April 7, 1931. H. P. DONLE 1,800,057

TELEVISION

Filed Dec. 26, 1928 2 Sheets-Sheet 1

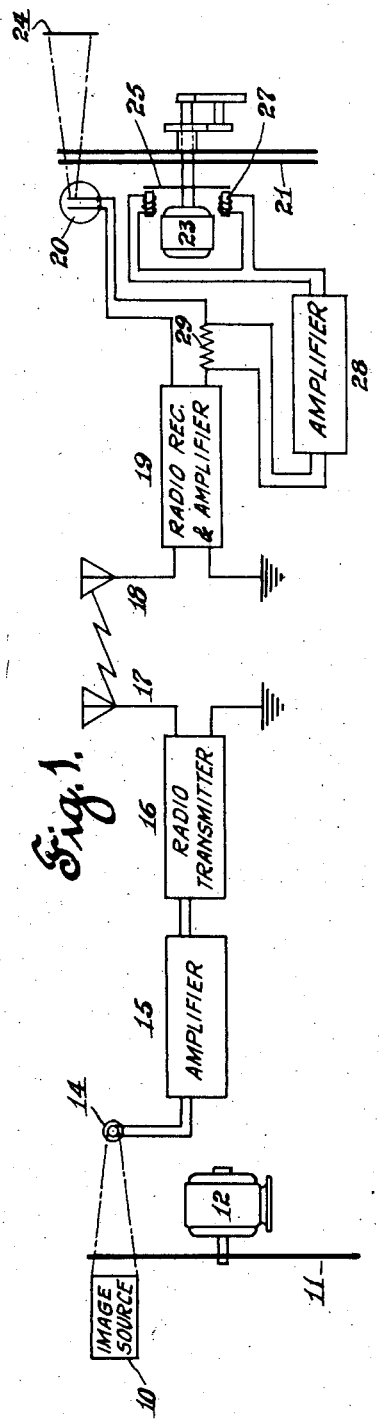

Fig. 1.

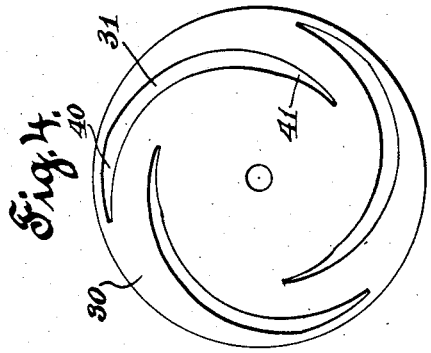

Fig. 4.

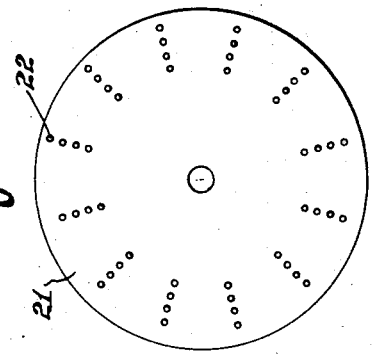

Fig. 3.

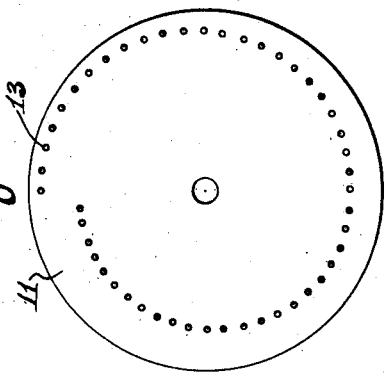

Fig. 2.

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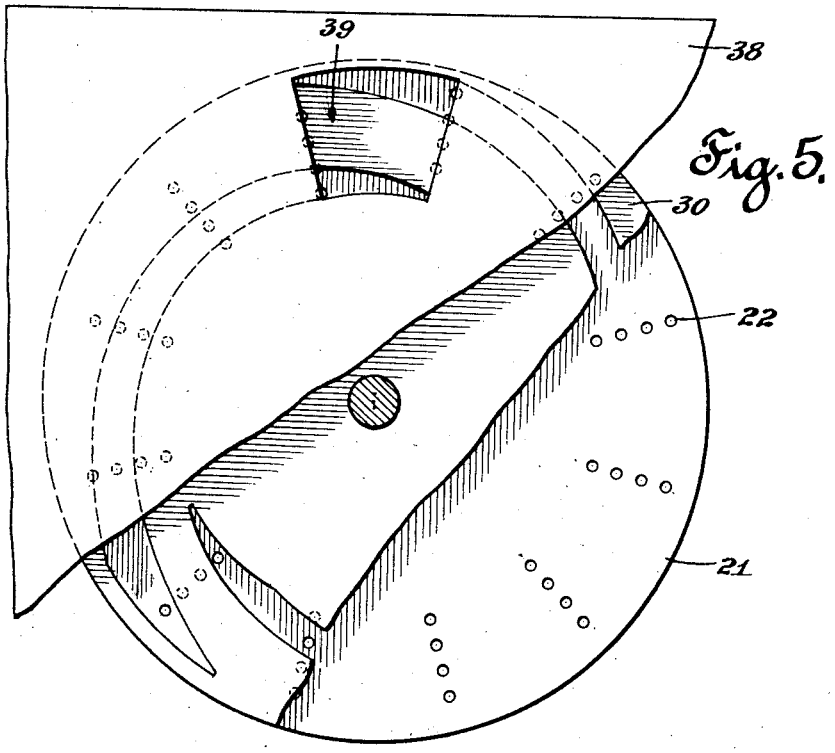


Fig. 5.

Fig. 6.

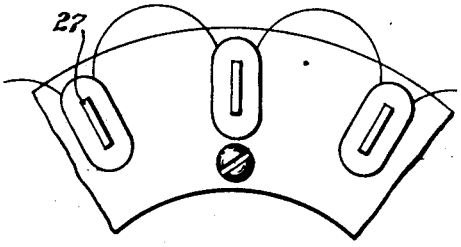


Fig. 7.

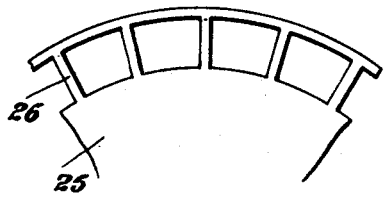
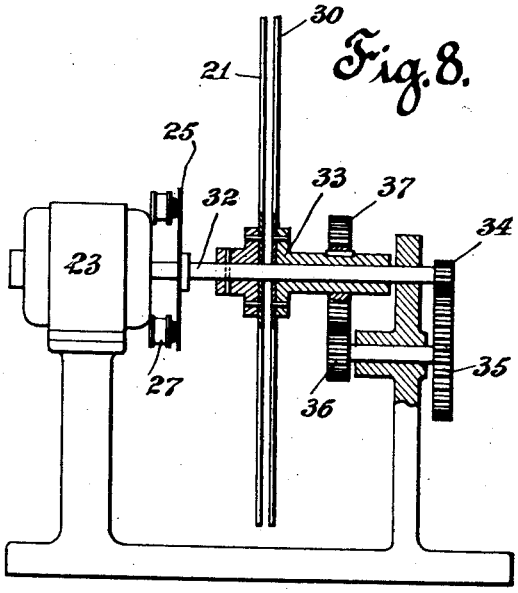


Fig. 8.



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Patented Apr. 7, 1931 1,800,057

UNITED STATES PATENT OFFICE

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TELEVISION

Application filed December 26, 1928. Serial 328,337.

My invention relates to systems and apparatus for conveying from one point to another visual impressions and commonly termed television. It is particularly intended for transmitting moving pictures and the reproduction of living scenes.

The main object of the invention is to reproduce a moving picture with accuracy, steadiness and of maximum size with simple and reliable apparatus and utilizing a single channel of communication. It will be understood that various features of these improvements may be utilized independently of other features. The details of the preferred embodiment of the invention will be found set forth hereinafter.

In the form shown a receiving scanning member is in the form of a disc having the light apertures arranged spirally at uniform intervals. Instead of a single turn of 360° this spiral makes two or more turns. In the discs ordinarily employed there are usually either 24 or 48 holes in a single turn or circumference so that in a 24 hole disc the successive holes are arranged at intervals of 15° and in a 48 hole disc they would be arranged at intervals of 7½°. In the form shown herein the apertures are spaced apart 30° and by distributing these apertures throughout four turns, I provide a receiving disc which can be synchronized with a 48 hole transmitting disc.

This receiving disc is accordingly rotated at four times the angular speed of the transmitting disc. It is apparent therefore that this series of 48 holes can be made to pass by the frame or observation position in the same length of time that the 48 holes of the ordinary disc would take. The result would be that a light image would be visible simultaneously from one of the apertures in each turn. To prevent this the shutter member which is made of suitable opaque material has a number of slots each of which is in the form of a spiral whose shortest radius is slightly less than the shortest radius to the apertures of the scanning disc to permit the innermost aperture to register with the inner edge of the slot. The greatest radius of the slot is slightly greater than the radius to the outer scanning aperture so that the outer aperture can be brought into alignment with the outer edge of the slot. In other words, the radial dimension, relative to the disk centre, of the area exposed by the passage of one of these slots past a fixed point will be not less than the difference of radial mensuration of the first and last aperture of the multi-spiral scanning disk.

I have shown three of these shutter slots and the gear ratio between the scanning disc and the shutter disc is such that the shutter rotates at one-twelfth the speed of the scanning disc. In other words there are four revolutions of the scanning disc for one cycle of shutter apertures. The result is that for a given diameter of scanning disc the observation frame can be approximately sixteen times the area of the corresponding frame of the usual scanning disc.

To synchronize the scanning disc with the transmitting disc I may employ the construction of my former application #306,390, filed Sept. 17, 1928, or that of my application #322,360, filed November 28, 1928.

In the construction here shown I illustrate the device of the earlier application for convenience.

Fig. 1 is a diagrammatic view of transmitting and receiving apparatus embodying my invention.

Fig. 2 is a face view of the transmitting scanning disc.

Fig. 3 is a face view of the receiving scanning disc.

Fig. 4 is a face view of the shutter used with the scanner of Fig. 3.

Fig. 5 is a front view of the receiving apparatus showing the observation opening in

the face plate and the receiving scanner and shutter.

Fig. 6 is a fragmentary detail view of the field coils and the receiving synchronizer.

Fig. 7 is a corresponding fragmentary view of part of the armature of the scanner.

Fig. 8 is a side elevation and partial section of parts of the receiving mechanism.

The picture source or image to be transmitted is diagrammatically indicated at 10 and may of course represent an actual stationary or moving object or a moving film. The transmitting scanner 11 is driven by a suitable motor 12 and provided with one or more series usually one of apertures 13 arranged spirally (48 are shown herein) and through which the light from the image passes to a light sensitive cell 14. The output of this cell preferably passes through an amplifier 15 and a radio frequency transmitting device 16 provided with a suitable output antenna 17 and so forth.

At the receiving end is located a suitable pick-up antenna 18, and radio receiving and amplifying means 19. The output of this receiver is connected to a suitable light source 20 such as a so-called "neon" lamp.

The scanning disc 21 at the receiving end is light in weight and provided with a series of apertures 22 corresponding with the apertures 13 in the transmitter disc and is driven by a motor 23 of any suitable type at a speed such that each successive aperture 22 will synchronize with the apertures 13 and the image will accordingly be visible at 24 either on a screen or through a lens or in a frame as usual in systems of this character.

The synchronizing of the disc 21 with the disc 11 is accomplished through an electromagnetic system utilizing light actuating impulses derived from the transmitting station immediately after the passage of each line scanning aperture across the field of view, by suitable design of the transmitter. Attached to or rotatable with the receiving disc 21 is an armature plate or disc 25 of steel having bars 26, corresponding to the radial lines of apertures 22. A number of magnets or field coils 27 are preferably arranged to correspond with the number of armature bars 26 (or one half as many). The coils of these magnets are connected to the audio amplifier 28 which in turn is arranged in shunt with a resistance 29 in the receiving circuit.

When a signal impulse is received the grid of the last amplifier tube in 28 is charged negatively thus allowing only a small plate current to flow through the amplifier. When the current through the lamp 20 is reduced to the minimum value this negative charge is greatly reduced and a large current flows through the plate circuit and the field coils 27 thus energizing the latter.

The result of this arrangement is that when the reproducing disc 21 is rotating in exact synchronism with the transmitting disc 11 the maximum impulses occur when the poles of the coils are opposite the bars 26 of the armature disc.

In case the speed of the transmitting disc increases or decreases the maximum current impulses in the line to the synchronizing coils resulting from the current to the lamp 20 will occur earlier or later as the case may be thus producing a retarding or accelerating relation between the stationary field coils and the bars or arms 26 of the rotating armature attached to the reproducing disc 21. This in effect locks the disc 21 in exact synchronism with the transmitting disc 11 which will be maintained throughout a wide variation in speed of the transmitter disc due to the locking action of this device.

The shutter 30, in the form shown, is provided with three slots 31, all of which are alike and which are spaced at uniform intervals. Each slot is of a general spiral shape and so proportioned and placed that every two circumferentially adjacent apertures of a spiral will be partially uncovered simultaneously once during a complete passage of one shutter slot. The scanning disc 21 is mounted directly on the shaft 22 of the motor 23 so that they rotate at the same speed. The shutter 30 is secured to a sleeve 33 which is rotatably mounted on the same shaft so that the two discs are co-axially rotatable. The transmission gears 34, 35, 36 and 37 are designed to produce a ratio of 12 to 1 so that the scanning disc rotates 12 times as fast as the shutter. The face plate 38 has an observation opening 39 whose width represents approximately the circumferential space between the adjacent radial lines of apertures 22. The radial height of this opening 39 is approximately the same as the greatest radial dimension of the spiral set of apertures 22. At every point the shutter slot 31 is so proportioned relative to the spacings of the apertures 22 uncovered by it, that two adjacent apertures are always partially uncovered simultaneously. This means that the effective circumferential width of each shutter slot is gradually reduced as the radius is decreased.

The ends of the spiral slots are so tapered off that only one total aperture is visible at any instant, which total aperture may be made up of a portion of the aperture leaving the field of view and another portion of the aperture centering the field, as shown in Fig. 5 by the first and last apertures of the spiral series.

The result is that we are able to produce by the use of this invention a picture whose area is approximately 16 times the area of a picture produced by a scanning disc of the same diameter and utilizing the usual single turn spiral group of apertures.

Although this invention is primarily intended for radio transmission and reception,

certain features may be used in wire transmission as set forth in my application Number 322,360 above referred to.

It should also be understood that the scanning and shutter combination may be used with the synchronizer of said application #322,360 wherein the energy of the synchronizing impulse is independent of the light intensity of the picture source and in fact may be kept in step with the transmitter even when the picture is cut off.

I claim:

1. A television apparatus comprising a scanning disc having spirally disposed apertures, a shutter mounted on the same axis and having spirally disposed slots whose angular length is less than 360 degrees and means for rotating the disc and shutter at different relative speeds.

2. A television scanning apparatus comprising a disc having apertures arranged in a plurality of spiral convolutions, a cooperating shutter disc having spiral slots of an effective angular width gradually increasing from the inner to the outer end of the spiral, means for rotating the two discs at different relative speeds so as to analyze a television signal.

3. Television apparatus including a rotary scanning member, having a plurality of convolutions of spirally disposed light apertures, and a shutter member having spirally disposed tapering slots, and means for differentially rotating these two members at definitely related speeds.

4. Television apparatus comprising a scanning member having a number of rows of apertures and a shutter member having a plurality of discrete slots, each of which angularly overlaps the adjacent slots, and coacting with the scanning member, and means to rotate these members at relative speeds to expose the whole of no more than one scanning aperture at any instant.

5. A television scanning method wherein a disc having a plurality of convolutions of apertures coacts with a second disc having slots of a radial width substantially greater than that of a single aperture and covering less than 360 degrees of angular length, so that each aperture in turn is exposed thru a single slot, during one complete analysis of a television signal.

6. In television scanning apparatus employing a scanning member having a multispiral arrangement of apertures, a coacting shutter disc with a plurality of taper slots, each of which is less than 360 degrees in angular length.

7. In television scanning apparatus, the combination of a disc having apertures, arranged in a spiral of more than 360 degrees, with a shutter disc having slots arranged in a plurality of spirals, each spiral having an angular length of less than 360 degrees.

8. A television apparatus comprising a rotating scanning member having progressively displaced scanning apertures angularly disposed over more than 360 degrees and in a plurality of complete convolutions, a rotative shutter device adapted to revolve at a speed lower than that of said scanning member and containing a plurality of discrete openings, the angular length of each of which is less than 360 degrees, and means for rotating said scanning member and said shutter in a definite relation to each other.

HAROLD P. DONLE.