

July 27, 1948.

SUBSTITUTE FOR MISSING XR

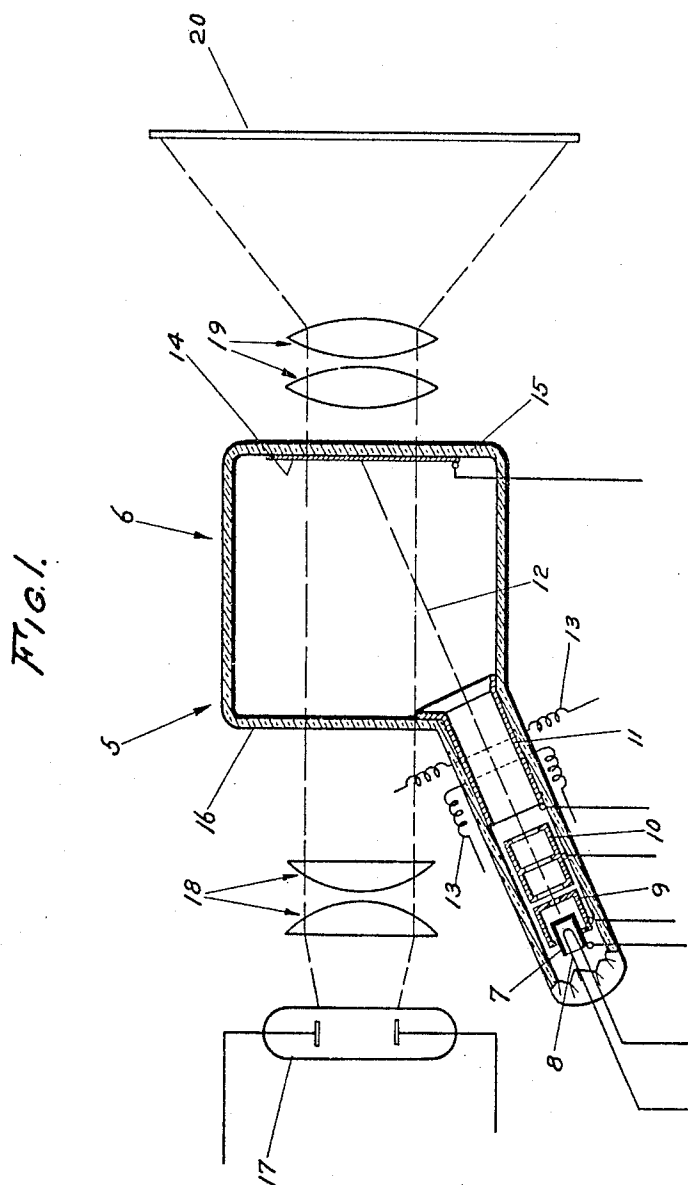
E. J. GORN

2,445,774

PICTURE RECEIVER UTILIZING ANOMALOUS
REFLECTION FROM SILVER

Filed Aug. 20, 1945

2 Sheets-Sheet 1

INVENTOR.
Elmer J. Gorn

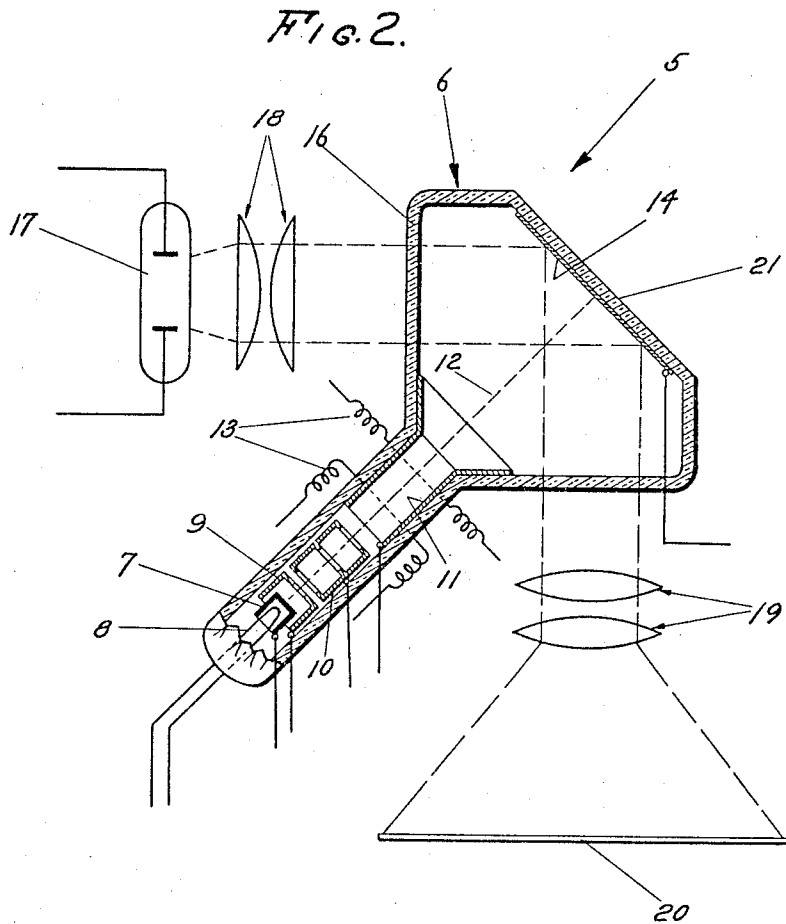
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UNITED STATES PATENT OFFICE

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PICTURE RECEIVER UTILIZING ANOMALOUS REFLECTION FROM SILVER

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11 Claims. (Cl. 178-7.5)

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My present invention relates to television systems, and more particularly to that part of the receiving equipment of such systems the function of which is to convert the received electrical signals into visible light.

One of the disadvantages of existing equipment of the general character indicated is that the size of the image appearing upon the viewing screen of the cathode-ray tube is too small to permit observation by more than a few persons, located close to the receiver, in a more or less direct line therewith, and in semi-darkness. Efforts to enlarge the image, for example by optical projection, or to permit greater general illumination in the room in which observation is taking place, have not been successful because of the low level of the light intensity that it is possible to obtain with a cathode-ray tube.

It is, therefore, among the objects of my present invention to devise a television receiving system which provides greatly increased image intensity, enabling enlargement to an appreciable size, and viewing under conditions of increased general illumination, thus eliminating the disadvantages of existing systems.

These and other objects of my present invention, which will become more apparent as the detailed description thereof progresses, are attained, briefly, in the following manner.

I have found that instead of forming the visible image directly from the received signals, as heretofore has been the case, greatly improved performance is obtained by providing a local source of lighting energy, and utilizing the received signals to control the instantaneous value of such energy. By so doing, considerable amplification is obtained.

To this end, I provide a local source of electromagnetic energy, in the form of ultra-violet light, more especially ultra-violet light of a wave length within a band of the spectrum extending from about 3075 Å. to about 3275 Å. This light is projected so as to fall upon a silver surface of substantial area, the silver surface, preferably, being in the form of a thin film of the metal, and by "thin film" I mean a film which, in so far as the unreflected light striking the same is concerned, is substantially transparent.

Now, in the region of the frequency spectrum to which reference has been made, there is a marked anomaly in the reflection coefficient of silver. At a certain point in the specific band above mentioned, the reflection coefficient is nearly zero, while on either side thereof, it rises to a considerable degree. Furthermore, within this

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band, the reflection coefficient of the silver varies with the temperature thereof, reaching a substantial value at about 150° C., and it is the latter property that is availed of in my present invention.

A portion of the ultra-violet radiation striking the above-described silver surface, either the transmitted or reflected portion thereof, is made to fall upon a sensitive screen, for example, a suitably fluorescent screen, which, under the action of the energy intercepted thereby, is excited, and caused to translate said energy into visible light.

By locally altering the temperature of the silver surface, which, as already stated, results in locally altering the reflection coefficient thereof, the visible light emanating from an elemental area of the fluorescent screen is correspondingly altered. Therefore, by utilizing the received electrical signals to control the temperature of elemental regions of said silver surface, said received signals may be reproduced on the fluorescent screen in terms of light values. I have found that this may be accomplished by employing the received electrical signals to intensity modulate an electron beam, which, in turn, is used to scan the silver surface.

In the accompanying specification I shall describe, and in the annexed drawings show, an illustrative embodiment of the television receiving system of my present invention. It is, however, to be clearly understood that I do not wish to be limited to the details herein shown and described for purposes of illustration only, inasmuch as changes therein may be made without the exercise of invention, and within the true spirit and scope of the claims hereto appended.

In said drawings,

Fig. 1 is a schematic view, in longitudinal section, of a receiving system assembled in accordance with the principles of my present invention; and

Fig. 2 is a similar view of a modified form thereof.

Referring now more in detail to my present invention, with particular reference to the embodiment thereof shown in Fig. 1 of the drawings, the numeral 5 generally designates a cathode-ray tube including a glass envelope 6 containing, at one end thereof, a cathode 7 adapted to be heated to thermionic emission by a heating filament 8. The emitted electrons are controlled by a suitably biased control electrode grid 9, accelerated by a first anode 10, and focused by an adjustable electrostatic field between said first

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anode and a second anode 11. The resulting electron beam 12 is adapted to be deflected by conventional scanning coils 13 in a manner well known in the art.

The scanning electron beam is directed toward an extended, metallic, preferably silver, surface 14 mounted on the inner surface of an end wall 15 of the envelope 6, said silver surface taking the form, for example, of a film of the metal of such depth that an appreciable amount of the unreflected energy striking the same, as will shortly be described, is transmitted thereby.

Disposed in advance of another end wall 16 of the envelope 6 is a suitable source 17 of ultra-violet light, more especially ultra-violet light of a wave length within a band extending from about 3075 Å. to about 3275 Å., said light being directed, by a suitable optical system 18, upon the silver surface 14. As indicated in earlier portions of this specification, the reflection coefficient of silver, in so far as energy of the wave length to which reference has been made is concerned, is reduced, and as a result, most of such energy is transmitted by the metallic film 14.

To the rear of said metallic film, I dispose a suitable optical system 19 for projecting the energy passing through said film onto a sensitive screen 20, for example, a suitably fluorescent screen. Under the action of the ultra-violet radiation, said screen becomes luminous.

Also as indicated in earlier portions of this specification, the reflection coefficient of silver may be varied as a function of the temperature thereof. Now, wherever the electron beam 12 strikes the silver film 14, the temperature of the elemental area struck becomes elevated, as a result of which, the reflection coefficient of said elemental area is increased, and less of the ultra-violet radiation passes through the film to strike the fluorescent screen 20. Hence, in the elemental area of the fluorescent screen so affected, the intensity of the resulting visible light is reduced. By reason of the foregoing, if the electron beam is intensity modulated by the received television signals, said television signals are translated into visible light values upon the fluorescent screen 20, and the scanning of said screen reproduces, in terms of visible light, the original transmitted image.

In the embodiment of my present invention under consideration, it is the transmitted portion of the ultra-violet light that is utilized to excite the fluorescent screen. Hence, if the received television signals are applied to the control grid of the cathode-ray tube in a positive direction, the image appearing upon the screen will be negative. This may be avoided by so biasing the cathode-ray tube that, normally, the scanning beam 12 maintains the silver film at an elevated temperature, thus maintaining a high reflection coefficient, and restricting the ultra-violet radiation falling upon the screen. Then, by applying the television signals to the cathode-ray tube in a negative direction, a positive image is made to appear upon the screen.

I shall now describe an embodiment of my present invention which, employing the reflected rather than the transmitted portion of the ultra-violet light to produce the image, avoids the necessity of normally maintaining the silver film at an elevated temperature.

Referring now to Fig. 2 of the drawings, it will be seen that, as before, ultra-violet radiations from the source 17 are directed by the optical system 18, through the wall 16 of the envelope 6, 75

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onto the silver film 14. However, said film 14 is not mounted upon a wall of the envelope which is parallel to the wall 16, but instead, is mounted upon a wall 21, which is disposed at a suitable angle for projecting the energy reflected by the film, through the optical system 19, onto the fluorescent screen 20.

In this case, inasmuch as the reflected energy is, normally, of low intensity, the image reproduced on the screen 20 will be positive when the cathode-ray tube is biased near cut-off, and the television signals are applied thereto in a positive direction. Also, in this case, the film 14 need not, if desired, be transparent.

This completes the description of the aforesaid illustrative embodiments of my present invention. It will be noted from all of the foregoing that I have provided a television receiving system in which greater image intensity can be obtained than has heretofore been the case, thereby enabling enlargement by optical projection, the observation of the image by a greater number of people, and the elimination of the necessity for observing the image in reduced general illumination.

Other objects and advantages of my present invention will readily occur to those skilled in the art to which the same relates.

What is claimed is:

30 1. In combination: a metallic silver member having an extended surface; means for illuminating said surface with electromagnetic energy of a wave length at which the reflection coefficient of said surface is capable of being varied; means for translating at least a portion of the energy striking said surface into visible light; and means for locally altering said reflection coefficient, whereby the quantity of said energy reaching said translating means is varied, and the intensity of the resulting visible light is correspondingly varied.

45 2. In combination: a member having an extended silver surface; means for illuminating said surface with electromagnetic energy of a wave length within a band extending from about 3075 Å. to about 3275 Å., whereby the reflection coefficient of said surface is capable of being varied; means for translating at least a portion of the energy striking said surface into visible light; and means for locally altering said reflection coefficient, whereby the quantity of said energy reaching said translating means is varied, and the intensity of the resulting visible light is correspondingly varied.

55 3. In combination: a member having an extended silver surface; means for illuminating said surface with an electromagnetic energy of a wave length within a band extending from about 3075 Å. to about 3275 Å., whereby the reflection coefficient of said surface is capable of being varied; a fluorescent screen for translating at least a portion of the energy striking said surface into visible light; and means for locally altering said reflection coefficient, whereby the quantity of said energy reaching said screen is varied, and the intensity of the resulting visible light is correspondingly varied.

70 4. In combination: a metallic silver member having an extended surface; means for illuminating said surface with electromagnetic energy of a wave length at which the reflection coefficient of said surface is capable of being varied; means for translating at least a portion of the energy striking said surface into visible light; and means

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for locally altering the temperature of said surface to, in turn, locally alter said reflection coefficient, whereby the quantity of said energy reaching said translating means is varied, and the intensity of the resulting visible light is correspondingly varied.

5. In combination: a member having an extended silver surface; means for illuminating said surface with electromagnetic energy of a wave length within a band extending from about 3075 Å. to about 3275 Å., whereby the reflection coefficient of said surface is capable of being varied; means for translating at least a portion of the energy striking said surface into visible light; and means for locally altering the temperature of said surface to, in turn, locally alter said reflection coefficient, whereby the quantity of said energy reaching said translating means is varied, and the intensity of the resulting visible light is correspondingly varied.

6. In combination: a member having an extended silver surface; means for illuminating said surface with electromagnetic energy of a wave length within a band extending from about 3075 Å. to about 3275 Å., whereby the reflection coefficient of said surface is capable of being varied; a fluorescent screen for translating at least a portion of the energy striking said surface into visible light; and means for locally altering the temperature of said surface to, in turn, locally alter said reflection coefficient, whereby the quantity of said energy reaching said screen is varied, and the intensity of the resulting visible light is correspondingly varied.

7. In combination: a metallic silver member having an extended surface; means for illuminating said surface with electromagnetic energy of a wave length at which the reflection coefficient of said surface is capable of being varied; means for translating at least a portion of the energy striking said surface into visible light; and means for scanning said surface with an electron beam to continuously locally alter said reflection coefficient, whereby the quantity of said energy reaching said translating means is varied, and the intensity of the resulting visible light is correspondingly varied.

8. In combination: a member having an extended silver surface; means for illuminating said surface with electromagnetic energy of a wave length within a band extending from about 3075 Å. to about 3275 Å., whereby the reflection coefficient of said surface is capable of being varied; means for translating at least a portion of the energy striking said surface into visible light; and means for scanning said surface with an

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electron beam to continuously locally alter said reflection coefficient, whereby the quantity of said energy reaching said translating means is varied, and the intensity of the resulting visible light is correspondingly varied.

9. In combination: a member having an extended silver surface; means for illuminating said surface with electromagnetic energy of a wave length within a band extending from about 3075 Å. to about 3275 Å., whereby the reflection coefficient of said surface is capable of being varied; a fluorescent screen for translating at least a portion of the energy striking said surface into visible light; and means for scanning said surface with an electron beam to continuously locally alter said reflection coefficient, whereby the quantity of said energy reaching said screen is varied, and the intensity of the resulting visible light is correspondingly varied.

10. In combination: a transparent silver film; means for illuminating said film with electromagnetic energy of a wave length within a band extending from about 3075 Å. to about 3275 Å., whereby the reflection coefficient of said film is capable of being varied; a fluorescent screen for translating the energy striking said film and transmitted thereby into visible light; and means for scanning said film with an electron beam to continuously locally alter said reflection coefficient, whereby the quantity of said energy so transmitted and reaching said screen is varied, and the intensity of the resulting visible light is correspondingly varied.

11. In combination: a transparent silver film; means for illuminating said film with electromagnetic energy of a wave length within a band extending from about 3075 Å. to about 3275 Å., whereby the reflection coefficient of said film is capable of being varied; a fluorescent screen for translating the energy striking said film and reflected into visible light; and means for scanning said film with an electron beam to continuously locally alter said reflection coefficient, whereby the quantity of said energy so reflected and reaching said screen is varied, and the intensity of the resulting visible light is correspondingly varied.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
Re. 22,115	Herbst	June 16, 1942
2,315,113	Farnsworth	Mar. 30, 1943