

July 14, 1942.

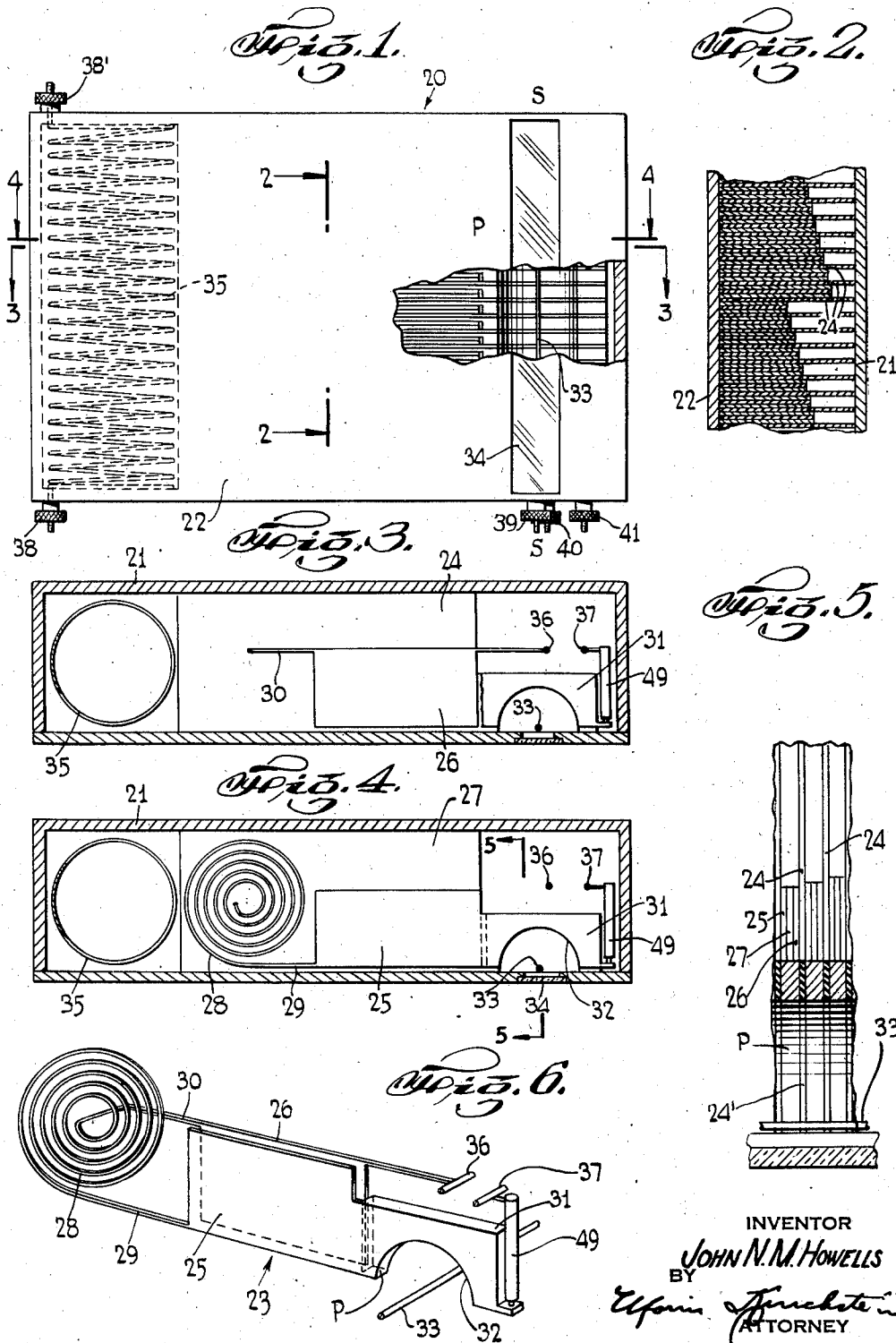
J. N. M. HOWELLS

2,289,363

TELEVISION SYSTEM AND METHOD

Filed March 27, 1940

3 Sheets-Sheet 1



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J. N. M. HOWELLS

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TELEVISION SYSTEM AND METHOD

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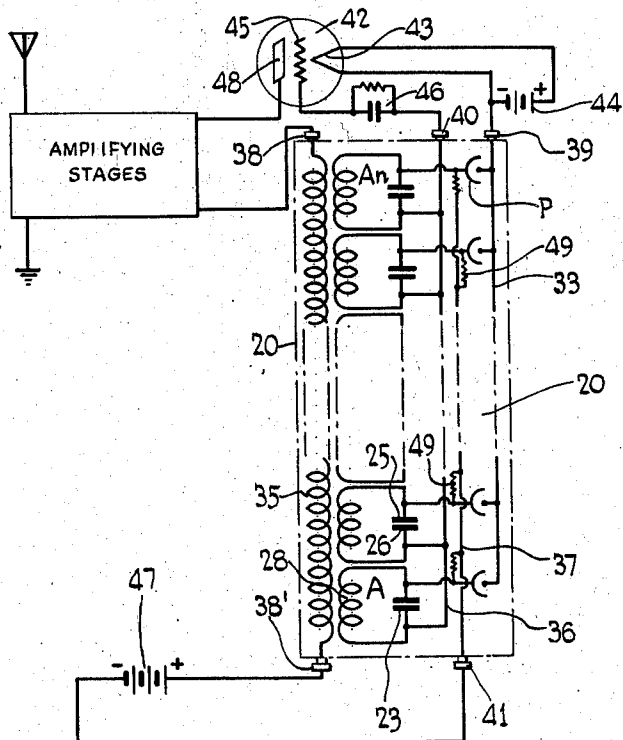
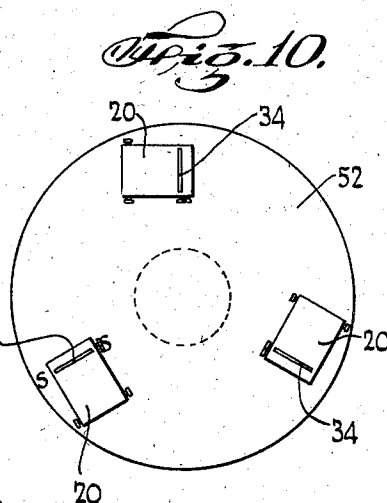
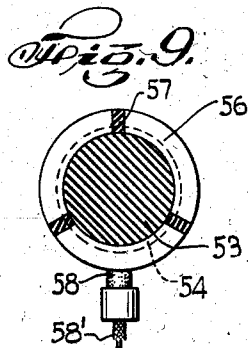
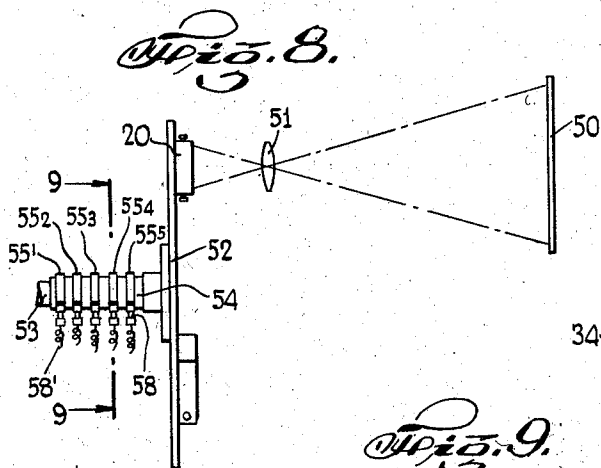


Fig. 7.



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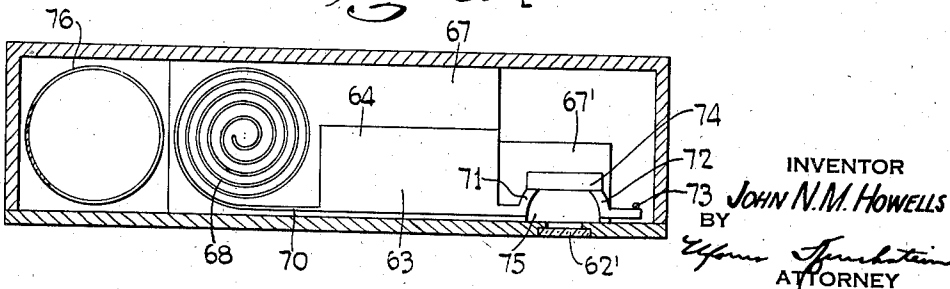
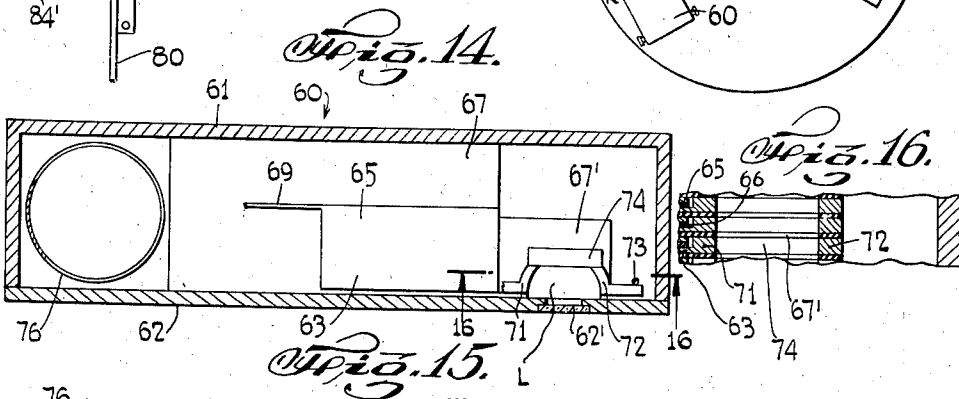
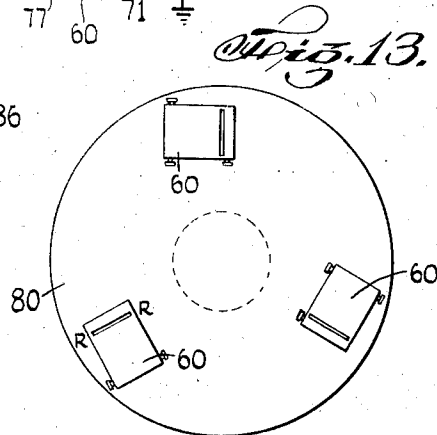
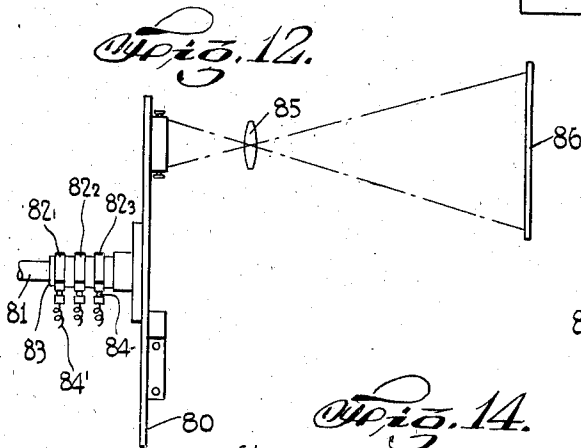
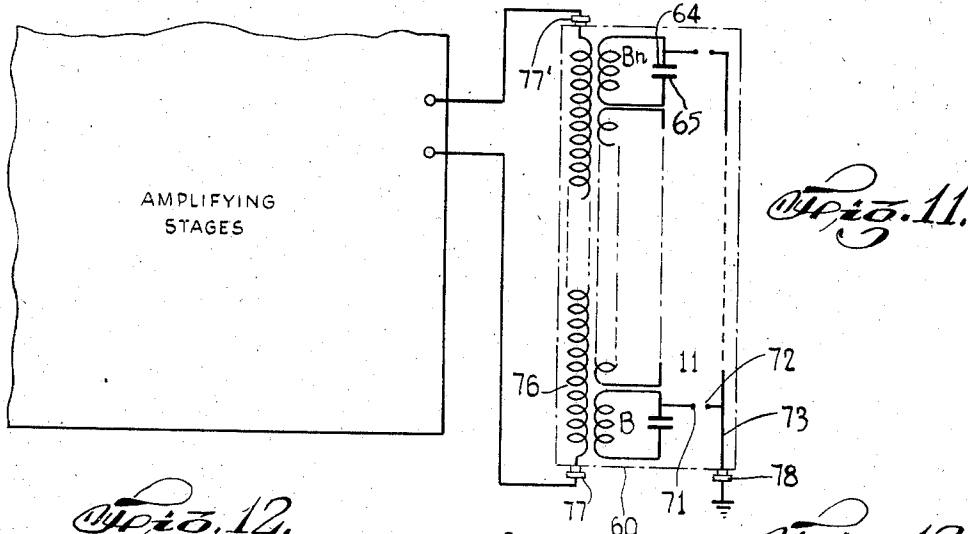
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TELEVISION SYSTEM AND METHOD

Filed March 27, 1940

3 Sheets-Sheet 3



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2,289,363

TELEVISION SYSTEM AND METHOD

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Application March 27, 1940, Serial No. 326,255

17 Claims. (Cl. 178—7.1)

This invention relates to a television system and method. More particularly, the invention relates to a television system which employs radio frequency carrier waves.

One of the objects of my invention is to provide a television system having novel means for scanning and reproducing scenes.

Another object of my invention is to provide highly compact and efficient television scanning and reproducing cells.

A further object of my invention is to provide an improved television system whose parts shall be relatively inexpensive to manufacture and assemble, and which shall be simple to use and shall transmit still or moving scenes with a high degree of fidelity.

Still another object of my invention is to provide a novel television transmitting system having a long transmission range.

Other objects of this invention will in part be obvious and in part hereinafter pointed out.

The invention accordingly consists in the features of construction, combinations of elements, and arrangement of parts which will be exemplified in the construction hereinafter described, and of which the scope of application will be indicated in the claims.

In the accompanying drawings, in which is shown one of the various possible embodiments of this invention,

Fig. 1 is a plan view of a scanning cell constructed in accordance with my invention and having a portion of its cover plate removed in order to show the interior arrangement of various elements thereof;

Fig. 2 is a sectional view taken along the lines 2—2 of Fig. 1;

Figs. 3 and 4 are sectional views taken along the lines 3—3 and 4—4, respectively, and showing different portions of one of the laminar units of which the scanning cell is composed;

Fig. 5 is an enlarged view taken along the line 5—5 of Fig. 4;

Fig. 6 is a perspective view of a laminar unit of the scanning cell shown in Fig. 1;

Fig. 7 is a wiring diagram of a simple television transmitting circuit employing the cell shown in Fig. 1;

Fig. 8 is an elevational schematic view of scanning apparatus employing my scanning cell;

Fig. 9 is an enlarged sectional view taken along the line 9—9 of Fig. 8;

Fig. 10 is a front view of the apparatus shown in Fig. 8;

Fig. 11 is a wiring diagram of a television receiver employing a reproducing cell embodying my invention;

Fig. 12 is an elevational schematic view of reproducing apparatus employing my reproducing cell;

Fig. 13 is a front elevational view of the apparatus shown in Fig. 12;

Figs. 14 and 15 are sectional views through a reproducing cell embodying my invention and showing different portions of one of the laminar units thereof; and

Fig. 16 is an enlarged sectional view taken along the lines 16—16 of Fig. 14.

In accordance with my invention, I provide a scanning cell comprising a plurality of closely spaced elemental photo-responsive areas *P* forming a narrow scanning line *S—S*. Each of these elemental areas is provided with means to associate a characteristic frequency therewith. Such means may comprise a capacitive or inductive reactance or both, electrically connected in a suitable manner with each of the areas *P* and preferably comprises a plurality of laminar units, each including a complete oscillatory circuit and having incorporated therewith an elemental photo-responsive area.

In Figs. 1 to 6 I have shown a scanning cell *20*, embodying my invention, housed in a casing *21* having a cover plate *22*. The scanning cell may comprise a plurality of condensers *23* closely packed together and suitably insulated from each other as by thin layers of mica *24*.

The condensers *23* may be of any type known to the art and preferably comprise two flat layers of metal foil *25* and *26* separated by an insulating layer such as a mica sheet *27*. Condensers of this type may be made extremely thin and are readily assembled into a compact condenser block such as shown in Fig. 1.

At the rear of each of the condensers *23* I may provide a coil *28*, whose ends are attached by leads *29* and *30* to the condenser plates *25* and *26*, respectively, as shown in Fig. 6. The coils *28* may frictionally engage and be supported by the insulating layers *24*.

Each set of condensers *23* and coils *28* thus connected forms an independent auxiliary circuit *A* (see Fig. 7) having a fixed natural resonant frequency which is a function of its inductive and capacitive reactances. I suitably adjust these circuit constants so that each of the auxiliary circuits *A—An* has a different resonant radio frequency.

Although this adjustment may be made by

varying either or both the capacitance or inductance, I prefer to vary the capacitance only, by changing the area of the condenser plates 25 and 26, as this method will permit standardization in the manufacture of the coils 28. The size and shape of the plates 25 and 26 may be readily changed so that a suitable resonant frequency may be assigned to each of the individual auxiliary circuits A—An before assembly of the condenser block. This may be conveniently accomplished by reducing the height of the plates 25 and 26.

The frequencies to which the various auxiliary circuits A—An are tuned should be spread apart sufficiently as, for example, 10 kilocycles, so that they may be readily segregated in a receiving circuit such as that hereinafter described without appreciable distortion.

I may also arrange the various condensers 23 and coils 28 in the housing 21 so as to reduce inductive and capacitive coupling between the circuits A—An having neighboring frequencies and thus further reduce any tendency to distort the transmitted image.

Thus, if 144 auxiliary circuits are employed in transmitting an image five inches high, in the manner hereinafter described, and the frequencies employed range from 10,000 to 11,430 in steps of 10 kilocycles, the laminar units, each comprising a condenser 23 and connected coil 28, may be arranged from front to rear in the housing 21 so that their resonant frequencies are successively stepped in series of twelves in the following order: 10,000; 10,120; 10,240; 10,360; 10,480; 10,600; 10,720; 10,840; 10,960; 11,080; 11,200; 11,320; 10,010; 10,130—11,190; 11,310; 11,430. This arrangement of the auxiliary circuits and variation of the height of the condenser plates 25 and 26 will result in a stepped profile of the condensers 23 in the condenser block such as shown in Fig. 2.

Associated with each condenser plate 25, I may provide a narrow block 31 having a concave surface 32. The block 31 may be integrally formed with the plate 25 as indicated in Fig. 6 and has a depth substantially equal to the depth of the condensers 23. The groove 32 is suitably provided with a thin layer of any well known photo-responsive substance, such as potassium, which emits electrons under the influence of light to provide an elemental photo-responsive area P. The blocks 31 may be spaced from each other by an extension 24' (see Fig. 5) of the mica sheet 24. The extensions 24' are preferably concaved in the same manner as the blocks 31.

The elemental photo-responsive areas are aligned across the width of the scanning cell 20 to form a narrow scanning line S—S.

An electrode 33 of fine wire, insulated from the housing 21 and suitably supported therein, is disposed over the scanning line S—S transversely of the blocks 31 and is adapted to receive electrons emitted from the elemental photo-responsive areas P.

A colorless transparent plate 34 is provided in the cover plate 22 over the scanning line S—S.

Air may be evacuated from the entire interior of the housing or only that portion thereof adjacent the blocks 31 in order to facilitate passage of electrons from the photo-responsive areas P to the wire electrode 33.

A tickler coil 35 may also be provided within the housing 21 and disposed in close proximity

to the coils 28 across the full width of the scanning cell 20.

All the auxiliary circuits A—An may be connected in parallel within the cell 20 as shown in Fig. 7. For this purpose, I may provide wires 36 and 37. The wire 36 may be directly connected to each of the condenser plates 26 and the wire 37 may be connected to each of the condenser plates 25 through a blocking resistor 49.

Suitable terminals 38, 38', 39, 40 and 41 may be provided on the exterior of the housing 21 for the tickler coil 35, the electrode 33 and the wires 36 and 37, respectively.

I may provide any suitable transmitting circuit which is adapted to transmit the plurality of frequencies associated with the elemental photo-responsive areas P, such as, for example, a multi-frequency oscillator or an oscillator modulated by said plurality of frequencies.

In Fig. 7 I have illustrated a simple multi-frequency oscillating circuit adapted to generate and transmit a plurality of frequencies by employing a scanning cell 20 such as that described with reference to Figs. 1 to 6. The electrical symbols enclosed within the dotted lines on said figure represent the elements contained in a scanning cell 20.

The oscillating circuit may comprise a vacuum tube oscillator 42 whose filament is heated by means of a low potential battery 44. The grid 45 of the tube 42 is connected through a grid leak 46, terminal 40 and wire 36 to the condenser plates 26 of each laminar unit. Each of the other condenser plates 25, which are directly connected with their respective associated elemental photo-responsive areas P, is connected through its own resistor 49, wire 37 and terminal 41 to the negative binding post of a high potential battery 47, thus maintaining a suitable negative potential upon the photo-responsive areas. The electrode wire 33 is maintained at a lower potential than the areas P by connection through the terminal 39 to the filament 42.

In order to provide a feed-back from the plate for oscillation, the tickler coil 35 is connected through its terminals 38, 38' between the positive binding post of the plate battery 47 and the plate 48 of the vacuum tube 42. Suitable amplifying stages and an antenna system are also connected in the plate circuit in any well known manner.

In the operation of the circuit illustrated in Fig. 7, when light strikes one of the elemental photo-responsive surfaces P associated with one of the auxiliary circuits A—An, an oscillating circuit will be completed through said auxiliary circuit, photo-responsive area, electrode 33, vacuum tube 42, tickler coil 35 and battery 47 in a manner well known in the art. As the return plate circuit to the filament passes through the elemental photo-responsive cells, the amplitude of the oscillations generated at the frequency of any auxiliary circuit will be dependent upon the degree of energization of the photo-responsive surface associated with said circuit and this, in turn, depends upon the intensity of the light falling on said surface. The amplitude of the oscillations generated at any particular frequency will therefore be a function of the intensity of the light falling on the photo-responsive surface P associated with said frequency.

I also provide means to cause the frequency generated in any auxiliary circuit, A—An, to only be modulated by the photo-responsive area P as-

sociated with said circuit. Such means may comprise the blocking resistances 49 series-connected between each of the photo-responsive surfaces P and the wire 37 which supplies negative potential to said surface. By this construction, the alternating potential generated in each of the auxiliary circuits A—An is applied directly to the photo-responsive surface P associated with it and any effect the alternating potential generated in one auxiliary circuit A—An has on a photo-responsive surface P not associated with it is almost wholly dissipated by passage in series through two blocking resistances 49.

It will thus be seen that I have provided a plurality of parallel auxiliary oscillating circuits A—An having varied natural resonant frequencies wherein the amplitude of the current and voltage flowing in each circuit is a function of the intensity of light falling on an elemental photo-responsive cell associated with that circuit.

It is apparent that if other types of oscillating circuits are used other than that illustrated in Fig. 7, the elements and connections within my scanning cell 20 may be altered, changed or increased to conform to the features and requirements of such alternative circuits without departing from the spirit of my invention.

My novel scanning cell 20 may be employed to scan a scene with the aid of a suitable optical system either by moving the scanning cell relative to the optical system or moving the optical system relative to the scanning cell or by a combination of both of these movements.

In Figs. 8, 9 and 10 I have shown one form of apparatus adapted to employ my novel scanning cell in scanning a scene 50 by rotating a plurality of identical scanning cells 20 relative to a fixed optical system 51.

I may provide a disc 52 fixed at the end of a rotating shaft 53 of insulating material. Equidistantly spaced apart adjacent the periphery of said disc, I may dispose a plurality of scanning cells 20 having their scanning lines S—S identically equidistantly and radially disposed relative to the shaft 53. The path of travel of said scanning lines is suitably disposed relative to the optical system 51 so that the scanning lines S—S, as they are rotated, will traverse an image of the scene 50 cast by the optical system 51 on the scanning disc 52.

Said shaft may be provided with a plurality of split rings 55₁, 55₂, 55₃, 55₄, and 55₅ separated from each other by insulating sleeves 54. Each of said rings may comprise a plurality of electrically conductive sectors 56 equal in number to the number of scanning cells employed and separated from each other by insulating sectors 57.

Electrical connections are provided, in accordance with the circuit shown in Fig. 7, between the terminals 38, 38', 39, 40 and 41 of each scanning cell 20 and a sector on each of the rings 55₁, 55₂, 55₃, 55₄ and 55₅, respectively. Suitable brushes 58 and wires 58' are provided to contact the split rings 55₁, 55₂, 55₃, 55₄, and 55₅ and thereby connect the corresponding terminals 38, 38', 39, 40 and 41 of the cells 20 in the oscillating tube circuit so that each of the rotating scanning cells, while it scans the scene, will be inserted in the transmitting circuit.

The cells 20 should be spaced close enough together and the disc 52 should be rotated at a sufficiently high speed to maintain the illusion of continual vision at the receiver as is well known in the art.

It will thus be seen that when a picture is to

be transmitted by means of my improved cell 20, it is scanned in one direction in time and in the other direction by a complex radio frequency wave comprising a plurality of different fixed radio frequencies and the amplitude of each frequency will continually vary in accordance with the light tone value of the corresponding elemental areas of the scene being transmitted.

As the scanning speed of a television transmitting system employing my invention is relatively low, the carrier frequencies generated by the auxiliary circuits may be of a relatively low order and will therefore have a transmitting range which is limited only by the power of the sending station.

I also provide means for segregating the several frequencies of the complex transmitted wave and resolving them into a visible image. Such means comprises a plurality of closely spaced elemental light emitting areas L forming a narrow reproducing line R—R. Each of these elemental areas is provided with means to associate a characteristic frequency therewith. Such means may comprise a capacitive or inductive reactance or both, electrically connected in a suitable manner with each of the light emitting areas L and preferably comprises a plurality of laminar units, each including a complete oscillatory circuit and having incorporated therewith an elemental light emitting area.

In Figs. 14 through 16 I have shown a reproducing cell 60 embodying my invention and having a construction essentially the same as that shown and described in my scanning cell 20. Said reproducing cell may comprise a casing 61 having a cover plate 62. Housed within the casing are a plurality of condensers 63 of any well known type and preferably comprising a pair of flat condenser plates 64 and 65 separated by a sheet 66 of insulation, such as mica. The condensers 63 are electrically insulated from each other by a sheet of insulation 67, such as mica, and are closely packed together to form a condenser block. Each condenser 63 is provided with a coil 68 which may be disposed at the rear thereof and is connected thereto by leads 69 and 70, as indicated in Figs. 14 and 15. The coils 68 may frictionally engage and be supported by the insulating layers 67.

Each set of condensers 63 and coils 68 thus connected forms an independent auxiliary circuit B (see Fig. 11) having a fixed natural resonant frequency which is a function of its inductive and capacitive reactances. I suitably adjust these circuit constants so that each of the auxiliary circuits B—Bn in the receiver has a natural frequency corresponding to the frequencies generated by the matching circuits A—An in the transmitter. The condensers 63 and coils 68 are so disposed within the casing 61 that each of the receiving circuits B—Bn, corresponding to the respective sending circuits A—An, occupy the same relative position with respect to each other within the casing 61. I prefer to adjust the frequencies of the auxiliary circuits B—Bn by varying the size of the condenser plates 64 and 65 in the same manner as the plates 25 and 26 in the scanning cell 20.

Associated with each condenser plate 64 I provide suitable means for visually indicating the strength of the current induced in each of the auxiliary circuits B—Bn. Such means may comprise a pair of spaced arcuate terminals 71 and 72 of which one terminal 71 may be integrally formed with the condenser plate 64. The other

terminals 72 may be connected in parallel by a wire 73. The sets of terminals 71 and 72, associated with each of the auxiliary circuits B—B_n, have a depth substantially equal to the depth of the condensers 63 and are spaced from each other by means of extensions 67' of the mica sheets 67. A rubber insulating block 74 may also be disposed at the rear of each set of terminals 71 and 72 as shown in Fig. 15 and be suitably attached thereto as, for example, by vulcanization. The extensions 67' are preferably provided with a recess shaped to conform to the space between the terminals 71 and 72.

It will thus be seen that I have provided a narrow reproducing line R—R in the form of a trough 75 which is composed alternately of layers of insulation 67' and aligned elemental light-emitting areas L comprising pairs of terminals 71 and 72.

A colorless transparent plate 62' is disposed in the cover plate 72 over the reproducing line R—R.

Air may be evacuated from the portion of the cell adjacent the trough 75 and a suitable gas introduced which will emit a substantially white luminous light when an alternating current is passed therethrough, as is well known to the art.

A coil 76 may also be provided within the housing 61 and disposed in close proximity to the coils 68 across the full width of the reproducing cell 60.

Suitable terminals 77, 77' and 78 may be provided on the exterior of the housing 61 for the two ends of the coil 76 and the wire 73, respectively.

I may provide any suitable receiving circuit adapted to segregate the plurality of frequencies transmitted in accordance with my invention and actuate the light emitting areas L corresponding to the matching energized light responsive areas P at the transmitter.

In Fig. 11 I have illustrated a simple receiving circuit employing a reproducing cell 60 such as that described with reference to Figs. 14, 15 and 16. The electrical symbols enclosed within the dotted lines on said figure represent the elements contained in a reproducing cell 60.

The receiving circuit comprises the usual amplifying stages which feed an energizing coil 76. The coils 68 of the auxiliary oscillating circuits B—B_n are inductively coupled with the energizing coil 76 so that a high frequency alternating voltage will be induced in each of the auxiliary circuits whose potential is proportional to the amplitude of the matching frequency generated in the auxiliary transmitting circuits A—A_n. The voltage thus applied to the terminal 71 will create aluminous discharge between it and the grounded terminal 72 whose intensity is proportional to the amplitude of the matching frequency at the transmitter.

Many circuits such as, for example, simple, regenerative or oscillating detector circuits might be employed in place of the circuit shown in Fig. 11 which use a reproducing cell comprising a plurality of elemental light emitting means each having a characteristic frequency associated therewith. If a feed-back oscillating circuit is employed, the terminals 71 and 72 of my reproducing cell 60 may be inserted in the plate return circuit in the same manner that the photo-responsive areas P and wire electrode 33 are inserted in the transmitter circuit of Fig. 7.

If such alternative circuits are employed, it is apparent that the elements and connections

within my reproducing cell 60 may be altered, changed or increased to conform to the features and requirements of such circuit, without departing from the spirit of my invention.

In place of the terminals 71 and 72, I may provide other suitable light emitting means such as a fluorescent layer suitably deposited on the transparent plate 62' and locally energized at elemental portions of its length by the potential of terminals associated with each of the auxiliary circuits B—B_n. The fluorescent layer may be located in the plate return circuit in a manner similar to the disposition of the wire electrode 33 in the transmitter circuit of Fig. 7.

The mechanical apparatus, including the optical system, employed in a television receiver embodying my invention should be of the same character as that used at the transmitting end. Accordingly, in the embodiment of my invention herein described, the mechanical apparatus may comprise a disc 80 fixed to the end of a shaft 81 of insulating material whose rotation is synchronized with the rotation of the shaft 53 at the transmitter by any means well known in the art.

Mounted adjacent the periphery of the disc 80 are a plurality of identical reproducing cells 60 equal in number to the number of scanning cells 20 used at the transmitter and having their reproducing lines R—R angularly spaced and disposed relative to each other and the shaft 81 in the same manner as the scanning lines S—S and shaft 53.

Sectoral split rings 82₁, 82₂, and 82₃, similar to the split rings 55, may also be provided and separated from each other by insulating sleeves 83. Three split rings may be provided, one for each connection to the terminals 77, 77' and 78 of the various reproducing cells 60. Each of the split rings 82₁, 82₂, and 82₃ are provided with a pick-up brush 84 and connecting wire 84' to successively insert each of the rotating reproducing cells 60 in the receiver circuit while it is in position to reproduce a scene.

When a televised picture is reproduced by means of my improved cell 60, the reproducing line R—R, connected in the receiving circuit, will appear as a single line having a varying intensity of light along its length corresponding to the varied intensity of the line of the scene being scanned by the complex radio frequency wave and as the line R—R moves with the disc, it will reproduce the televised image, casting it by means of a fixed optical system 85 on a viewing screen 86.

My television system may also be employed to transmit colored pictures by employing colored filter plates in place of the colorless cover plates 34 in successive scanning cells 20. Said filter plates may be colored in complementary colors as is well known in the art so that various scanning cells 20 will transmit the various color components of the scene to be televised. The cover plates in the reproducing cell may also be replaced by filter plates colored in complementary colors to correspond to the colors of the filter plates in the scanning cell.

It will thus be seen that there is provided a system and method by which the several objects of this invention are achieved, and which is well adapted to meet the conditions of practical use.

As various possible embodiments might be made of the above invention, and as various changes might be made in the embodiments above set forth, it is to be understood that all matter herein set forth or shown in the accompanying

drawings is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. A unitary scanning cell adapted to be mechanically moved for scanning, said cell comprising a plurality of closely spaced linearly aligned electrically insulated elemental photo-responsive areas and a plurality of laminar electrical means, each having a characteristic frequency, each of said areas having a different laminar means electrically associated therewith, said laminar means being so connected that the number of external leads taken from said cell for placing all of said means in an electrical television scanning circuit is no greater than the number of leads required to place one of said laminar means in said circuit.

2. A unitary scanning cell adapted to be mechanically moved for scanning, said cell comprising a plurality of closely spaced linearly aligned electrically insulated elemental photo-responsive areas and a plurality of laminar electrical means each having a characteristic frequency, each of said areas having a different laminar means electrically associated therewith, each of said laminar means being substantially coplanar with its associated elemental area, said laminar means being so connected that the number of external leads taken from said cell for placing all of said means in an electrical television scanning circuit is no greater than the number of leads required to place one of said laminar means in said circuit.

3. A unitary television scanning cell adapted to be mechanically moved for scanning, said cell comprising a plurality of electrically insulated adjacently disposed laminae, each of said laminae including an elemental photo-responsive area in a resonant circuit to associate a frequency characteristic of its position to said area, said circuits being connected in parallel within said cell.

4. A unitary television scanning cell adapted to be mechanically moved for scanning, said cell comprising a plurality of electrically insulated adjacently disposed laminae, each of said laminae including an elemental photo-responsive area in a resonant circuit to associate a frequency characteristic of its position to said area, said circuits being connected in parallel within said cell, common means to apply an electric potential to said areas, and means intermediate said common potential applying means and said areas to prevent interference between said circuits.

5. A unitary television scanning cell comprising a plurality of electrically insulated adjacently disposed laminae, each of said laminae including an elemental photo-responsive area in a resonant circuit to associate a frequency characteristic of its position to said area, said circuits being connected in parallel within said cell, common means to apply an electric potential to said areas, and resistance means intermediate said common potential applying means and said areas to prevent interference between said circuits.

6. A unitary television scanning cell comprising a plurality of electrically insulated adjacently disposed laminae, each of said laminae including a pair of parallel insulated electrically conductive plates forming a capacitance and a flat inductance coil interconnecting said plates, an edge of one of said plates having a photo-sensitive area thereon, said coil and said plates forming a resonant circuit to associate a frequency char-

acteristic of its position with said area, the areas of the several laminae being linearly aligned.

7. A unitary television scanning cell adapted to be mechanically moved for scanning, said cell comprising a large number of electrically insulated adjacently disposed laminae, each of said laminae including a different oscillatory means and an elemental photo-responsive area whereby a characteristic frequency is associated with each elemental photo-responsive area, said areas being aligned, a common electrode for said areas, and means disposed wholly within said cell to electrically connect said oscillatory means in parallel whereby the external leads from said cell are reduced to the number of leads required to connect but one of said laminae in an electrical television sending circuit.

8. A unitary television scanning cell adapted to be mechanically moved for scanning, said cell comprising a large number of electrically insulated adjacently disposed laminae, each of said laminae including a different oscillatory means and an elemental photo-responsive area whereby a characteristic frequency is associated with each elemental photo-responsive area, said areas being aligned, the difference between the characteristic frequency of adjacent laminae being greater than the difference between the characteristic frequency of remote laminae so as to reduce coupling between adjacent cells, a common electrode for said areas, and means disposed wholly within said cell to electrically connect said oscillatory means in parallel whereby the external leads from said cell are reduced to the number of leads required to connect but one of said laminae in an electrical television sending circuit.

9. A unitary television reproducing cell adapted to be mechanically moved for reproducing, said cell comprising a plurality of closely spaced linearly aligned electrically insulated elemental light-emissive means and a plurality of laminar electrical means, each having a characteristic frequency, each of said elemental light-emissive means having a different laminar means electrically associated therewith, said laminar means being so connected that the number of external leads taken from said cell for placing all of said means in an electric television reproducing circuit is no greater than the number of leads required to place one of said laminar means in said circuit.

10. A unitary television reproducing cell adapted to be mechanically moved for reproducing, said cell comprising a plurality of closely spaced linearly aligned electrically insulated elemental light-emissive means and a plurality of laminar electrical means, each having a characteristic frequency, each of said elemental light-emissive means having a different laminar means electrically associated therewith, each of said laminar means being substantially coplanar with its associated elemental light-emissive means, said laminar means being so connected that the number of external leads taken from said cell for placing all of said means in an electric television reproducing circuit is no greater than the number of leads required to place one of said laminar means in said circuit.

11. A unitary television reproducing cell adapted to be mechanically moved for reproducing, said cell comprising a plurality of electrically insulated adjacently disposed laminae, each of said laminae including an elemental light-emissive means in a resonant circuit to associate a

frequency characteristic of its position to said light-emissive means, said circuits being connected in parallel within said cell.

12. A unitary television reproducing cell comprising a plurality of electrically insulated adjacently disposed laminae, each of said laminae including a pair of parallel insulated electrically conductive plates forming a capacitance and a flat inductance coil interconnecting said plates, an edge of one of said plates having a light-emissive means thereon, said coil and said plates forming a resonant circuit to associate a frequency characteristic of its position to said light-emissive means, the light-emissive means of the several laminae being linearly aligned.

13. A unitary television reproducing cell adapted to be mechanically moved for reproducing, said cell comprising a large number of electrically insulated adjacently disposed laminae, each of said laminae including a different oscillatory means and an elemental light-emissive means whereby a characteristic frequency is associated with each elemental light-emissive means, said means being aligned, a common electrode for said light-emissive means, and common means disposed wholly within said cell to energize all of said laminae whereby the external leads from said cell are reduced to the number of leads required to connect but one of said laminae in an electrical television receiving circuit.

14. A unitary television reproducing cell adapted to be mechanically moved for reproducing, said cell comprising a large number of electrically insulated adjacently disposed laminae, each of said laminae including a different oscillatory means and an elemental light-emissive means whereby a characteristic frequency is associated with each elemental light-emissive means, said means being aligned, the difference between the characteristic frequency of adjacent laminae being greater than the difference between the characteristic frequency of remote laminae so as to reduce coupling between adjacent cells, a com-

mon electrode for said light-emissive means, and common means disposed wholly within said cell to energize all of said laminae whereby the external leads from said cell are reduced to the number of leads required to connect but one of said laminae in an electrical television receiving circuit.

15. A television transmitting system comprising a plurality of electrically insulated closely spaced elemental photo-responsive areas having a common circuit and a common feed back to associate different radio frequencies with each of said areas, the amplitudes of each of said radio frequencies being modulated by said areas in accordance with the light tone value of the corresponding elemental area of the scene being transmitted.

16. A television transmitting circuit comprising a vacuum tube, a plurality of parallel auxiliary circuits of different resonant frequencies, a plurality of elemental electrically insulated photo-responsive areas, each of said areas being associated with one of said circuits whereby each of said areas is characterized by a different frequency, and means to cause said vacuum tube to oscillate at said frequencies, the amplitude of each of said frequencies being controlled by its associated photo-responsive area.

17. A television transmitting circuit comprising a vacuum tube, a plurality of parallel auxiliary circuits of different resonant frequencies, a plurality of elemental electrically insulated photo-responsive areas, each of said areas being associated with one of said circuits whereby each of said areas is characterized by a different frequency, means to prevent said areas from being associated with any other than their characterizing frequencies, and means to cause said vacuum tube to oscillate at said frequencies, the amplitude of each of said frequencies being controlled by its associated photo-responsive area.

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