

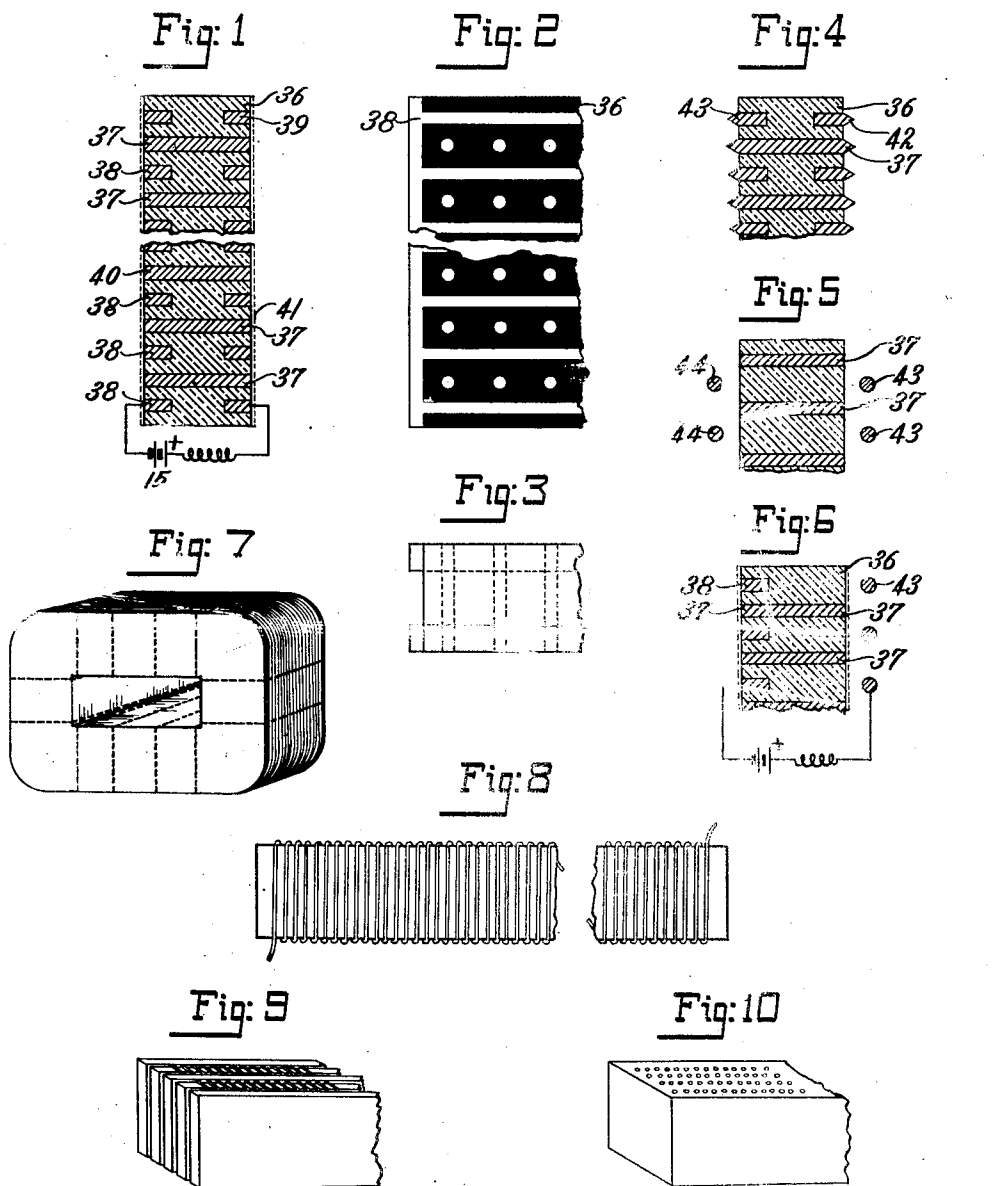
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TELEVISION

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TELEVISION

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This invention relates in general to photo-electric plates, for use in television systems; and the object of the invention is to provide an improved photo-electric plate, and new and improved processes or methods of constructing the same.

This application is in part a continuation of my prior application, Serial No. 705,413, filed April 10, 1924, for a system of television.

The photo-electric plate forming the subject matter of this invention is disclosed in Figs. 1 to 10 of the drawing. Figs. 1 to 6, inclusive, illustrate in a diagrammatic manner a number of forms of the plate, while Figs. 7 to 10, inclusive, illustrate two processes by which a plate of the form shown in Fig. 5 may be constructed.

Referring to Figs. 1 to 5, inclusive, 36 represents a slab of insulating material through which extend, conveniently at right angles to the flat, broad faces thereof, a large number of independent conductors 37. Imbedded in the faces of the slab are what may be termed grids of conductive material, indicated respectively at 38 and 39. The elements of these grids extend past the corresponding ends of the conductors 37 but out of contact therewith, preferably so that each conductor lies between two grid elements. These grids form the terminals of the plate. The external circuit from grid to grid includes a battery 15 and the primary of an induction coil, as shown in the drawing, Fig. 1.

A plate of the foregoing general construction is adapted for use in a television transmitter of the type described in my prior application above referred to. As described in that application, the plate is enclosed in a cathode ray tube, in such a manner that the right-hand side of the plate may be traversed or scanned by a movable cathode ray. It will be understood also that the apparatus is so arranged that an image may be focused on the left-hand side of the plate. The function of the plate is to produce a light current which fluctuates in value in accordance with the amount of light impinging on successively selected areas of the plate.

The light currents are produced by the battery 15. In order to complete the battery circuit, a conductive path must be established between at least one of the conductors 37 and both of the grids. Any expedient may be resorted to in order to cause a conductive path to be formed between one of the conductors 37 and the grid 39 when the cathode stream impinges on the plate at the end of such conductor at the right-hand side of the plate. If the materials employed in the construction of the plate are not such as to produce

the necessary conductive paths between the conductors 37 and the grid 39 under the influence of the cathode stream or ray, the plate may be coated with or have adjacent thereto a medium that will properly respond to the cathode ray. Thus, for example, a coating of potassium hydride, selenium, etc., may be placed on that face of the plate exposed to the cathode ray. Since the purpose of the cathode ray is simply to analyze the plate in small sections, the conductance of the paths between the conductors 37 and the grid 39 is preferably the same at all points on the plate; but the conductive paths on the other side of the plate must vary in conductance according to the chosen characteristic or characteristics of the light in accordance with which the current or train of energy to be transmitted is to be modulated. The simplest method for securing this result is to coat that face of the plate on which the image is formed with potassium hydride, selenium or other suitable material. The dotted lines 40 and 41 in Fig. 1 represent the photo-electric media.

Selenium is a substance which changes its resistance under the influence of light, and is well adapted for use on the image side of the plate. The coating or layer of selenium which is applied to the plate should be thin enough so that the light may produce a resistance change throughout. In other words, the thickness of the coating must not be greater than the depth to which light will effectively penetrate selenium. This value is approximately .0014 cm.

The electron-emitting substances, such as potassium hydride, are especially adapted for use on the cathode ray side of the plate, due to the fact that the change in emission is instantaneously responsive to the influence of the cathode ray. Because of the extreme rapidity with which the cathode ray scans the plate, it is desirable to use a substance which has no appreciable sluggishness or time lag. If potassium hydride is to be used, this substance may be formed on the plate by the process which is disclosed in the patent to Kunz, No. 1,381,474, granted June 14, 1921. When potassium hydride is deposited in this manner, it forms a layer or film of minute, separate globules.

The construction of the plate which is shown in Fig. 1 can be varied considerably. The shape of the transverse conductors and of the grids may be altered, and if desired, the grids may be replaced by any suitable conductor elements which span the area of the plate, so long as the light and the electrons of the cathode ray can reach

the plate. In Figs. 4, 5 and 6, I have shown several other simple forms which the plate may have.

In the arrangement shown in Fig. 4, the bars or elements of the grids 42 and 43, as well as the ends of the conductors 37, are sharp and project beyond the faces of the slab of insulating material. The construction is otherwise the same as in Fig. 1.

In Fig. 5, the elements or bars of the grids 43 and 44 lie spaced apart from the faces of the slab in which the conductors 37 are imbedded. In this construction, fine mesh screens may well be used as the grids, the size of the mesh being selected to correspond with the spacing of the conductors 37, so that the interstices between the wires of the screen will come opposite the ends of the conductors 37. The same photo-electric materials may be used as are described in connection with Fig. 1, and they may be applied in the same way. The right-hand grid 43, since it is separate from the plate, will have no coating of photo-electric material. The left-hand grid 44, however, should be partially imbedded in the selenium coating, if this substance is used, so as to insure good electrical contact between the grid and the selenium. In case it is desired to use potassium hydride on the image side of the plate, the coating should be applied to the grid 44 rather than to the left face of the plate.

In Fig. 6, I have shown a combination of the arrangements depicted in Figs. 1 and 5, grid 38 being imbedded in the slab and the grid 43 lying outside the slab.

The operation of a plate of the type disclosed is explained in my prior application hereinbefore referred to. It will be necessary, therefore, to refer only very briefly to the particular functions which are performed by the plate. The plate shown in Fig. 6 may be referred to conveniently, as the construction shown here is well adapted for the employment of both types of photo-electric control; viz. by change in resistance and by change in electronic emission.

It will be assumed that a plate such as shown in Fig. 6 is suitably positioned in a cathode ray tube, as illustrated in my prior application, that an image is focused on the left-hand face of the plate, and that the right-hand face of the plate is being scanned by the movable cathode ray. At the instant that the cathode ray is impinging on the end of the upper transverse conductor 37, a circuit will be completed as follows: From the negative pole of the battery to the grid 38, thence by conduction through the selenium coating to the pin 37, through the pin 37 to the other side of the plate and to the globules of potassium hydride which are deposited on the end of the conductor, thence by electronic emission (caused by bombardment by the cathode ray) to the grid 43, and from the grid 43 by way of the primary of the induction coil to the positive pole of the battery. With a given battery, the value of the current flow in the above circuit depends on the electronic emission from the potassium hydride on the right-hand end of the conductor 37 and on the conductivity of the selenium which connects the left-hand end of the conductor 37 with the grid 38. The amount of electronic emission is constant for all of the pins 37, but the conductivity of the selenium connecting any particular pin 37 with the adjacent grid will depend upon the amount of light reaching that point. Thus, when the cathode ray moves on and includes the next conductor 37

in the circuit, the current flow will be over a circuit similar to the one traced, but the value of the current may be different, due to the fact that the particular spot on the plate in which the active conductor 37 is located may vary as to its illumination. It will be understood, therefore, that as the cathode ray scans the right-hand face of the plate, it includes all the conductors 37 in the circuit successively, and it will be understood further that the amount of current flowing in the circuit each time it includes a different conductor 37 will depend on the illumination at the left-hand end of such conductor. These varying currents constitute the so-called light current, which may be suitably amplified and transmitted to distant points for reproduction.

As stated hereinbefore, Figs. 7 to 10, inclusive, illustrate processes or methods by which a plate of the character described may be conveniently constructed. The plate illustrated in Fig. 5, using separate or detached grid elements, lends itself very well to construction by ordinary shop methods suitable for quantity production.

Referring to Fig. 7, one process by means of which the plates can be constructed may be described as follows: A coil form should first be constructed, of a size suitable to the dimensions of the plates which it is desired to manufacture. This coil form is then placed in a lathe or coil winder, and is wound full of insulated. The size of the wire will, of course, depend on the spacing desired for the transverse conductors 37. In practice these conductors 37 must be spaced very close together, so that a comparatively fine wire will have to be used. No. 28 double cotton-covered copper wire can be used with good results. As this wire is wound on the form, it is passed through a bath of liquid bakelite, otherwise known as bakelite varnish, and the insulating covering of the wire is thus impregnated with the bakelite compound as it is wound on the form. It is well to stop the winding operation after each layer has been formed for the purpose of applying additional bakelite solution with a brush. This latter is not strictly necessary, however.

When the coil is completely wound as described in the foregoing, it is placed in an oven. As heat is applied, the solvent is driven off, and at a certain temperature the bakelite is changed into a hard substance, of the familiar form, as is well understood. When removed from the oven, it will be found that the turns of wire in the coil are all thoroughly cemented together, so that the coil has become a rigid, solid body of the form substantially shown in Fig. 7 of the drawing. Plates of any desired thickness may now be cut from the coil by sawing it at the proper point. The dotted lines in Fig. 7 will illustrate how eight rectangular plates can be cut from a single coil.

After the plates have been cut out, they are again treated with a bakelite solution in order to fill up any small cavities or perforations which may have been left due to the evaporation of the solvent. For this purpose, some well-known form of vacuum pressure tank may be used. After being impregnated with the bakelite for a second time, the plates are again baked in an oven, after which they may be trimmed to the required dimensions and enclosed in suitable frames, depending on the exact form of transmitter in which they are to be used.

Figs. 8, 9 and 10 illustrate another process

which may be used, if desired. This second process is especially desirable where it is essential to obtain a plate which is absolutely impervious to gas. This is not to say that the bakelite plate is not gas tight, but it is not inherently as tight as the plate about to be described.

A quantity of thin glass strips are obtained, similar to what are shown in Figs. 8 and 9. A number of these glass strips are then wound with bare wire, as illustrated in Fig. 8. After this has been done, a number of wound strips are assembled alternately with unwound strips, as illustrated in Fig. 9, sufficient strips of glass being used to make a plate of the desired width. The glass strips may be assembled in a suitable frame, so that they can be clamped together and held securely in place after assembly, although a binding of wire applied at several points around the outside of the complete assembly will be found to be sufficient.

The assembled glass strips, which now have the form of a plate, are then placed in a flat-bottomed crucible or other receptacle which is just a little larger than the plate, and which forms a kind of mold. The crucible is then placed in a furnace, where heat is applied until the glass becomes slightly softened. During the heating of the plate, a quantity of some low-melting type of glass should be melted up separately. The exact type of glass is not particularly important, but I have found that lead borate can be used to good advantage. As soon as the plate has been heated to the proper point in the furnace, the melted lead borate is poured into the crucible or mold, sufficient material being used so that the plate is completely covered, all the spaces between the different glass sheets and the wires being completely filled. The furnace may now be closed, and a small additional amount of heat applied to insure that the glass is all thoroughly fused together into a homogeneous slab.

The furnace may now be cooled down, the glass slab being allowed to cool rather slowly, so that it will not become brittle. When the glass slab is sufficiently cool, it may be removed from the mold, after which it is placed in a grinding machine and the two faces of the slab are ground off to a depth of perhaps one-eighth of an inch, or enough so that all of the wire is removed except the portions which extend in a direction transverse to the completed plate. The result will be a rectangular slab of glass in which are imbedded a large number of fine wires. Fig. 10 will give an idea of the appearance of a small section of a plate constructed in this way.

Having described my invention, what I consider to be new and desire to have protected by Letters Patent will be pointed out in the appended claims.

What is claimed is:

1. A photo-electric plate having conductors electrically insulated from each other and extending through the same, a terminal conductor which extends past but not in contact with the ends of the aforesaid conductors on one side of the plate, and there being on the same side of the plate a medium that forms between each of the first-mentioned conductors and the said terminal conductor under the influence of light a path that is conductive in proportion to a pre-determined characteristic of the light falling thereon.

2. The process of constructing a photo-electric plate consisting of insulating material perforated by a plurality of conductors, which consists in

winding a plurality of glass strips with wire, in assembling the wound strips alternately with unwound strips to form a plate, in fusing the glass strips together by casting melted glass around the plate in a mold, and in grinding away a part of each face of the plate so as to remove the wires which lie in a plane parallel to the faces.

3. A photo-electric plate comprising insulating material and parallel insulated conductors extending through the plate at a plurality of points, a conductive grid on one face of the plate, and light sensitive material connecting said grid and said conductors.

4. A photo-electric plate comprising a slab of insulating material, a plurality of metal pins perforating said slab at right angles to the faces of said plate and arranged in horizontal and vertical rows, and a grid embedded in the insulating material on one face of said plate, said grid comprising a plurality of parallel bars each of which lies between two rows of pins but is insulated therefrom, and a light sensitive coating on said one face of said plate for forming a conductive path between said pins and said grid.

5. A photo-electric plate having a main supporting body of insulating material, a plurality of fine conductors perforating said insulating material at right angles to the faces of said plate, a conductive grid embedded in one face of said plate and insulated from said pins, a second grid spanning the other face of said plate, and a coating of photo-electric material deposited on each face of said plate.

6. A plate for use in a television device, said plate comprising insulating material and parallel insulated conductors extending through the plate at a plurality of points, a conductive grid on one face of the plate, and material sensitive to a cathode ray connecting said grid and said conductors.

7. The process of constructing a photo-electric plate consisting of insulating material perforated by a plurality of conductors, which consists in forming a plurality of flat single-layer coils of wire on strips of insulation, in assembling said coils in spaced relation to form a plate structure, in filling the interstices between the wires in said plate structure with insulating material, and in removing all material from each face of the plate which contains wire not normal to the surface.

8. A photo-electric plate for a cathode ray television transmitter comprising a body of insulating material perforated by a plurality of fine conductors, a conductive body spanning the cathode ray side of the plate, and material sensitive to the cathode ray for establishing conduction between said conductive body and said conductors.

9. A plate for use in constructing a photo-electric device, said plate comprising a slab of insulating material, a plurality of metal pins perforating said slab substantially at right angles to the faces of the plate, said pins being arranged in horizontal and vertical rows, a grid on one face of said plate comprising a plurality of metal bars embedded in said insulating material and extending past the ends of said pins but not in contact therewith, and a second grid spanning the other face of said plate.

10. A plate for use in constructing a photo-electric device, said plate comprising a slab of insulating material, a plurality of metal pins perforating said slab at right angles to the faces of said plate and arranged in horizontal and vertical rows, and a grid embedded in the insu-

lating material on one face of said plate, said grid comprising a plurality of parallel bars each of which lies between two rows of pins but is insulated therefrom.

- 5 11. A plate for use in a television device, said plate comprising two parallel spaced grids insulated from each other, a plurality of insulated parallel metal pins extending between said grids at right angles to the faces thereof, the ends of
10 said pins on one side of said plate lying within the apertures of one of said grids and the ends of said pins on the other side lying adjacent to but not quite touching the other grid, and material impervious to light filling the spaces be-
15 tween said pins.

12. A photo-electric plate composed of insulating material, a plurality of short parallel metal pins embedded in said insulating material and connecting the opposite faces of said plate, the ends of said pins on one face lying in the
20 plane thereof, and a coating of variable resistance material on said one face of said plate in contact with the end of each pin, and a conductive grid spanning that face of the plate on
25 which said material is deposited.

13. In a photo-electric plate, a slab of insulating material, separate conductors perforating said slab perpendicular to the faces thereof, there being not less than twenty such conductors
30 per inch in any direction parallel to the face of the plate, a coating of photo-electric material on one face of said plate directly on the ends

of said conductors, and a conductive member to which conduction is established from each of said separate conductors by said photo-electric material under the action of light.

14. A plate for use in a television device, said
80 plate comprising insulating material and parallel insulated conductors extending through the plate at a plurality of points, a conductive grid on one face of the plate, a conductive grid on the other face of the plate, and coatings of ma-
85 terial sensitive to light and to a cathode ray on the two faces of the plate, respectively, for connecting said grids with said conductors.

15. A photo-electric plate for a cathode ray television transmitter comprising insulating ma-
90 terial, a conductive grid spanning one face of said plate, a plurality of insulated conductors extending through said plate, light sensitive material for electrically connecting said grid with
95 said conductors, and a second grid spanning the other face of said plate to which said conductors are electrically connected by electron emission under the influence of the cathode ray.

16. In apparatus for the transmission of pictures and views, a plate having on one face
100 thereof light sensitive resistance material, a conductive grid on the resistance material, and a plurality of conductors extending through the plate and arranged intermediate the elements of the grid.

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