

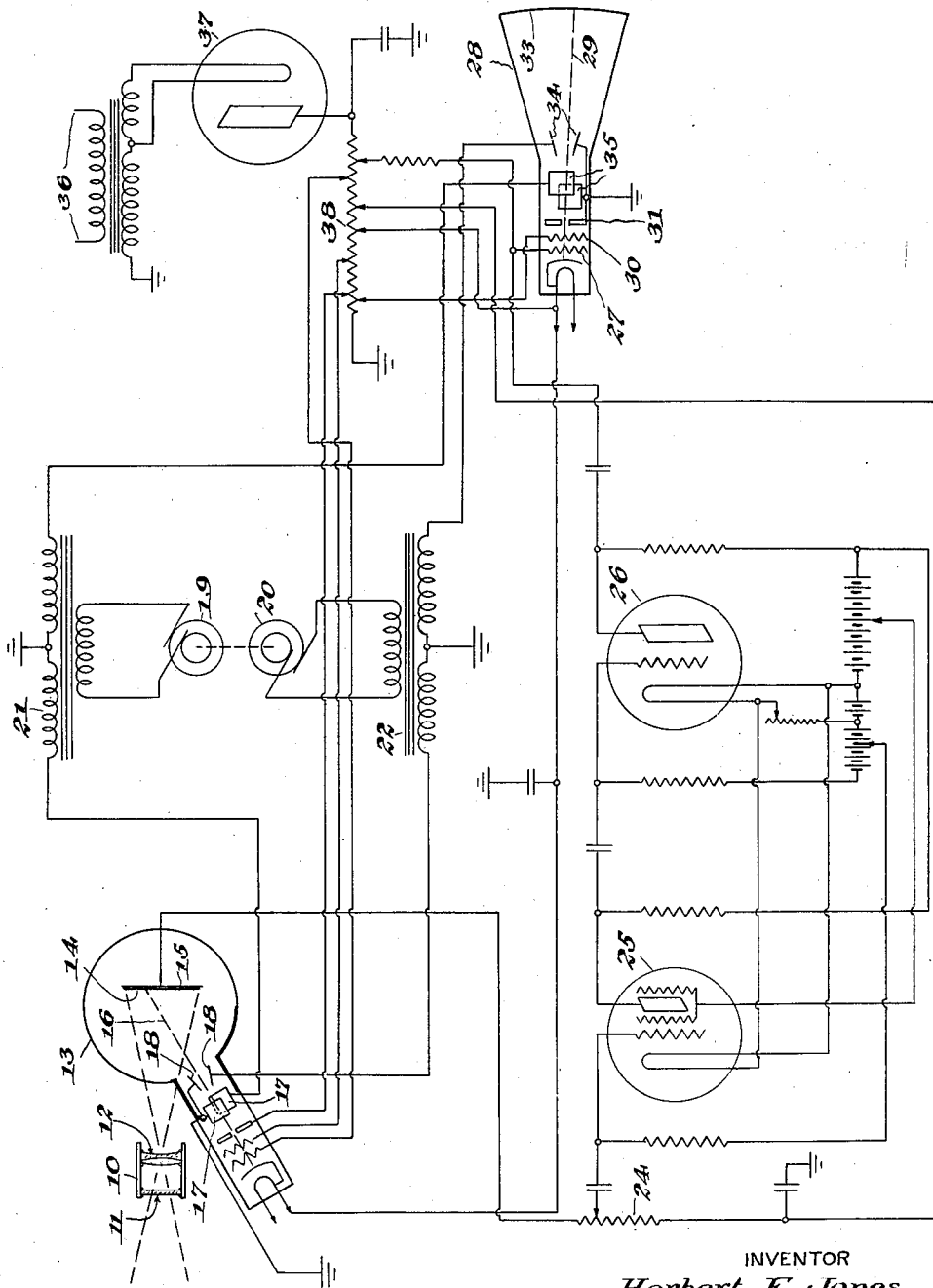
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PHOTOELECTRIC HAZE PENETRATOR

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PHOTOELECTRIC HAZE PENETRATOR

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8 Claims. (Cl. 178-6.8)

My invention relates to improvements in photo-electric haze penetrators, and it consists in the combinations, constructions and arrangements herein described and claimed.

5 The invention relates to that type of apparatus using infra-red rays whose wave lengths are too long to be perceptible to the eye, but which penetrate haze, fog, mist, etc. much better than those rays that make up the visible
10 spectrum. This infra-red radiant energy is transformed by certain photo-sensitive material into electrical energy and in connection with a scanning device is transmitted with proper amplification to another scanning device that forms
15 a visual image. By this means a visual image can be reproduced of an object that is either a source of infra-red radiations or lighted by reflected infra-red radiations even when atmospheric conditions would absorb and diffuse
20 all visible light.

An object of my invention is to increase the range of ocular perception through haze, mist, fog, smoke, and all other vapors and suspended particles that cause a lack of transparency to the atmosphere.

25 A further object of the invention is to provide a device making use of photo-sensitive cells in an iconoscope tube which allows a greater time of exposure before discharge thus permitting
30 very weak radiations to be built up into a signal current large enough for proper amplification and use.

A further object of the invention is to provide a device which has no mechanical movable parts and which, therefore, obviates the troubles caused by mechanical scanning.

Other objects and advantages will appear in the following specification, and the novel features of the invention will be particularly
40 pointed out in the appended claims.

My invention is illustrated in the accompanying drawing which is a diagrammatic showing of the apparatus and of the circuit connections therewith.

45 In the drawing at the upper left hand corner is shown a tube 10 for receiving the infra-red radiations, and containing a filter 11 and a lens system 12. The filter 11 is transparent to infra-red rays only. An iconoscope tube is shown at
50 13. This is a special cathode ray tube such as that used in television transmission. It includes a plate 14 of insulating material such as mica, having a silver backing 15. The mica plate has thereon thousands of photo-sensitive globules, each of which is very active photo-electrically
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and forms with the silver backing a tiny condenser. The photo-sensitive material is a caesium oxide sensitized by a special process. Each small particle forms a tiny photo cell in series with the condenser. As light falls on these cells a charge is built up proportional to the light intensity and is discharged in steady succession by a cathode ray beam.

This plate is in position to be scanned by a cathode beam 16 by means of alternating current supplied to deflecting plates 17 and 18. The pair of plates 17 is at right angles to the pair of plates 18 and it is the result of action of these two pairs of plates that causes the cathode beam to scan or to cover the whole area of the plate 14. The alternating current causes an electro-static field to be set up between these plates which varies in accordance with the frequencies of the current generated by the generators 19 and 20 through the respective transformers 21 and 22. As this electro-static field varies the action upon the electron beam 16 causes it to be swung from one side of the plate to the other. The plate 15 is maintained negative to the auxiliary anode 23 through the biasing resistor 24, but since the photo-electric globules on the plate 14 are separated from the conducting plate 15 there is no conduction between the plate 14 and the anode 23 even though the photo-electric globules emit electrons. As the cathode beam 16 strikes a particular point on the plate 14 there is conduction set up between the plate 14 and the anode 23, each photo-sensitive globule acting as an individual photo cell.

35 As the cathode beam 16 scans the plate 14 point by point a current is developed between the plate 14 and the anode 23. Each particular point of this current is directly proportional to the intensity of light incident on the particular point. It is amplified by the vacuum tube 25 and can be again amplified by as many stages as may be necessary.

In the drawing I have shown only one amplifying tube 25 and a power tube 26 by means of which the current is finally amplified and is impressed on the control grid 27 of the cathode ray receiving tube 28.

The cathode ray-receiving tube 28 is similar to the cathode ray oscillograph and is used as a television receiver. The cathode beam 29 of this tube passes through the control grid 27 and is focused by the action of the two anodes 30 and 31 on the fluorescent screen 33. The latter is composed of fluorescent material that will
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give off a greenish light when subjected to cathode ray bombardment, the intensity of the fluorescent spot being directly proportional to the intensity of the cathode ray.

5 The cathode beam is caused to scan the fluorescent screen by deflecting plates 34 and 35 in the same manner as was described for the beam 16 in the tube 13. These deflecting plates are connected to the transformers 22 and 21
10 respectively. Therefore at any instant the cathode beam 29 is in the same relative position as the cathode beam 16 and the two beams scan their respective screens in exactly the same manner, with the exception that the pair of vertical
15 deflecting plates in the receiving tube 28 is reversed with respect to the vertical deflecting plates in the tube 13, and similarly the horizontal deflecting plates in receiving tube 28 are reversed with respect to the horizontal deflecting
20 plates in the transmitting tube 13. This is necessary in order to erect the image on the screen 33 since the transmitted image from the plate 14 is inverted by means of the lens system 12.

As was described above, the signal voltage from
25 the plate 14 is impressed on the control grid 27 of the cathode grid tube 28 and this signal voltage is varying with the variations of light intensities on the plate 14. This varying voltage applied to the control grid 27 varies the intensity of the
30 cathode beam 29. Therefore the intensity of the cathode beam at any instant is proportional to the light intensity on the particular point on the plate 14 that is covered by the cathode beam 16 at that instant, and since the two beams 16 and
35 29 scan their respective screens in synchronism, as was described above, the brightness of any particular point on the screen 33 will vary in accordance with the intensity of light on its corresponding point on plate 14.

40 The intensity of the infra-red radiation of any point of the image on plate 14 will be proportional to the infra-red radiation being emitted or reflected from the corresponding point of the object in front of the lens system 12. Therefore as beam 16 scans the plate 14 and as the
45 beam 29 scans the fluorescent screen 33, there will be an exact point to point correspondence between the object and the fluorescent screen 33 and the brightness of each point on the fluorescent screen 33 will be proportional to the intensity of the infra-red radiation being emitted or
50 reflected from the corresponding point of the object.

The power used by the cathode ray tubes and
55 amplifiers is supplied by some source of alternating current through the transformer 36, the high voltages for the anodes of the tubes 13 and 28 being supplied by operating the rectifier 37, the difference in voltages and the positive and
60 negative bias being given by the resistor 38.

I claim:

1. A haze penetrator system comprising a filter which passes infrared rays, a cathode ray tube having a photo-electric mosaic screen, an
65 electron gun and deflecting means, a lens associated with the filter and the screen for forming an inverted image of an object on said screen, a cathode ray receiving tube having an electron gun, a fluorescent screen and deflecting means,
70 electrical connections between the screen of the first tube and the gun of the second tube for modulating the electron beam as it passes to the second tube, common sources of potential for deflecting the electron beams horizontally and
75 vertically at the transmitter and receiver, and

electrical connections between the deflecting member at the receiving station and the generator which invert the received image to form an erect image.

2. A fog and haze penetrator system comprising, in combination, an optical system including a filter which passes substantially infrared rays only, a cathode ray tube having an infrared photo-sensitive screen, an electron gun and deflecting means, a cathode ray receiving
10 tube having an electron gun, a fluorescent screen and deflecting means, and electrical connections between the infrared photo-sensitive screen of the first tube and the gun of the second tube for modulating the electron beam as it passes to
15 the second tube, said system being provided with a common source of potential for deflecting the electron beams horizontally and vertically at both the transmitter and the receiver.

3. A fog and haze penetrator system comprising, in combination, a cathode ray transmitting tube having a photo-electric mosaic screen, an electron gun and deflecting means, means for forming an inverted image of an object on said
20 screen, a cathode ray receiving tube having an electron gun, a fluorescent screen and deflecting means, electrical connections between the screen of the first tube and the gun of the second tube for modulating the electron beam of the second tube, means for deflecting the electron beams
30 horizontally and vertically at the transmitter and receiver, and electrical connections associated with the deflecting means at the receiving station for inverting the received image to form an erect image.

4. A combined, unitary television transmitting and receiving apparatus for use in penetrating fog, haze and the like, comprising a cathode ray transmitting tube having an infrared photo-sensitive screen, an electron gun and deflecting
40 means, means associated with the infrared photo-sensitive screen for forming an image thereon, a cathode ray receiving tube having an electron gun, a fluorescent screen and deflecting means, electrical connections between the
45 infrared photo-sensitive screen of the first tube and the gun of the second tube for modulating the electron beam of the second tube, and a source of potential for deflecting the electron beams horizontally and vertically at the transmitter and receiver.

5. A combined, unitary television transmitting and receiving apparatus for use in penetrating fog, haze and the like, comprising a cathode ray tube having a photo-electric mosaic screen, an
55 electron gun and deflecting means, means associated with the screen for forming an inverted image of an object on said screen, a cathode ray receiving tube having an electron gun, a fluorescent screen and deflecting means,
60 electrical connections between the screen of the first tube and the gun of the second tube for modulating the electron beam of the second tube, common sources of potential for deflecting the electron beams horizontally and vertically at the
65 transmitter and receiver, and electrical connections between the deflecting member at the receiving station and the common source of potential which inverts the received image to form an erect image.

6. A combined, unitary television transmitting and receiving apparatus for use in penetrating fog, haze and the like, comprising, in combination, a filter which passes substantially only
75 infrared rays, a cathode ray tube having an

infrared photo-sensitive screen, an electron gun and deflecting means, a lens associated with the filter and the screen for forming an image of an object on said screen, a cathode ray receiving tube having an electron gun, a fluorescent screen and deflecting means, electrical connections between the infrared photo-sensitive screen of the first tube and the gun of the second tube for modulating the electron beam of the second tube, common sources of potential for deflecting the electron beams horizontally and vertically at the transmitter and receiver, and electrical connections between the deflecting member at the receiving station and the common sources of potential which cause an image to be formed at the receiving station.

7. A television system comprising, in combination, a cathode ray transmitting tube having a photo-electric mosaic screen, an electron gun and deflecting means, means associated with the screen for forming an inverted image of an object on said screen, a cathode ray receiving tube having an electron gun, a fluorescent screen and

deflecting means, means for transmitting electrical impulses between the screen of the first tube and the gun of the second tube for modulating the electron beam of the second tube, means for deflecting the electron beams horizontally and vertically at the transmitter and receiver, and electrical connections associated with the deflecting means at the receiving station for inverting the received image to form an erect image.

8. That improvement in methods of visibly detecting normally visible objects rendered invisible because of fog, haze or other atmospheric dispersions, which comprises filtering out substantially all except the infrared light rays radiating from said objects by translation of infrared light therefrom onto an infrared photo-sensitive screen, scanning said screen with a cathode ray to develop a train of electrical impulses, and translating the electrical impulses into an optically visible image.

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