

April 16, 1935.

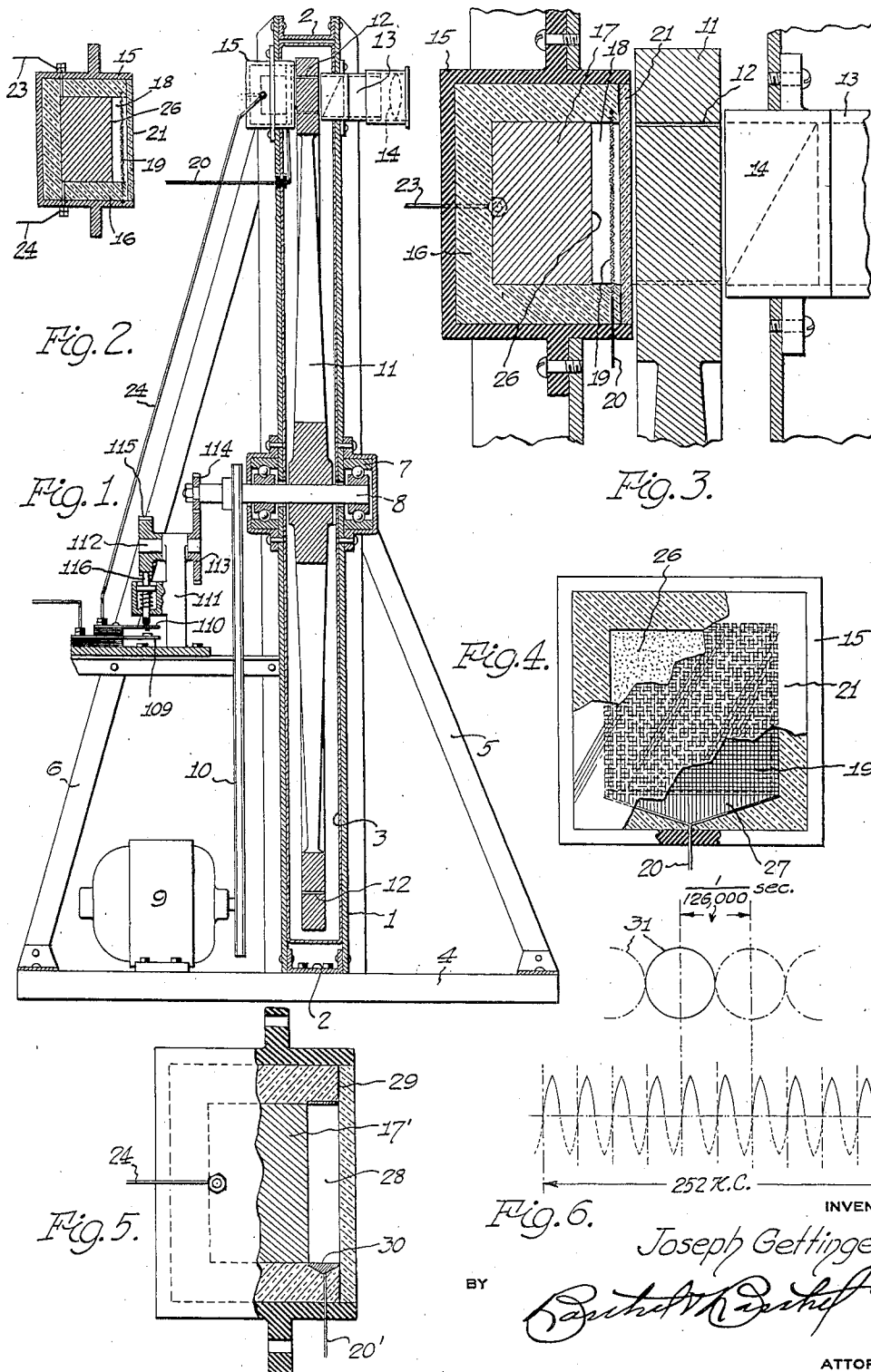
J. GETTINGER

1,998,231

TELEVISION APPARATUS AND SYSTEM

Filed June 16, 1932

6 Sheets-Sheet 1



BY

Joseph Gettinger,
Barthelme & Barthelme

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April 16, 1935.

J. GETTINGER

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TELEVISION APPARATUS AND SYSTEM

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6 Sheets-Sheet 2

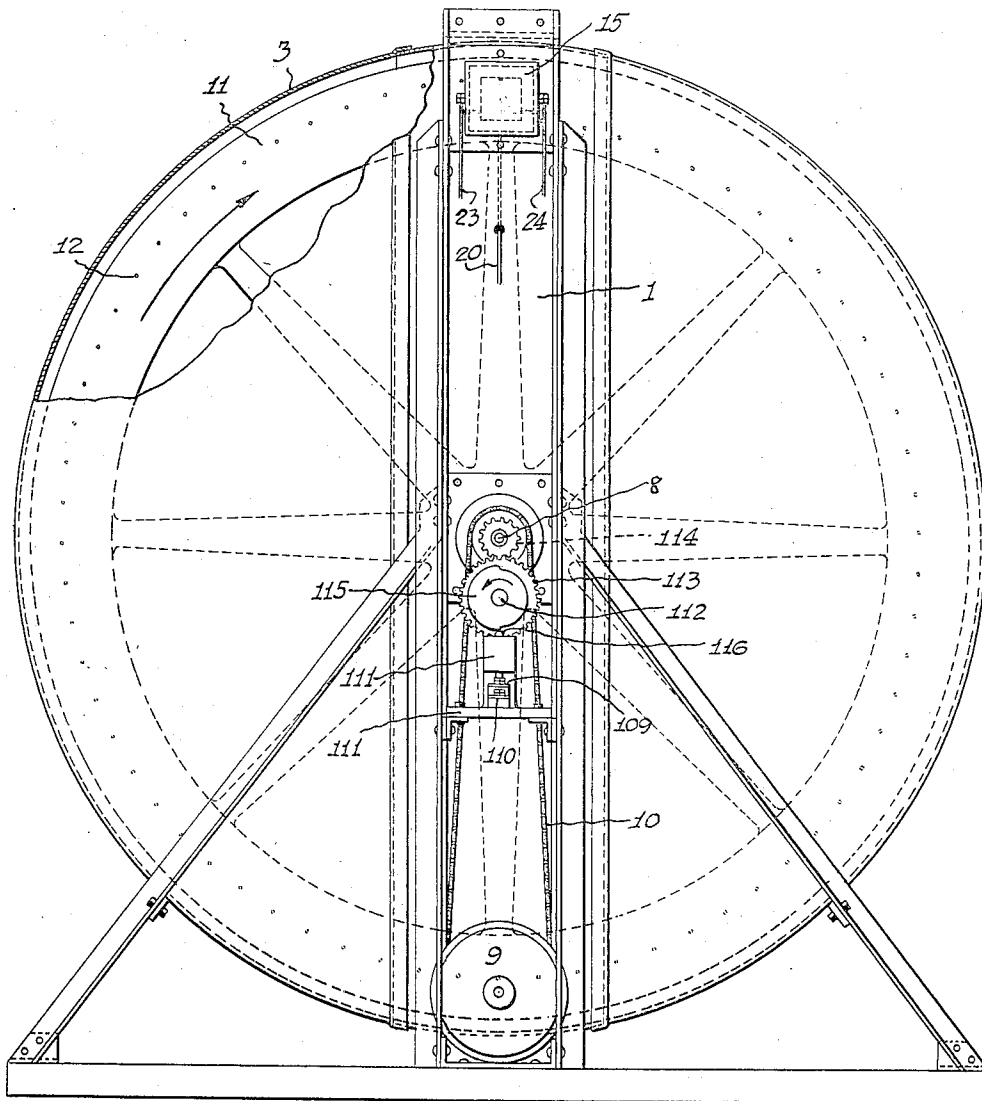


Fig. 7.

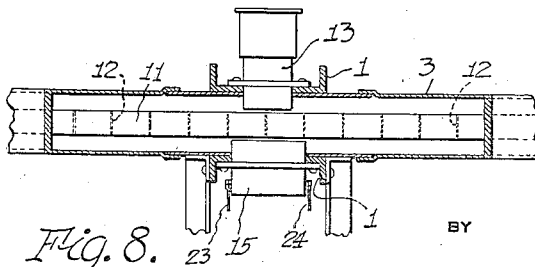


Fig. 8.

INVENTOR

Joseph Gettlinger

By *Barth & Barth*

ATTORNEYS

April 16, 1935.

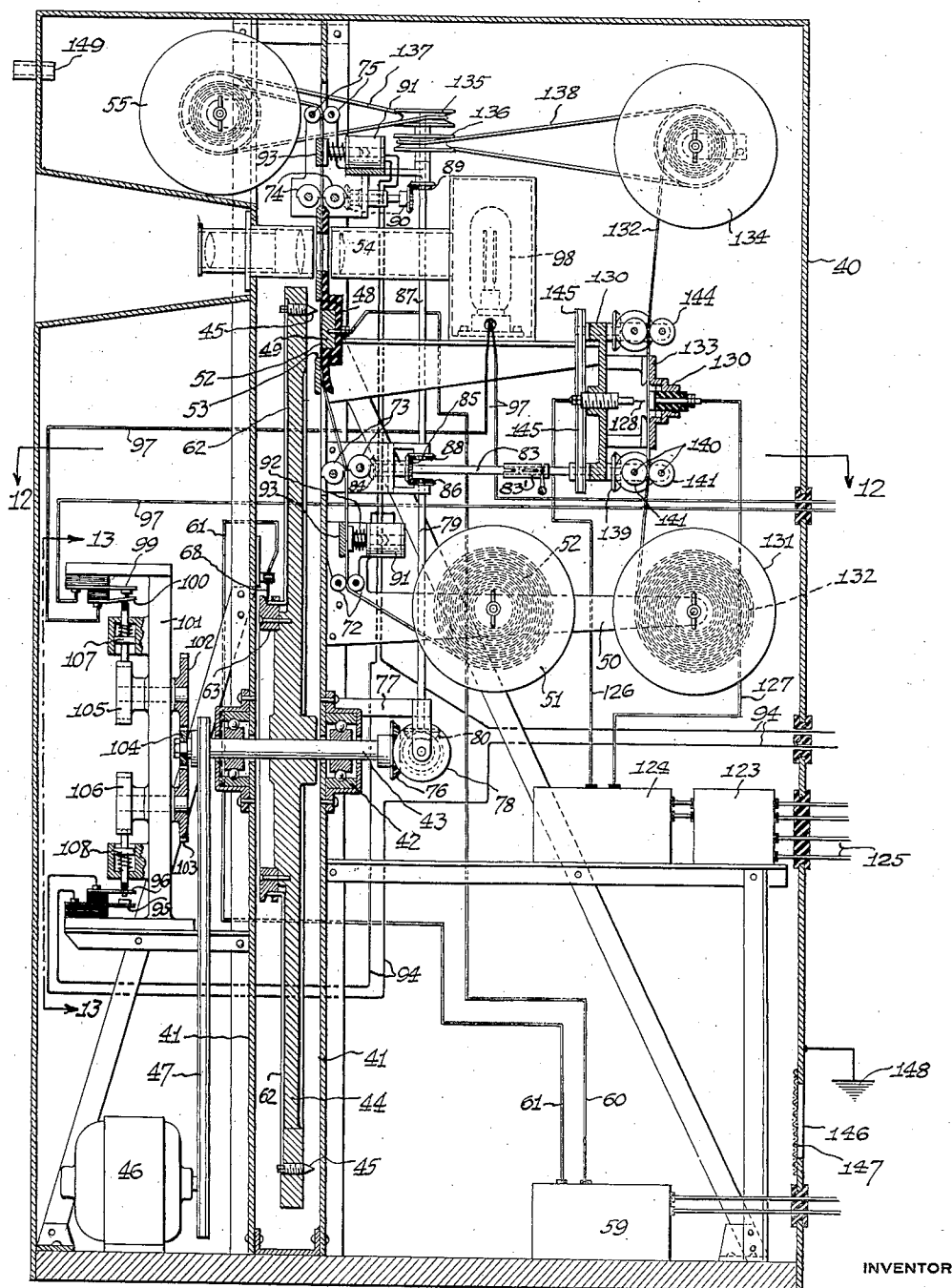
J. GETTINGER

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TELEVISION APPARATUS AND SYSTEM

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6 Sheets-Sheet 3



BY

Joseph Gettinger

Barthelme Barthel

ATTORNEYS

April 16, 1935.

J. GETTINGER

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TELEVISION APPARATUS AND SYSTEM

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6 Sheets-Sheet 4

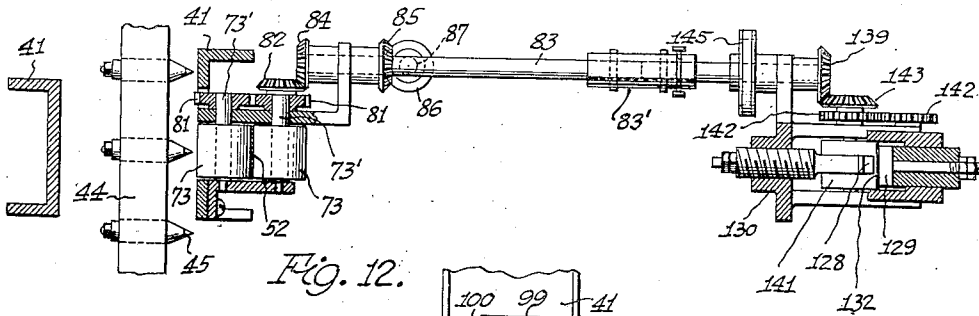


Fig. 12.

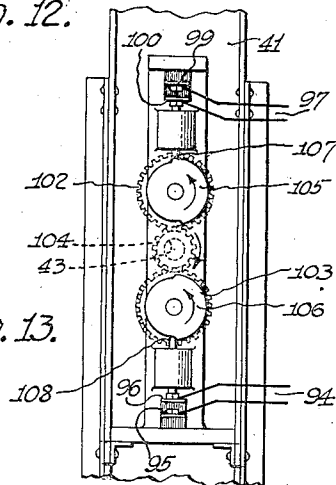


Fig. 13.

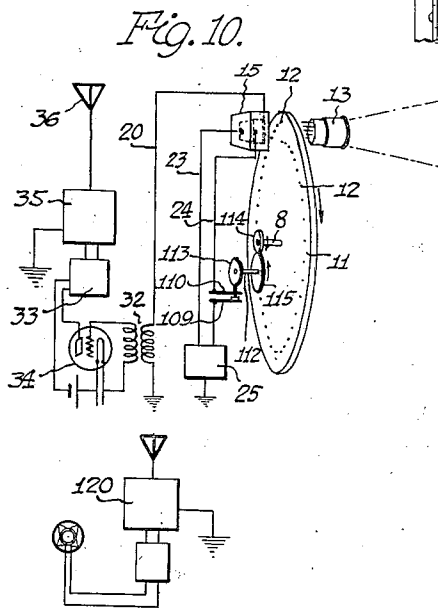


Fig. 10.

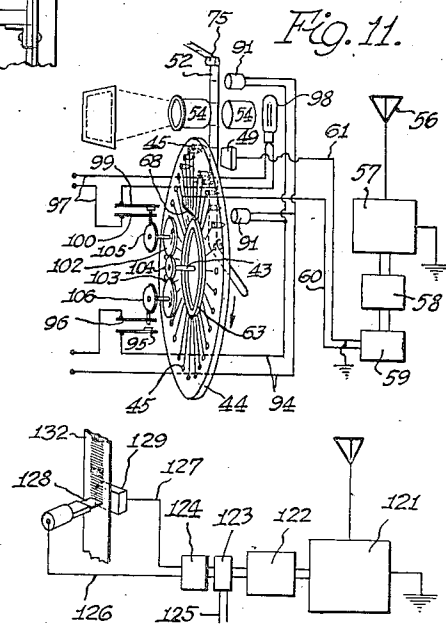


Fig. 11.

INVENTOR

Joseph Gettinger

BY

Robert M. Rietel

ATTORNEYS

April 16, 1935.

J. GETTINGER

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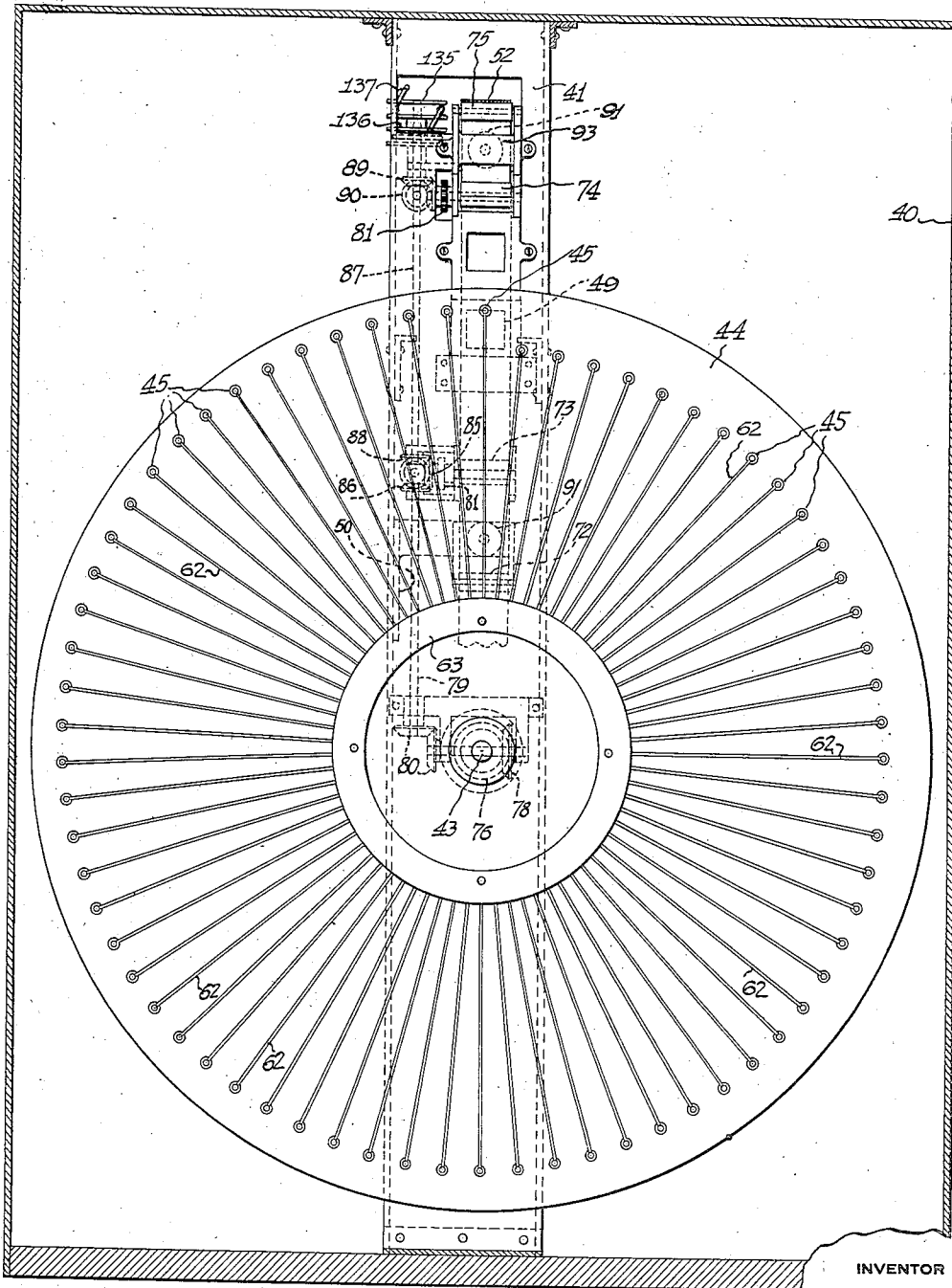


Fig. 14.

BY

Joseph Getfinger,

Barthel & Barthel

ATTORNEYS

April 16, 1935.

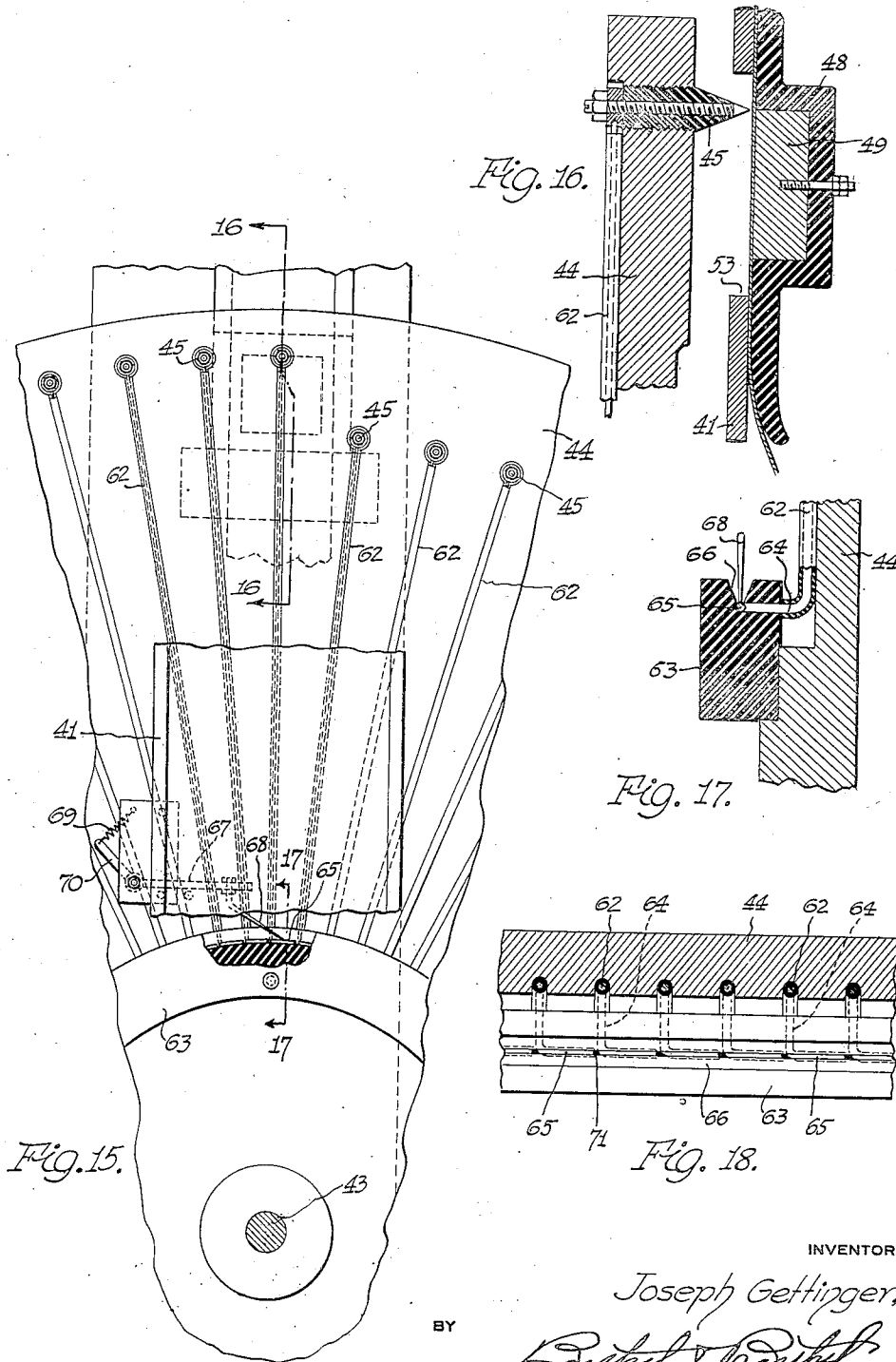
J. GETTINGER

1,998,231

TELEVISION APPARATUS AND SYSTEM

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6 Sheets-Sheet 6



INVENTOR

Joseph Gettinger,

BY

Barthel & Barthel

ATTORNEYS

UNITED STATES PATENT OFFICE

1,998,231

TELEVISION APPARATUS AND SYSTEM

Joseph Gettinger, Detroit, Mich.

Application June 16, 1932, Serial No. 617,549

6 Claims. (Cl. 178—6)

The present invention pertains to a novel television apparatus and system, either wired or wireless, and the principal object is to provide successive, complete images rather than a scanned image at the receiving end. In keeping with this general object, the apparatus is adapted to produce film exposures in the receiving apparatus, and although these exposures are produced by scanning in synchronism with a scanning disk at the transmitter, they are projected as complete images in rapid succession upon a screen after the fashion of a motion picture projector. The rate of projection in motion picture work is approximately sixteen exposures per second, and accordingly, the device of this invention is adapted to make a similar number of exposures per second and throw them upon the screen.

Another object of the invention is to do away with the shutter which has hitherto been found necessary during shifting of the film in motion picture work. According to the invention, the apparatus is so constructed that the photoelectric cell at the transmitter received no current while the film in the receiving set is being shifted, and at the same time the projector lamp is extinguished, so that no light is projected through the film and no shutter is therefore necessary during shifting of the film.

Another object of the invention is to dispense with synchronous motors in the transmitting and receiving sets. In the receiving set, the film actuating mechanism is permanently timed and synchronized with the film developing means, and the speed of the latter is regulated from an adjustable speed motor until a clear image is projected.

The film developing means is an electrical apparatus adapted to scan areas of the film with electrical discharges which vary in their properties according to the light received at the photoelectric cell. The film is of such a nature as to react to these discharges to reproduce thereon the nature of light impressed upon the cell. The film areas thus exposed to the electrical discharges are instantaneously developed and, as already indicated, projected upon a screen, from a projector embodied in a receiving instrument.

Still another object of the invention is to produce a concurrent sound record with the film record. Ordinarily, the event being broadcast by television may also be broadcast visually by radio, but since the picture film is adapted to be used repeatedly, it is desirable to have a sound record for such repeated showings. Accordingly, the receiving instrument contains a sound record-

ing apparatus which is sensitive to a radio broadcasting station at the television transmitting station. The sound recording instrument may be used at the option of the owner. For recording the sound, there is employed a sound film sensitive to electrical discharges somewhat similar to those already described and which is driven in synchronism with the picture film in the receiving instrument. In making a subsequent showing of the picture film, both the picture and sound films are obviously run synchronously through a projector and a sound reproducing machine respectively.

The invention is fully disclosed by way of example in the following description and in the accompanying drawings, in which—

Figure 1 is a vertical section of the camera;
Fig. 2 is a plan section of the photoelectric cell;
Fig. 3 is an enlarged detail in the same plane as Figure 1;

Fig. 4 is a plan section of the photoelectric cell, showing several planes thereof;

Fig. 5 is a vertical section, partly in elevation, of a modified form of photo cell;

Fig. 6 is a diagram showing the relation between the current frequency and the scanning disk speed;

Fig. 7 is an elevation of the camera, showing particularly the scanning disk and the means for driving the same;

Fig. 8 is a detail plan section of the scanning disk and camera parts;

Fig. 9 is a vertical section of the receiving instrument;

Fig. 10 is a diagram of the camera and transmitter;

Fig. 11 is a diagram of the receiving set;

Fig. 12 is a detail plan section on the line 12—12 of Figure 9;

Fig. 13 is a detail elevation in the plane 13—13 of Figure 9;

Fig. 14 is an elevation of the contact disk of the receiving instrument;

Fig. 15 is a detail thereof, partly in section;

Fig. 16 is an enlarged detail on the line 16—16 of Figure 15;

Fig. 17 is an enlarged detail on line 17—17 of Figure 15; and

Fig. 18 is a developed plan section of the commutator.

Reference to these views will now be made by use of like characters which are employed to designate corresponding parts throughout.

In Figure 1, the camera or instrument which makes the first impression is shown as compris-

ing a housing consisting of a pair of spaced frame members 1 secured together by channel members 2. The frame thus formed supports a cylindrical light-proof casing 3. This structure rests on a base 4 and is maintained in upright position by suitable props 5 and 6.

To the centers of the plates 1 are secured bearings 7 in which is journaled a shaft 8. An electric motor 9 is mounted on the base and is connected to the shaft by a chain 10 or other suitable driving means. On the shaft 8 and within the liner 3 is secured a scanning disk 11 formed with a spiral series of apertures 12 therethrough.

In one of the plates 1 and opposite the apertures part of the scanning disk is mounted a light tube 13 which may be equipped, if desired, with a lens system 14. The light tube is exposed to the object whose image is to be transmitted, and this object may be illuminated in a manner well known in the television art.

The opposite disk 1 supports a photoelectric cell positioned to receive the light rays which are passed from the tube 13 through the apertures 12. The cell is enclosed in an insulating housing 15 secured to the plate 1 and includes a heavy insulating lining 16 within the housing. Into the housing is fitted a block 17 of pure metal and of substantially cubical formation, leaving however a vacuum space 18 adjacent the disk 11. A screen 19 is stretched across the vacuum space and is joined by a conductor 20 to the amplifier of the broadcasting apparatus as will presently appear. The forward or open face of the vacuum space 18 is sealed by a glass plate 21 adapted to transmit light rays from the apertures 12 without distortion. In this connection it is to be noted that the plate 21 consists of glass which is so placed as to have a grain parallel to the apertures 12. Also, the apertures 12 have a length at least sixteen times their diameter, for optical efficiency and accuracy in the passage of the light beam therethrough.

The face of the block 17 at the vacuum space 18 is coated with an alkali metal 26 whereby emissions are delivered therefrom when a light beam is received during a negative current charge in the block. A triangular shaped conductor 27 is mounted at that side of the space 18 toward which the disk 11 rotates. This block is the collector of the emissions and transmits them to the conductor 20 as shown in Figure 4. The conductor 27 is secured to the screen 19, and the triangular shape thereof is conducive to perfect transmission of the emissions over the circuit, as will be described in another application.

In Figure 5 is shown a modified form of photoelectric cell wherein the screen is replaced by a gas-filled space 28 serving as a part of the system for conducting the emissions delivered from the metal block 17. Around the border of this space is mounted a frame 29 having an enlarged side 30 of triangular cross section, connected to the conductor 20 leading to the amplifier. The part 30 is positioned at the side of the space toward which the scanning disk rotates and functions in the same manner as the member 27 of Figure 4.

Figure 6 illustrates diagrammatically the travel of the apertures 12 across the photoelectric cell. Although the light passes in lines across the cell, spots of light 31 are illustrated in tangential relation in Figure 6. In the time that a spot of light travels a distance equal to its diameter, it is desired that at least two impulses occur in the current passing through the cell, in order that the line of light may be finally subdivided in the

amplifier and broadcasting circuits and picked up in the same state of subdivision at the receiving instrument, as will presently appear. In the apparatus shown, a spot of light traverses its diameter in 1/126 thousandth of a second, and consequently the frequency of the current is 252 kilocycle per second.

It is also to be noted that the spacing of the apertures 12 in the disk 11 is only slightly less than the width of the sensitive part of the photoelectric cell, so that a given aperture will not commence its travel across the cell appreciably before the preceding aperture has completed its travel across the cell. The spacing of successive apertures radially of the disk is slightly less than the diameter of the apertures to afford a slight overlapping of light paths across the tube 13 and thus assure complete covering of the object to be transmitted.

The current established in the conductor 20 by the emissions of the cell is induced by means of coils 32 into an amplifying system 33, the first stage of which is indicated by the numeral 34. From the amplifying system, the current is delivered to a grounded transmitter 35 and thence to an aerial 36 from which it is broadcast.

The receiving instrument is built in a housing 40 and includes a pair of supporting plates 41 carrying a pair of roller bearings 42 in which is journaled a shaft 43. On the shaft is mounted a disk 44 carrying a spiral series of electrodes 45 spaced in the same angular sequence as the apertures 12 of the disk 11. A motor 46 mounted in the housing drives the shaft through a chain 47.

One of the plates 41 supports an insulating housing 48 in which is mounted an electrode block 49 adapted to be scanned by the free points of the spiral series of electrodes 45. An arm 50 extending from the plate 41 supports a reel 51 on which is wound a film 52. This film is passed between the housing 48 and the supporting plate 41 and is exposed to the electrodes through an aperture 53 in the plate. The film is then carried through a projector 54 and is finally wound on a take-up reel 55.

The radiations from the aerial 36 are received, as shown in Figure 11, by an aerial 56 connected successively to a receiving set 57, amplifying system 58 and a high voltage transformer 59 such as a Tesla coil. With reference again to Figure 9, the outward terminals of the transformer 59 are connected respectively to the electrode 49 by a conductor 60 and to a commutator system at the disk 44, presently to be described, by a conductor 61. High voltage discharges corresponding to the emissions from the photoelectric cell are thus produced from the electrodes 45 to the block 49 and through the film, producing on the latter successive pictures while the film is stopped intermittently at the block 49. The film is advanced intermittently to the projector 54 and wound up on the spool 55, so that the reception is in the form of a motion picture rather than a scan picture as in the present television devices.

With reference now to the details of the electrode disk 44, each electrode 45 has a conductor 62 extending therefrom to an insulating ring 63 mounted concentrically on the disk. The inner ends of the conductors are first directed into the ring as at 64 and then circumferentially of the ring, as at 65, beneath a peripheral groove 66 cut in the ring. A bell crank lever is mounted on one of the plates 41, and to one of its arms 67 is secured a contact member 68 beneath which the segments 65 are adapted to rotate in sliding con-

tact therewith. A spring 69 draws the other arm 70 of the bell crank upwardly and thus holds the contact 68 in resilient engagement with the segments 65. The segments, moreover, are insulated from each other by means of mica inserts 71. The conductor 61 from the transformer 59 is joined to the contact member 68 as may be seen in Figure 9.

The film 52 unwinding from the reel 51 passes first between a pair of guide rollers 72 and then through a pair of 180° cams 73. These cams are so positioned relatively to each other that the high points thereof are concurrently in engagement with opposite sides of the film 52, or during an interval of 180° of rotation. During the remaining half of each revolution, the film is relieved of any driving action by the cams. On leaving the projector 54, the film passes between a pair of similar cams 74 and then through a final pair of guide rollers 75, from which it is wound up on the reel 55. The cams 74 are in synchronism with and operate in the same manner as the cams 73, cooperating therewith in intermittently moving the film during actuation thereof by the mechanism which will now be described.

One of the ends of the shaft 43 carries a bevel gear 76 adjacent which is a bracket 77 supporting another gear 78 meshing with the gear 76. A vertical shaft 79 carries at one end a bevel gear 80 meshing with the gear 78.

The shafts 73' (Figure 12) on which the cams 73 are mounted carry meshing gears 81, and one of these shafts carries a bevel gear 82. A horizontal shaft 83 suitably journaled in the housing carries a bevel gear 84 meshing with the gear 82 and still another gear 85 meshing with a beveled gear 86 on the upper end of the shaft 79. Another vertical shaft 87 is mounted in line with the shaft 79 and carries at its lower end a gear 88 meshing with the gear 85. The upper end of this shaft carries a bevel gear 89 which is operatively connected to the cams 74 through gearing 90 similar to that which extends from the gear 86 to the cams 73. Thus, a gear drive is established from the shaft 43 to both pairs of cams 73 and 74, operating the latter in the manner already described.

At selected points along the length of the film 52 between the spools 51 and 55 are mounted devices for holding the film in a fixed and taut condition while it is stationary. This means consists of two or more electro-magnets 91 having spring pressed plungers 92 which normally press the film against stops 93 when the magnets are de-energized. The conductors 94 which supply current to the magnets pass through a switch consisting of a fixed contact 95 and a movable contact 96. Similarly the conductors 97 for supplying current to the projector lamp 98 pass through a switch comprising a fixed contact 99 and a movable contact 100.

The switches are mounted on a frame piece 101 carrying a pair of gears 102 and 103 meshing with a pinion 104 on the shaft 43. The gears 102 and 103 rotate with cams 105 and 106 acting on spring pressed plungers 107 and 108 adapted to close the normally open switches previously described. It will be seen that the switches are oppositely disposed, that is, the magnet switch is open while the lamp switch is closed and vice versa. The cams 105 and 106 are so related to the switches and to the film feeding gear that the magnet circuit is open to release the film while the latter is being fed by the cams 73 and 75, at which time the lamp circuit is open.

Conversely, when the film is not moved by the cams 73 and 75, the magnet switch 95, 96 is open to permit the plungers 92 to hold the film against the stops 93, at which time the lamp circuit is closed.

It is not necessary to synchronize the motor 46 with the motor 9 as in conventional television apparatus. A suitable adjusting means on the motor 6 is utilized to vary the speed thereof until a clear picture is projected. The film feeding means is timed with and geared directly to the disk, so that no separate adjustment thereof is required.

The commutator mechanism including the segments 65 and the contact blade 68 permits flow of current only to the particular electrode 45 which is travelling across the film at any given instance. As already indicated, the portion of film at the block 49 is developed by the action of the spark discharge therethrough, intensified by the high voltage coil 59. This action causes a chemical and thermal action on the film, and the character of the film is such that by this action a picture is instantly produced thereon.

More specifically this film is composed of a material of an absorbent character. Such material may consist of cellulose similar to the ordinary celluloid film or a product made from cellulose. This film is impregnated with glycerine which owing to its hygroscopic and hydrolizing properties has a certain moisture content whereby said film is rendered conductive to a spark discharge of a predetermined voltage and current. Other substances having similar chemical characteristics may be substituted for the glycerine.

Incorporated with the glycerine are certain dye or coloring substances normally opaque to light. The passage of a spark discharge across and through this film alters the chemical and physical structure of both glycerine and the dye or coloring matter in accordance with the varying intensity of the discharge which is determined by the intensity of light impinging on the photo-electric cell.

Further, this dye matter when subjected to a spark discharge of varying intensity is thereby rendered more or less transparent due to a chemical change in the glycerine and its reaction upon the dye or coloring matter. This action instantaneously conditions said film whereby successive portions of said film are permanently altered chemically and physically to permit more or less light to be transmitted therethrough. Said film is then ready for immediate passage through the picture projector.

The physical dimensions of the film is such as to provide a high resistance which permits the use of a voltage of high intensity and low current flow in order that each peak spark discharge shall only affect a minute portion of the film at any one instant.

The value of this resistance is such as to develop a varying quantity of heat which is proportional to the varying intensity of spark discharge which effects a chemical change in the glycerine whereby acetic acid is produced in varying amounts per unit of time.

The reaction of this acid upon the pigment of the dye substance (which is normally opaque) together with the effect of the ozone produced by the spark discharge and its intense oxidation property affects both the glycerine and dye substance causing a permanent change therein. This change is continuous and affects the transparency of the dye substance in varying degrees

which permits the transmission of more or less light therethrough and which is in correspondence with the intensity of the light variation impinging on the photo-electric cell.

5 The temperature and heat developed by the spark discharge is of instant duration and of high frequency and said heat is wholly absorbed in the chemical reaction. Thus the material of the film itself and its inherent transparency remains unchanged.

10 The resistance of the film is determined by the degree of moisture content in the glycerine, and upon this depends the voltage and current required.

15 In this manner a film is produced having a texture similar to that of a photographic negative in that varying degrees of transparency between the high lights and deep shadows thereof are produced by the progressive movement of the electrode across the film whereby corresponding changes in the dye matter occur in accordance with the varying intensity of the spark discharge.

20 While the above results are obtained by the spark discharge through a conductive film similar results may be obtained electrostatically from a glycerine-color combination layer applied to the surface of a transparent film. This film is of a high insulating character and in this capacity provides a dielectric between the electrode and block, these constituting the plates of a condenser.

30 Varying potentials applied across said electrode and block cause a change in the glycerine-color layer in a manner similar to that caused by a spark discharge through the conductive impregnated film. Moreover, the impregnated film may contain a plurality of colors which are either eradicated or toned selectively in accordance with characteristics of the spark discharge determined by the color of light impinging on the photo electric cell. The film is continuously impregnated and the pictures are localized thereon by the intermittent motion of the film.

35 If the apparatus is intended to make, for example, fifteen exposures per second, the disk 44 is geared to make thirty revolutions per second, since the apparatus is rendered optically and photographically inactive during alternate rotations of the disk 44 to permit shifting of the film between exposures. It is evident that the photo-electric cell must likewise be inactive during corresponding, alternate revolutions of the disk 11, and this action is accomplished for both disks by the mechanism shown in Figures 1 and 10. The conductor 24 in the circuit between the power source 25 and the photoelectric cell contains a normally open switch comprising a fixed contact 109 and a movable contact 110. Adjacent these contacts is a bracket 111 supporting a shaft 112 which carries at one end a gear 113 meshing with a pinion 114 on the shaft 8. The other end of the shaft 112 carries a cam 115 adapted to move a spring pressed plunger 116 into engagement with the movable contact 110 to close the circuit. This cam is constructed in such a manner as to hold the switch closed on alternate revolutions of the shaft 8 and permitted to open on the intervening revolutions. Inasmuch as this switch controls the emanations from the transmitter 35, it also determines the operative and ideal paths of the receiving instrument.

70 In transmitting an animated scene by this apparatus, a conventional radio outfit may be used in conjunction therewith for transmitting the accompanying sounds. The sound would ordinarily lag behind the projection of the scene from

the projector 54 due to the difference between the speeds of sound and light in travelling from the scene to the transmitting apparatus. This lag is compensated to a great extent by the interval of time required for the travel of the exposed film section from the block 49 to the projector 54. It will be seen in Figure 9 that this distance is approximately twice the length of a film exposure, so that if the receiver makes fifteen exposures per second and the disk 44 turns thirty times per second, the interval between exposure and projection will be two-thirtieths of a second.

The film is a permanent record and may be used repeatedly, in which case an accompanying sound record would be desirable. A sound record may be made concurrently with the first film record, at the option of the owner of the receiving set, and mechanism for this purpose is therefore provided in the receiving set. A radio broadcasting station 120 is erected at the scene to be reproduced, as shown in Figure 10, and the message therefrom may be picked up by a receiver 121 associated with the receiving set as illustrated in Figure 11. The receiver 121 is connected to an amplifier 122 and then to a current interrupter 123 and a high frequency transformer 124 similar to the member 59 of Figure 9. The interrupter has a power input 125 as shown in Figures 9 and 11. The output lines 126 and 127 from the transformer 124 lead respectively to a knife-edge electrode 128 and an opposed surface electrode 129 supported in a bracket 130. The arm 50 carries a reel 131 on which is wound a sound film 132. The film is drawn through a guide 133 across the face of the electrode 129 and wound on another reel 134 suitably mounted in the housing. The upper end of the shaft 29 carries a pair of pulleys 135 and 136 connected respectively by belts 137 and 138 to the reels 55 and 34 so that the latter are turned together and in definite relation to the disk 44.

The shaft 83 is extended through the bracket 130, as shown in Figure 12, and carries a bevel pinion 139 adjacent the guide 133. A pair of shafts 140 are journaled in the bearing and carry rollers 141 engaging opposite sides of the film 132. The shafts also carry meshing gears 142, and one of the shafts carries still another bevel pinion 143 meshing with the pinion 139, whereby the friction rollers 141 are driven from the shaft 83. A similar shaft and roller mechanism indicated generally by the numeral 144 in Figure 9 is mounted in the upper part of the bracket 130 and connected to the shaft 83 by a sprocket chain 145. The sound film is thus propelled in synchronism with the picture film 52. This apparatus may be cut out, when desired, by means of a clutch 23' in the shaft 83.

By reason of the interrupter 123, an intermittent current is delivered to the electrodes 128 and 129, and the transformer 124 causes this current to produce high frequency and high voltage electrical discharges through the film 132. Variations in the intensity of the discharges are produced by variations in the sound at the source and in turn result in variations in the impressions or reactions produced on the film 132. The film may then be passed through a suitable sound reproducer to reproduce the original sound simultaneously with a showing of the film 52.

70 The casing 40 of the receiving instrument requires circulation of air therethrough because of the ozone and other chemical products produced by the electrical discharges upon the films and also for cooling purposes. Accordingly, an open-

ing 146 is made near the bottom of the housing and covered with a screen 147 to prevent interference, the housing being grounded as at 148. A suction tube 149 is inserted at the upper end of the opposite wall of the housing and is connected to any suitable suction apparatus, whereby a circulation of air through the housing is produced.

It will be readily understood that the system and apparatus described herein may be used in a wired circuit as well as in a radio circuit. An example of the utility of the invention in a wired circuit is in the sending of photographs over telegraph wires in newspaper work, and in this connection a photograph may be transmitted by means of the invention in a small fraction of the time ordinarily required.

Although specific embodiments of the invention have been illustrated and described, it will be understood that various alterations in the details of construction may be made without departing from the scope of the invention, as indicated by the appended claims.

What I claim is:—

1. A television receiver comprising means for receiving current impulses from a photo-electric cell, means for supporting a film, means for converting the said impulses into electrical discharges and for passing said discharges through said film in a two-dimensional pattern, a projector, and means for moving said film intermittently through said projector, electro-magnetic holding means for engaging said film between movements thereof, and switching means operable by said electrode disk for releasing said holding means from said film during movements of the latter.

2. A television receiver comprising means for receiving current impulses from a photo-electric cell, means for supporting a film, means for converting the said impulses into electrical discharges and for passing said discharges through said film in a two-dimensional pattern, a projector, cams adapted to engage opposite sides of the film and to feed the film intermittently to said projector, said cams being geared to said electrode disk, electro-magnetic holding means for engaging said film between movements thereof, and switching means operable by said electrode disk for releasing said holding means from said film during movements of the latter.

3. A television receiver comprising means for receiving current impulses from a photo-electric cell, means for supporting a film, means for converting said impulses into electrical discharges and for conducting said discharges through said film in a two-dimensional pattern, said film comprising a glycerine content having a color medium therein susceptible to change due to a varying electrical discharge to permanently alter the tone of said color medium in accordance with the intensity of the electrical discharge, a projector, and means for moving said film intermittently through said projector, electro-magnetic holding means for engaging said film be-

tween movements thereof, and switching means operable by said electrode disk for releasing said holding means from said film during movements of the latter.

4. A television receiver comprising means for receiving current impulses from a photo-electric cell, means for supporting a film, means for converting said impulses into electric discharges and for conducting said discharges through said film in a two-dimensional pattern, said film comprising a glycerine content having a color medium therein susceptible to change due to a varying electrical discharge therethrough which permanently alters the tone of said color medium in accordance with the intensity of the electrical discharge, a projector, cams adapted to engage opposite sides of the film and to feed the film intermittently to said projector, said cams being geared to said electrode disk, electro-magnetic holding means for engaging said film between movements thereof, and switching means operable by said electrode disk for releasing said holding means from said film during movements of the latter.

5. A television receiver comprising means for receiving current impulses from a photo-electric cell, means for supporting a film, means for converting said impulses into electrical discharges and for conducting said discharges through said film in a two-dimensional pattern, said film comprising a hygroscopic medium having a color medium therein susceptible to change due to a varying electrical discharge to permanently alter the tone of said color medium in accordance with the intensity of the electrical discharge, a projector, and means for moving said film intermittently through said projector, electro-magnetic holding means for engaging said film between movements thereof, and switching means operable by said electrode disk for releasing said holding means from said film during movements of the latter.

6. A television receiver comprising means for receiving current impulses from a photo-electric cell, means for supporting a film, means for converting said impulses into electric discharges and for conducting said discharges through said film in a two-dimensional pattern, said film comprising a hygroscopic medium having a color medium therein susceptible to change due to a varying electrical discharge therethrough which permanently alters the tone of said color medium in accordance with the intensity of the electrical discharge, a projector, cams adapted to engage opposite sides of the film and to feed the film intermittently to said projector, said cams being geared to said electrode disk, electro-magnetic holding means for engaging said film between movements thereof, and switching means operable by said electrode disk for releasing said holding means from said film during movements of the latter.

JOSEPH GETTINGER.