Sept. 4, 1934. C. W. HOUGH 1,972,444

PICTURE TRANSMISSION AND RECEPTION SYSTEM

Original Filed June 12, 1928 4 Sheets-Sheet 1

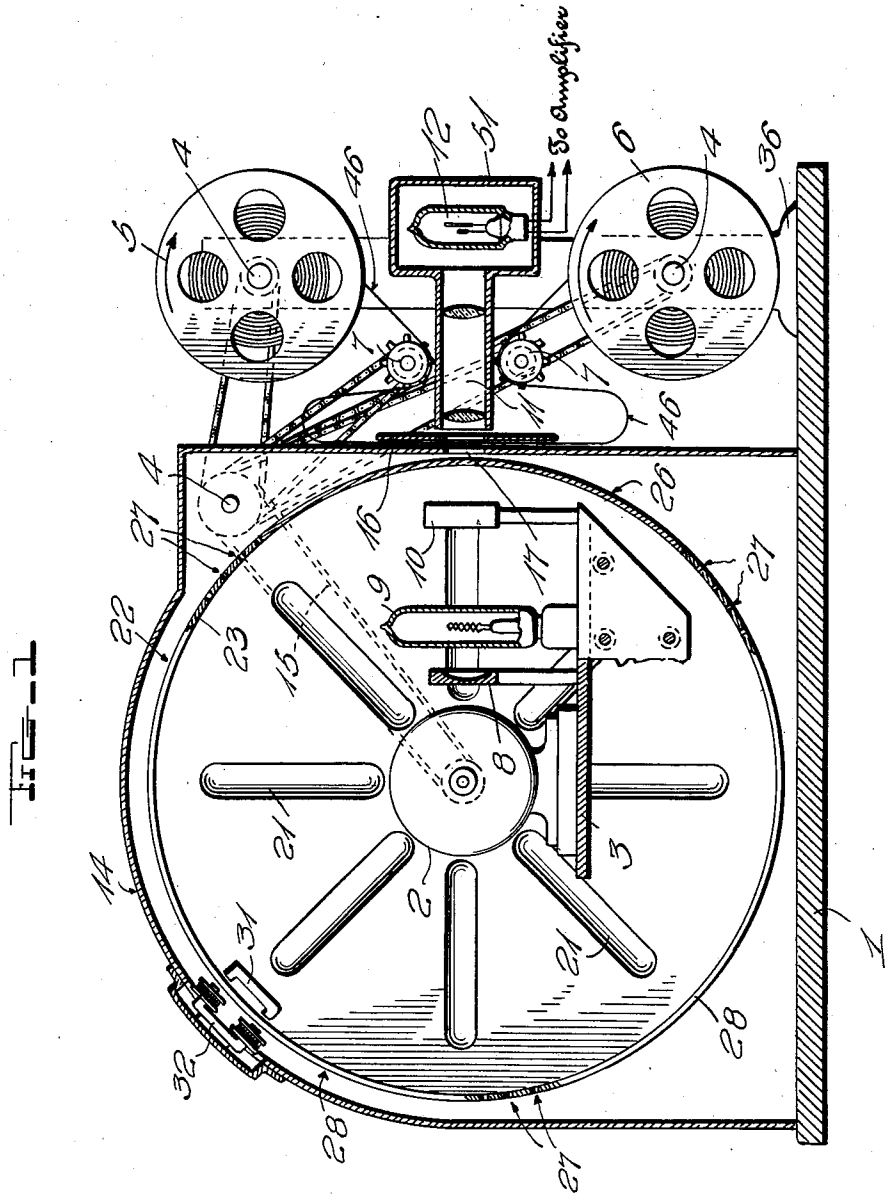


FIG. 1

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FIG. 4

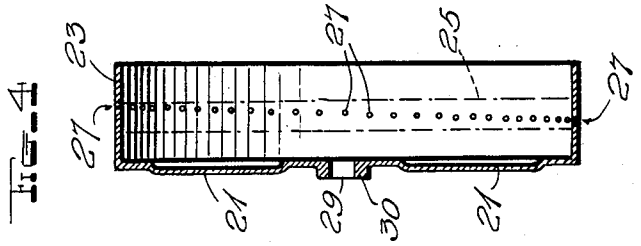


FIG. 3

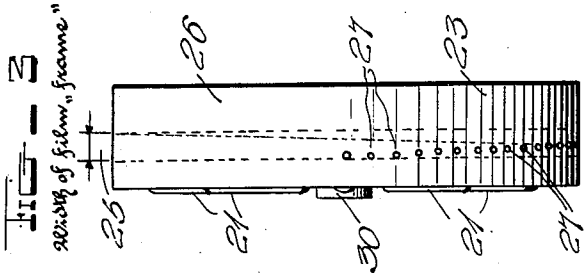


FIG. 2

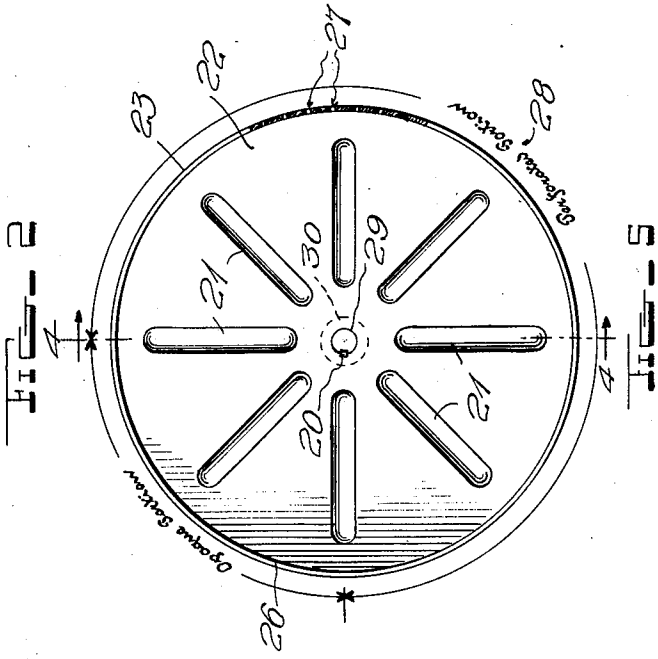
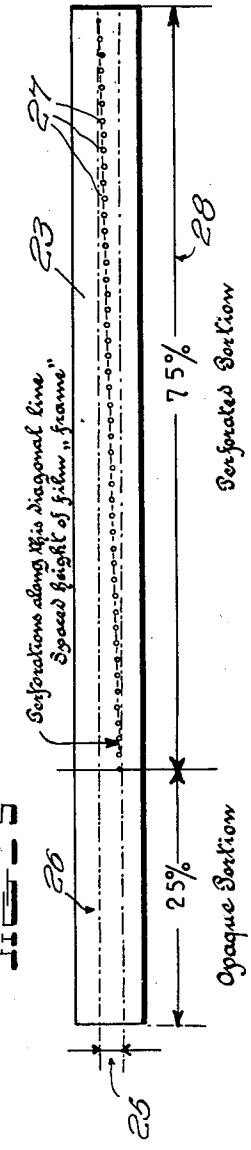


FIG. 5



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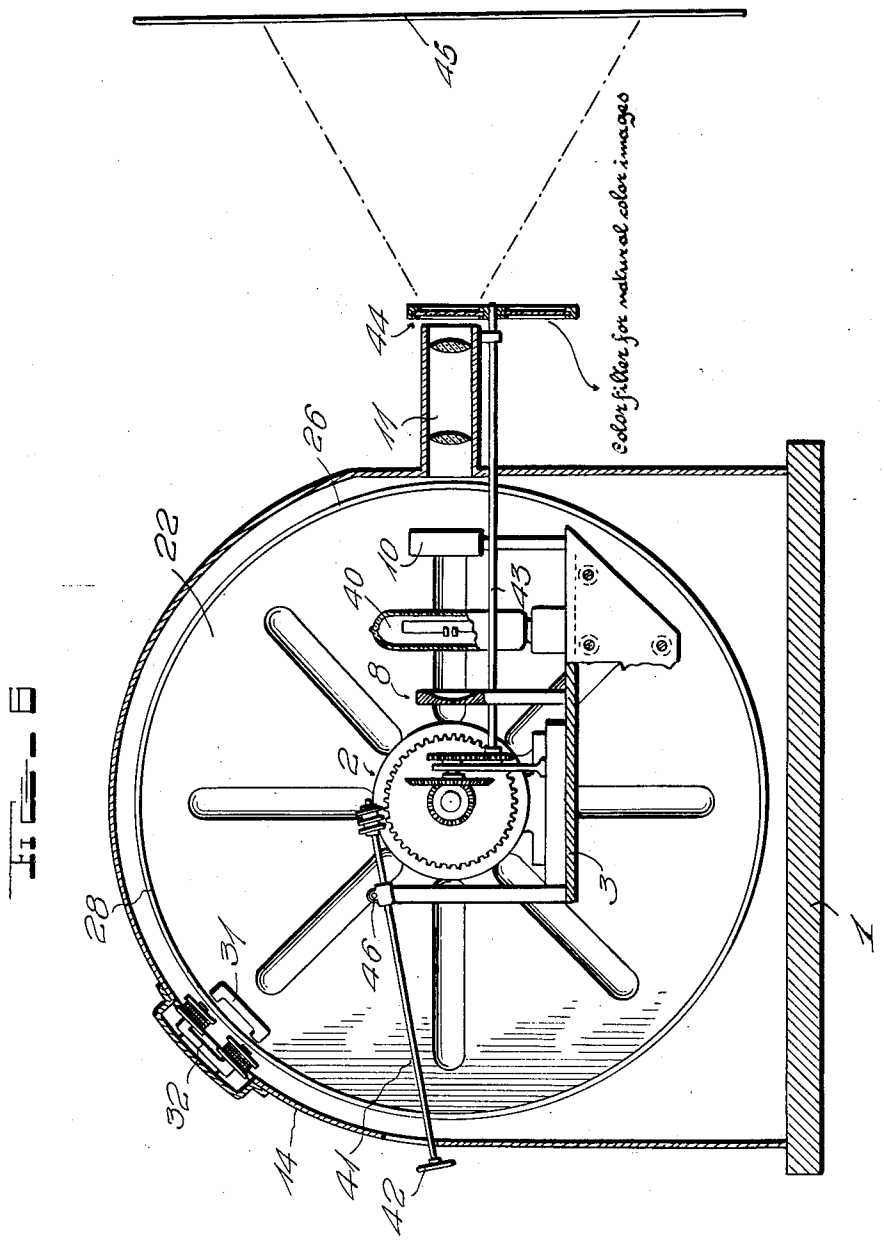


FIG. 5

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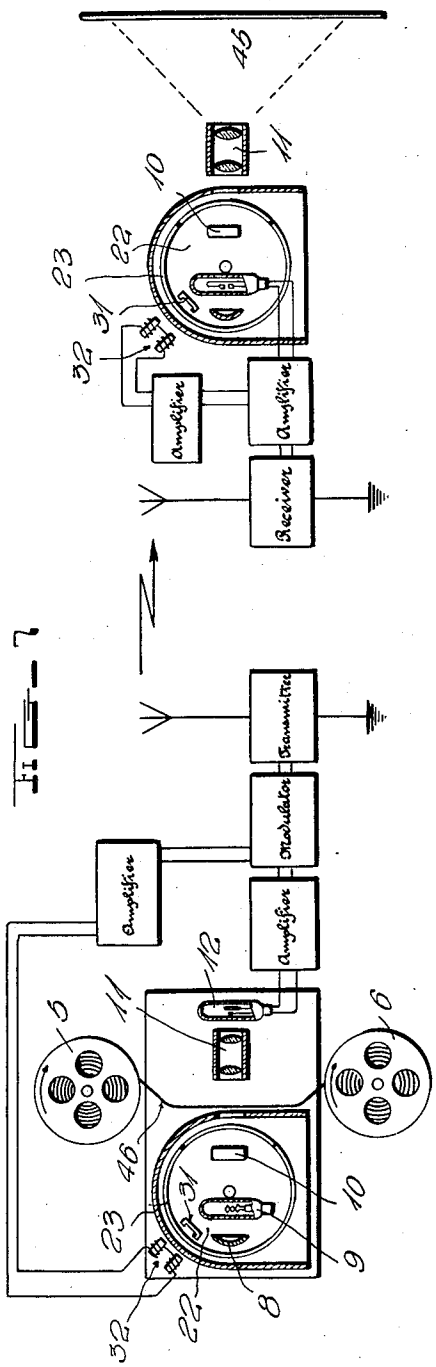


FIG. 7

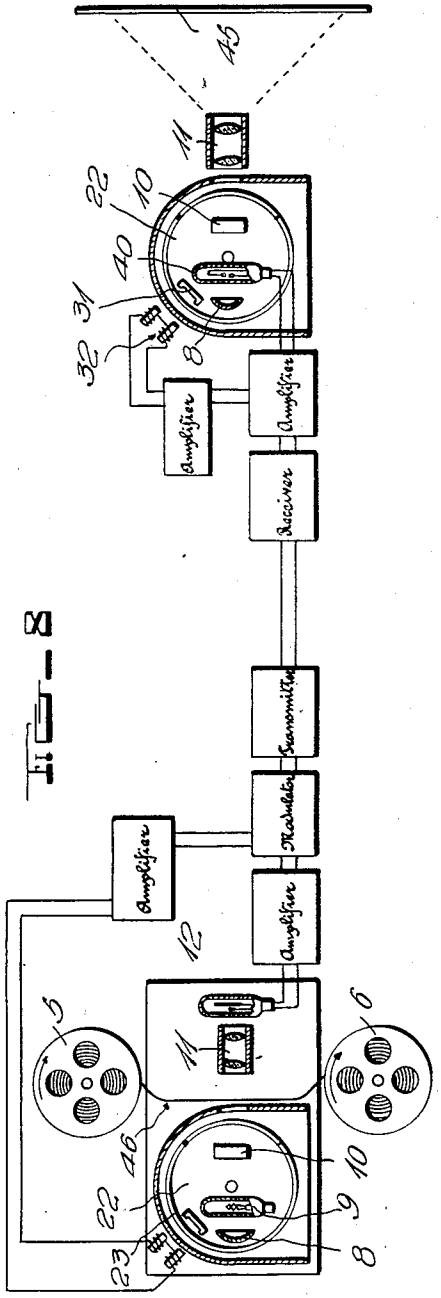


FIG. 8

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UNITED STATES PATENT OFFICE

1,972,444

PICTURE TRANSMISSION AND RECEPTION SYSTEM

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Original application June 12, 1928, Serial No. 284,768. Divided and this application September 7, 1929, Serial No. 391,039

4 Claims. (Cl. 178—69.5)

My invention relates to systems for the transmission and reception of a plurality of individual pictures and more particularly to systems wherein such pictures comprise the individual pictures of a motion picture film.

An object of my invention is to provide a synchronizing system employed in systems for the transmission and reception of motion pictures.

Another object of my invention is to provide a system for the transmission and reception of motion pictures where synchronization of the transmitter and receiver is maintained.

A further object of my invention is to provide a synchronizing system for motion picture transmitters and receivers whereby the synchronization is automatically maintained.

A better understanding of my invention can be had from the specification following and from the accompanying drawings, wherein:

Figure 1 illustrates the apparatus I employ in the transmission of motion pictures; Fig. 2 illustrates the scanning wheel I employ in the apparatus of my invention; Fig. 3 shows further details of the scanning wheel or band and illustrates the perforations for interrupting or scanning; Fig. 4 shows further details of the perforations in the scanning wheel or band; Fig. 5 illustrates the relative spacing of the perforations in the scanning wheel or band; Fig. 6 illustrates the synchronizing method and the system I employ for the reception of motion pictures; and Figs. 7 and 8 are diagrammatic illustrations of my system for the transmission and reception of motion pictures, by space radio and wired radio systems respectively.

In Fig. 1 of the drawings the transmission apparatus is mounted on a base 1. Base 1 has an upstanding member 36 upon which are mounted film reels 5 and 6. A case 14 for the motor 2 together with reflector 8, projection lamp 9, and condensing lens 10, is mounted on the common base 1. A base 3 supporting motor 2, reflector 8, projection lamp 9 and condensing lens 10 is mounted on case 14. An upstanding member 36 supports driving mechanism for reels 5 and 6, and film 46. The driving mechanism includes motor 2, chain or belt 15, pulleys and sprockets 4 and 7 and Geneva star or cam movements 16. Upstanding member 36 supports in addition to the driving mechanism for film 46, focusing lens 11 and light sensitive cell 12 enclosed by cover 51. An opening 17 is provided through the case 14 and is of similar dimensions to one picture "frame" of film 46.

In Fig. 2 of the drawings, the scanner wheel 22 has an upstanding rim 23 which is perforated to interrupt the rays of light. Scanner wheel 22 is made rigid by ribs 21 pressed therein. A hub 30 has a key 20 whereby the exact position of scanner wheel can be determined in respect to the lens and other equipment, thus enabling synchronization of both transmission and reception equipment.

This application is a division of my copending application Serial No. 284,768, filed June 12, 1928, certain descriptions of the system in its entirety being more completely set forth therein.

Fig. 3 shows the scanner wheel 22 and scanner band 23 with perforations 27, the perforations being arranged in a width 25 on the band 23 corresponding to the width of the film "frame". A hub 30 and hole 29 indicate the mounting of the scanner wheel 22 on the shaft of the motor 2 illustrated in Fig. 1. Numeral 28 represents the circular degree of perforations while 26 represents that portion of the band 23 which is opaque or not perforated.

Figs. 4 and 5 show the scanner band 23 of scanner wheel 22 in greater detail. The reference characters here are the same as those of Fig. 3 wherein, 23 represents the scanner band in its entirety, 25 represents the width of the area 28 which is perforated. The perforations 27 are spaced along a diagonal line and spaced the height of the film frame. The portion 26 is opaque and not perforated and constitutes 25% of the circular measure of the scanner band 23. The scanner band 23 is a development of scanner wheel 22 although it might be otherwise constructed of suitable material and secured to the scanning wheel by rivets or machine screws.

Fig. 6 shows the receiving apparatus and includes a base 1 similar to the base 1 of the transmitter illustrated in Fig. 1. A case 14 is mounted on base 1 and supports the sub-base 3 upon which are mounted motor 2, reflector 8, high frequency arc light or glow discharge tube 40 and condensing lens 10. An upstanding member mounted on base 3 supports an adjustable shaft 41 for adjusting the apparatus in synchronism with the transmitting apparatus. Shaft 41 has a knob or dial 42 for synchronization adjustment. Scanner wheel 22 is mounted on the shaft of motor 2 and movable therewith. Inclosure case 14 also provides a support for focusing lens 11 and color filter 44. Color filter 44 is mechanically connected with the shaft of motor 2 by shaft 43 and is adjusted for synchronization with scanning wheel 22. Color filter 11

44 intercepts light rays projected on the screen 45.

Fig. 7 is a diagrammatic illustration of my system for transmission and reception of motion pictures by space radio, reference numbers corresponding to those in the preceding Figs. 1 and 6. Variations of current are amplified and modulate the output of the space radio transmitter.

Fig. 8 is a diagrammatic illustration of my system for the transmission and reception of motion pictures by wired radio, reference numbers corresponding to those in Figs. 1 and 6. Variations of current are amplified and caused to modulate the output energy of a wired radio transmitter. The wired radio transmitter is connected electrically with the receiver.

The standard speed of projection is at the rate of sixteen "frames" per second. The opaque section 26 of scanning band 23 cuts off the projecting light during the downward movement of the film. The film is then held stationary and the perforated section 25 of the scanning band 23 allows the light to be projected through the picture and on the light sensitive cell 12. The opaque portion 26 of the scanning band 23 shuts off the light and the film is again moved down one frame and the cycle repeated. At the rate of sixteen projections per second, the time required for a complete cycle is 4/64 second. Of this, roughly 1/64 second is devoted to the movement of the film and during this interval the light sensitive cell 12 is dark. 3/64 second is devoted to the projection. This means that each individual "frame" of the motion picture film 46 must be scanned, transmitted, received and reproduced in 3/64 second. The synchronizing system employed is operated during the 1/64 second interval when no picture is being transmitted. The method of synchronizing employed with my system for transmission and reception is shown. Scanning wheel 22 is shown with scanning band 23. The opaque portion 26 of scanning band 23 is illustrated as constituting a 90° arc or ¼ the circumference of scanning band 23. Synchronizing magnet 31 is mounted on scanning wheel 22. Synchronizing coil system 32 is stationary and may be mounted on the scanning wheel case 14. The scanning wheel 22 rotates in synchronism with the transmitter scanning wheel and therefore the beam of light occupies the same relative position on the receiving screen at each instant. The projection lens mounting 11 is movable in and out so that the images may be focused properly on a receiving screen of varying dimensions. A rotating color filter 44 is shown revolving in front of the projector lens system. This is operated by suitable mechanical connection 43 to the driving motor 2. There are two color screens in this element. The screens are made of two compensated complementary colors which give the effect to the eye of natural colors. This two part screen rotates at one-half the speed of the standard scanning wheel 22, showing alternate pictures through the different colored portions of the screen. The filter 44 may be located anywhere in the light path but it is convenient to place it where it may be removed if monochrome pictures are preferred or if at any time ordinary instead of colored motion pictures are being sent out by the transmitter.

The manner in which synchronism of the transmitter and receivers is obtained when the receivers and transmitter operate on the same system of electric current supply of 60 cycles, synchronism inherent in the 60 cycle supply can usually be depended upon. This is largely true in stations that are interconnected in super power systems. Ordinary 60 cycle synchronous motors may be used and the scanning wheel adjusted around its axis, until the picture becomes sharp and then fixed in this position. For space radio and where the 60 cycle motors do not operate on the same system another method must be used to periodically correct any tendency to get out of step. The system of my invention employs a synchronizing impulse in the form of modulated high frequency energy during the period that the picture "frame" is being moved, the opaque section of the scanning member shutting off the light beam and no impulses caused by variations of light being transmitted.

In the transmitter, as shown in Fig. 1 of the accompanying drawings, electromagnetic members 32, 33 and 53 connected through an amplifier to the modulation circuit, are mounted on frame 14 in close proximity to the scanning wheel 22. An electromagnet or a permanent magnet 31 is mounted on the scanning wheel 22 so that the core 53 and magnet 31 will be in close proximity when the light is obstructed by the opaque portion 26 of the rim. As the magnet 31 is turned past the stationary core 53 there is generated an electrical impulse in the winding of stationary coil 33. This generated impulse is amplified and caused to modulate the carrier energy of the transmitter.

The impulse is received and amplified and caused to energize a similar arrangement at the receiver. The receiver is shown in detail in Fig. 5. The energization of the coil 33 in the receiver will act of a similar electromagnet or permanent magnet 31 on the scanning wheel 22 of the receiver and retard or advance the scanning wheel. Thus a synchronizing impulse will be exerted during each revolution of scanning wheel 23 during the interval when no picture is being transmitted. Sound could also be recorded on the motion picture film to be transmitted and at the receiving station the pictures in natural colors could be reproduced accompanied by the reproduced sound.

It is obvious that the picture transmission system of my invention presents many advantages over systems employed heretofore. It is essential to my invention that the transmission of the impulse for synchronizing the receiver scanning member with that of the transmitter must take place during the time that each picture frame is moved to or from transmitting position. Ordinarily this interval of time contributes nothing to the transmission or reception of the image.

From the accompanying drawings and the foregoing specification it is pointed out that the synchronization force is generated and received during the interval between the exposure of the successive picture frames of the motion picture film. In this manner I provide a synchronizing or correcting means for each picture frame of the motion picture film.

It is obvious that many systems for the transmission and reception of motion pictures may be employed without departing from the spirit of my invention, and I do not intend to limit my invention to the foregoing specification or to the accompanying drawings but only by the restrictions imposed by the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. In a system for the transmission and reception of motion pictures the combination of a motion picture film, means for producing current variations corresponding to light and dark areas of said motion picture film, means for producing light variations from said current variations corresponding to said light and dark areas, means for preventing the transmission and reception of said current variations when the individual pictures of said motion picture film are being moved to and from the position for transmitting, means for producing an electrical impulse when no picture is being transmitted and means for receiving said electrical impulse whereby said transmitting means and said receiving means are synchronized during the period between the transmission of successive pictures.

2. In a system for the transmission and reception of pictures, a motion picture film, a rotary shutter having a plurality of perforations for directing a plurality of beams of light over the respective light and dark areas of said film, means for producing variations of current corresponding to said light and dark areas, means for obstructing said current variations when said film is in motion, means for synchronizing the movement of said film with the rotary movement of said shutter, means for producing light variations from said current variations, means for directing said light variations on respective portions of a visible screen, means for producing electrical impulses during the time that said film is in motion and means for synchronizing said transmission and reception means by said electrical impulses.

3. In a picture transmission and receiving system the combination of a picture film, a revolving shutter having perforations for directing beams of light onto and through light and dark areas of said film and actuating a light sensitive cell, said shutter having an opaque section for obstructing said beam of light, means for synchronizing the movement of said shutter with the changing of successive pictures of said film whereby said light sensitive cell is not actuated when said pictures are being changed, means including a channel for transmitting impulses initiated by said light sensitive cell, motor driven receiving apparatus arranged to respond to said impulses and to reconstruct the light and dark areas of said film in view of an observer, and an impulse initiating device operable under the control of said revolving shutter for transmitting periodically to said receiving apparatus an impulse whereby the motor of said receiving apparatus may be synchronized with said revolving shutter.

4. In a system for the transmission and reception of motion pictures by electrical systems, a motion picture film, means for transmitting said pictures comprising means for intermittently moving said motion picture film, means for successively scanning elemental portions of each successive picture on said film with beams of light, light sensitive means to produce variations of current corresponding to light and dark areas of said pictures, means for obstructing said beams of light during the time interval that said pictures are being moved to or from the immediate transmitting position, means for synchronizing the intermittent movement of said film and said scanning means, means for generating an electrical impulse during the time interval that said pictures are in motion; amplifying, modulating and generating means associated with said light sensitive means and said electrical impulse, generating means; and receiving apparatus comprising means responsive to variations of current for reconstructing the light and dark areas of said pictures and further means responsive to said electrical impulses for synchronizing said receiving apparatus with said transmitting means.

CLINTON W. HOUGH.