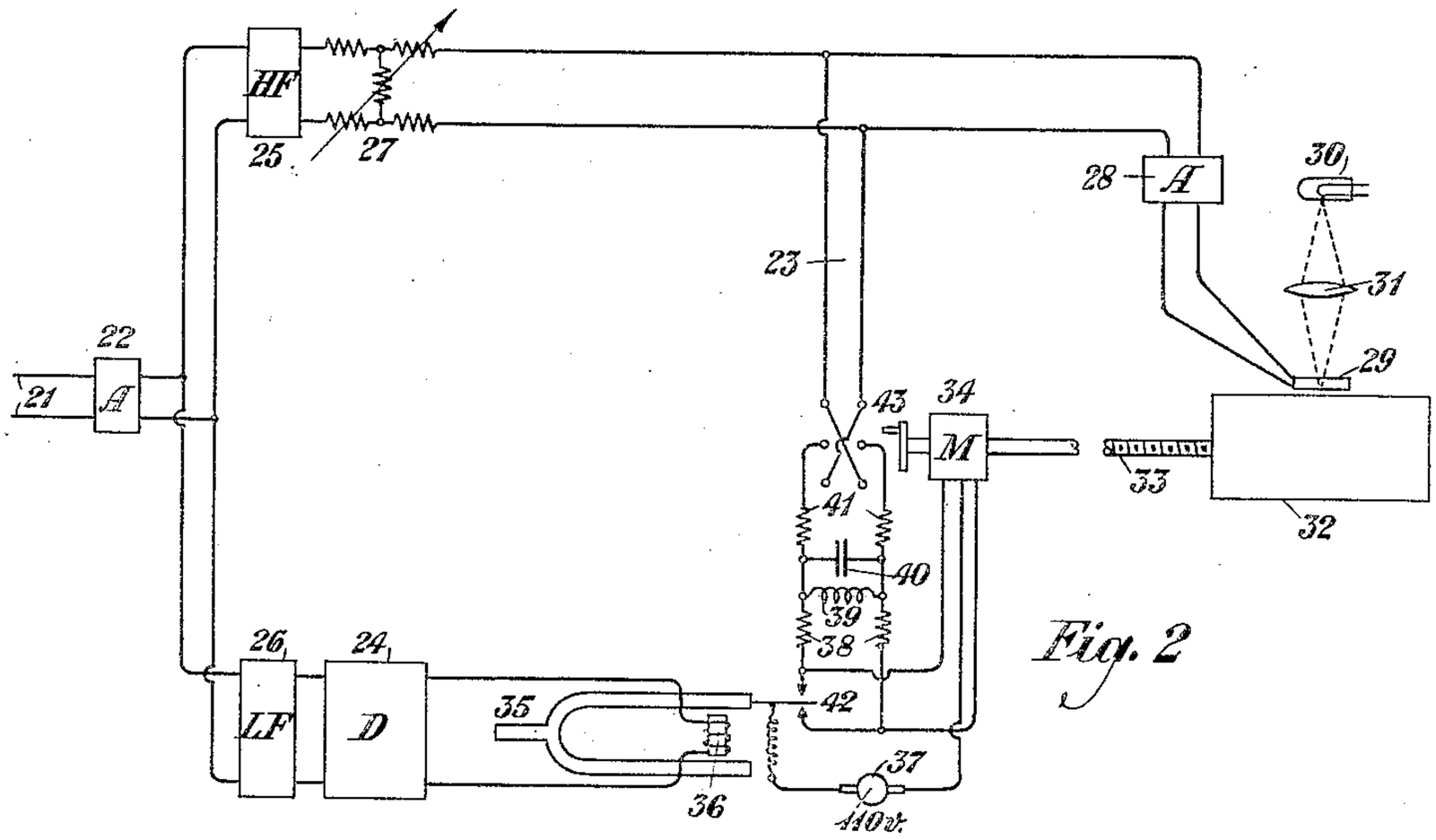

Fig. 2

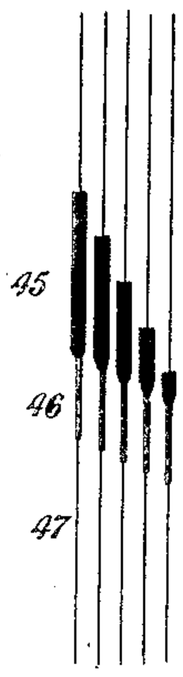

Fig. 3

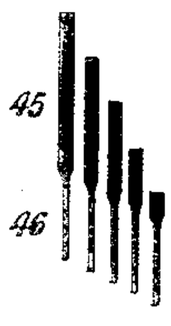

Fig. 4

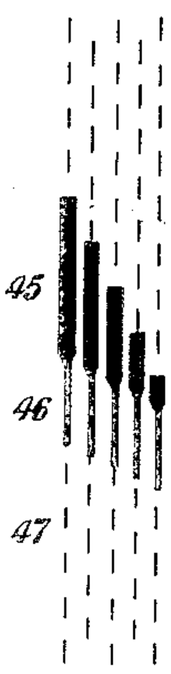

Fig. 5

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UNITED STATES PATENT OFFICE.

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SYSTEM OF PICTURE TRANSMISSION.

Application filed January 23, 1925. Serial No. 4,322.

An object of our invention is to provide a system of picture transmission by which the pictures may be received with suitable contrast of light and shade for newspaper reproduction. Another object of our invention is to provide for a light half tone dot pattern in the parts of the received picture of maximum light. Another object of our invention relates to producing such a dot pattern with the dots staggered in successive vertical rows so that they will lie along diagonal lines at 45°. These and other objects of our invention will become apparent on consideration of an example of practice according to the invention which we now proceed to disclose in the following specification. It will be understood that the description that follows relates to this example of the invention and that the definition of the invention will be given in the appended claims.

Referring to the drawings, Figure 1 is a diagram of picture transmitting apparatus suitable for use in connection with our invention; Fig. 2 is a diagram of corresponding picture receiving apparatus embodying our invention; and Figs. 3, 4 and 5 are enlarged "half tone" diagrams that will be referred to in explaining the operation of the apparatus of Fig. 2.

At the sending end shown in Fig. 1, the image of the opening in the screen 13, which is illuminated by light from the source 11, is focused by lens 12 on the picture which is in the form of a semi-transparent film wrapped on the glass drum 14. Within the drum 14 is a photoelectric cell 15 which receives the light varying in intensity inversely according to the degree of shade of the intervening spot of the film. The drum 14 is rotated by the phonic wheel motor 16 controlled by the tuning fork 18. This motor also drives two generators 20 and 20'. Low frequency current from generator 20' is interrupted 60 times per second by fork 18 and the corresponding wave trains are put through the low-pass filter 9 and on the line 21. Relatively higher frequency current from generator 20 is modulated at 6 by the current determined by the photoelectric cell 15, and this modulated current is put through the high-pass filter 8 and on the line 21. The shaft 5 carrying drum 14 has screw-threaded engagement with a support, so that the spot of the film lying in the path of the light beam describes a helical course, and the successive elements of the film cause the current from generator 20 to be modulated according to their shade.

The picture transmitting current and the synchronizing current coming in on the line 21 are amplified by the amplifier 22 of Fig. 2 and separated into respective paths by the high-pass filter 25 and the low-pass filter 26. The high-pass current through the filter 25 has been modulated according to the intensity of shade of the successive elements of the picture to be transmitted. From the filter 25 this current passes through the adjustable artificial line 27 by which its intensity can be adjusted to the proper degree for the best effect in the receiving apparatus. Thence the current referred to goes through the amplifier 28 to the light valve 29.

Light from the source 30 focused by the lens 31 is passed in varying degree by the light valve 29 to the surface of the underlying sensitive film wrapped on the drum 32. This drum is rotated by the motor 34 and advanced by engagement of its screw-threaded shaft 33 with a suitable abutment, so that the spot of the sensitive receiving film under the light valve 29 traces a helical path on that film. By means which will be described herein, the sensitive film on the drum 32 is made to move in synchronism with the film at the transmitting end, so that the successive elements of the picture are reproduced in the proper location on the film on drum 32.

The low frequency component of current through the low-pass filter 26 goes to a detector 24 whose output consists of the 60 cycle current determined by the tuning fork 18 at the transmitting station. The tuning fork 35 at the receiving end with a natural frequency close to 60 cycles per second is kept vibrating at that frequency by the 60 cycle current just mentioned in the windings of the magnet 36.

110 volt current from the generator 37 is applied alternately to different windings of the motor 34 by the vibrating contact 42, and thus the motor 34 is kept going in synchronism with the 60 cycle current. Thus it will be seen that the rotation of the receiving

drum 32 synchronizes with the rotation of the sending drum 14 at the sending end of the system.

The resistances 38 are connected to the leads to the motor 34 so that opposite pulses of electromotive force of 60 cycle frequency are applied to these resistances. The inductance 39 and condenser 40 are designed so that the combination is tuned to a frequency of 300 cycles per second, which is the fifth harmonic of the tuning fork frequency of vibration, and the combination therefore acts as a harmonic producer passing an alternating current of 300 cycles per second through the resistances 41 to the switch 43. This switch 43 is a reversing switch which is operated one way at one revolution of the motor 34, the opposite way at the next revolution, and so on back and forth. The 300 cycle current from the switch 43 goes over the conductors 23 and is superposed on the picture current to the light valve 29.

In making half tone pictures for newspaper reproduction it will not do to leave large areas of light shade entirely blank, but the paper must be supported, and to do this it is necessary to print a light pattern of lines or dots. The shades are produced in the apparatus of Fig. 2 by opening of the light valve, thus making lines of greater or less width on the picture receiving surface. Thus in Fig. 3 the lines of greatest width at 45 correspond to a dark shade; the lines of intermediate width at 46 correspond to a medium shade; and the lines of least width at 47 correspond to a light shade. But in newspaper work it is inevitable that the thin lines, such as at 47, will print rather too heavily, so that the light parts of the picture will print too dark. As already explained, while it would be possible to close the light valve entirely for the shade 47 thus printing the picture as shown in Fig. 4, this would not give the necessary support to the paper.

By our invention we arrange the light valve so that it would operate as shown in Fig. 4, and then we superpose the locally generated 300 cycle current which operates the light valve to produce the dashes shown at 47′ in Fig. 5. Since the 300 cycle current is an exact harmonic of the frequency of the tuning fork 35 which drives the motor 34 and the film drum 32, it is evident that the dashes will fall in a definite pattern. The 300 cycle current being superposed on the picture shade current will vary the light valve opening slightly when it is open as at 45 or 46, but its effect at those places will be practically negligible. At 47′ in Fig. 5, it is evident that a lighter shade results on printing the picture through on the corresponding point in the case of the solid lines of Fig. 3.

The dashes formed as described, would naturally fall in a pattern perpendicular to the line of motion of the light spot relative to the film, because of the harmonic relation between the current forming the dashes and the currents driving the film motor. In order to stagger the dashes 47′ in successive vertical rows and thus form a more pleasing pattern, we provide the reversing switch 43. As the edge of the picture receiving sensitive film on the drum 32 passes under the light valve 29, the switch 43 is reversed so that the current goes over the conductors 23 in opposite phase as compared with the preceding rotation of the drum 32, and the staggered dash pattern is produced as at 47′ in Fig. 5.

For a more complete description of a light valve which is suitable for operation in response to modulated carrier currents without demodulation at the receiving station, reference is made to the application of H. E. Ives, Serial No. 711,755, filed May 8, 1924.

We claim:

1. The method of producing a picture at the receiving end of a picture transmitting system, which consists in superposing a faint dot pattern on the picture so that this pattern will appear in the parts of light shade of the picture but will be substantially masked in the parts of dark shade.

2. The method of producing a proper contrast of shade in the received picture in a picture transmitting system, which consists in printing parallel lines of varying width corresponding to the varying degrees of shade, making the lines of zero width in the parts of lightest shade, and superposing a uniform dot pattern on the entire picture so that it will be apparent in the areas of light shade and masked in the areas of dark shade.

3. In a picture transmitting system, receiving apparatus comprising an electromagnetic light valve, means to move a picture receiving surface relatively thereto, means to apply to the light valve currents modulated according to the shade of the elements of the picture to be transmitted, and means to apply superposed locally generated currents to the light valve to produce a faint dot pattern apparent in the areas of light shade and substantially masked in the areas of dark shade.

4. In a picture receiving apparatus, a light valve, means to move a picture receiving surface adjacent thereto, means to apply picture transmitting currents to the light valve, and means to apply relatively weak currents of regular periodicity to the light valve whereby in the absence of picture currents a faint dot pattern is produced, and when there are currents corresponding to substantial shade in the picture they mask the said dot pattern.

5. In a picture receiving system, a light

valve, a picture receiving element moved adjacent thereto, means to apply picture transmitting currents to the light valve, local means to superpose a regular periodic current to the light valve to produce a dot pattern, and means to reverse the phase of the last mentioned current at each cycle of movement of the picture receiving element so that the dots shall appear in staggered relation.

6. In combination, a picture receiving drum, a motor therefor, a light valve, a circuit to transmit current of two components, one for the light valve and one for the motor, a harmonic generator to receive current of the frequency for the motor and deliver a harmonic thereof, and a branch circuit to superpose said harmonic on the light valve.

7. In combination, a picture receiving drum, a motor therefor, a light valve, a circuit to transmit current of two components, one for the light valve and one for the motor, a harmonic generator to receive current of the frequency for the motor and deliver a harmonic thereof, a branch circuit to superpose said harmonic on the light valve circuit, and a switch in said branch circuit to reverse the phase at each revolution of the receiving drum.

8. The method of reproducing pictures suitable for use in connection with the stereotype process which comprises transmitting current representing the characteristics of the picture, exposing a photo sensitive surface in accordance with the current to reproduce the characteristics of the picture, and simultaneously therewith exposing said sensitive surface to form a printing structure which is submerged by the other exposure, except in the portions representing high lights, but which appears in such portions.

9. Means for producing a picture electrically comprising means for forming the picture with lines having a characteristic varying in accordance with the tone value of elemental areas of the original except in very light areas, and means for introducing a dot pattern in these very light areas.

10. The method of reproducing a picture which comprises transmitting a current representing the characteristics of the picture, exposing a photo-sensitive surface in accordance with said current to reproduce the dark areas of the picture as lines having a varying characteristic, and automatically introducing in the white areas of the picture dots to compose a printing structure.

11. The method of producing a picture electrically which consists in transmitting current representing the tone values, constructing the picture in the form of lines having characteristics varying in accordance with said current, and introducing a dot pattern into the light areas of the picture.

12. Means for electrically producing a picture comprising means for reproducing the dark portions of said picture from electric currents in the form of lines of varying width, and automatic means for introducing dots in the white portions of said picture to compose a printing structure suitable for news print reproductions.

13. The method of producing a picture electrically which consists in reproducing dark portions of the picture in the form of lines of varying width, and automatically introducing in the white portions of the received picture a dot structure suitable for news print reproductions.

In testimony whereof, we have signed our names to this specification this 16th day of January 1925.

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