Dec. 4, 1951 M. PONTE 2,577,628

TELEVISION SYSTEM

Filed Feb. 27, 1947

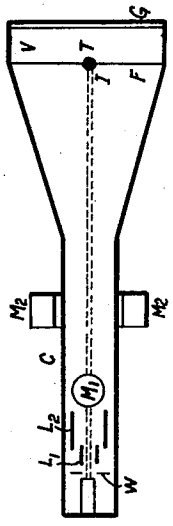


Fig. 2

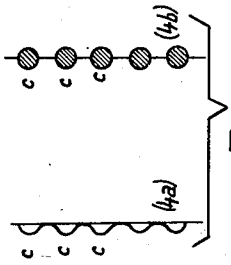


Fig. 4

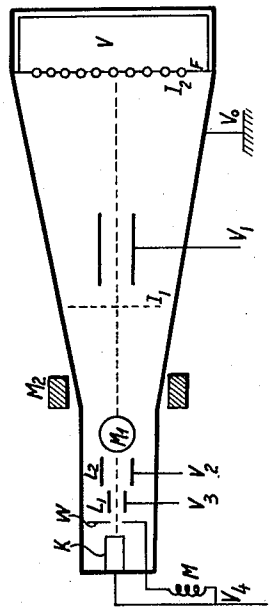


Fig. 6

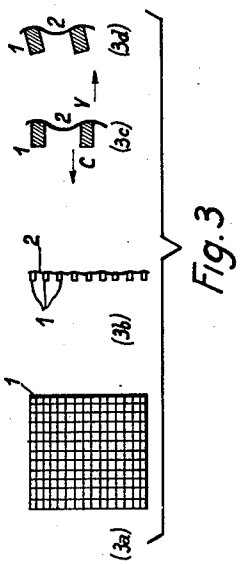


Fig. 3

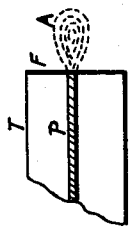


Fig. 1

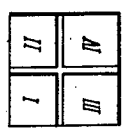


Fig. 5

Inventor
MAURICE PONTE
By Haseltine, Lake & Co.
Agents

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TELEVISION SYSTEM

Maurice Ponte, Paris, France, assignor to Compagnie Generale de Telegraphie Sans Fil, a corporation of France

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5 Claims. (Cl. 178—5.4)

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In dealing with various problems, such as those arising in television, it is necessary to produce luminous energy at a point from a beam of particles in motion. At present, these are generally electrons.

Such is the case with tubes employed for television reception, whether the luminous image produced is observed directly or whether it is projected on to a screen.

It is obviously necessary that the brightness given by the conversion of the image of the particles should be as great as possible, because the size of the images is limited by this characteristic. In the art as it is at present known, the cathodic fluoroscence of certain substances is employed, and much research has been undertaken with the object of increasing the luminous output of this phenomenon, both in connection with the nature of the screens upon which the beams impinge and in connection with the energy of the latter. However, in the latter connection, a limitation is set by the desire to produce a cathode spot of small dimensions, which imposes certain limits on the intensity conveyed by the beam, so that it is necessary to employ very high acceleration voltages, sometimes ranging to about a hundred thousand volts. Under these conditions, it is difficult to produce sufficiently stable fluorescent screens which do not burn under the impact of the electrons or which do not eventually change colour, which gives rise to modifications of undesirable colour.

The present invention concerns the means for providing a strong luminous screen, the various points of which can follow the modulation of the exciting beam, while it provides a new solution of the problem of tubes for the conversion of kinetic energy into luminous energy, applied non-limitatively to the reproduction of television images. To this end, the invention employs the luminous excitation of gases or of vapours traversed by beams of particles, and in particular by beams of electrons.

It is known, especially since Coolidge's experiments, that a beam of high-speed electrons, P (Figure 1), obtained in any manner in the vacuum tube T and traversing a thin impervious window F, produces in the air a luminous brush in the zone in which the electrons are stopped by the molecules of air at atmospheric pressure.

According to the invention, this phenomenon is utilised in a novel manner which will be clearly understood by reference to the accompanying non-limitative drawings, which are given to illustrate the following description, in which:

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Figure 1 shows diagrammatically ionization produced by passage of electrons through a thin wall.

Figure 2 shows a cathode ray tube constructed in accordance with this invention.

Figure 3 shows, partly in section, the development of parts constituting a resistance grid structure.

Figure 4 shows different structures for a goffered sheet in section.

Figure 5 shows diagrammatically an arrangement of the plurality of gas chambers used in the production of different colors.

Figure 6 shows partly diagrammatically and partly in section a cathode ray tube involving a further feature of this invention.

The invention involves the idea of increasing the pressure of the gas in order to localise the light emitted so as to determine a sufficiently small "point" to permit of a good definition, in conjunction with improvements in the outlet window rendering possible the application of the principle and defining the mesh of the system.

To this end, a cathode tube C (Figure 2) comprises a very thin impervious window F. This tube may be constructed in the normal way, for example with two electric lenses L_1, L_2, and deflecting systems illustrated as magnetic systems (M_1, M_2). According to a known method, an image of a diaphragm defining the spot is produced at I, and the scanning systems permit of scanning a considerable fraction of the window F, thus defining an electronic image which produces the luminous image transmitted, while the intensity of the beam is modulated, for example by the electrode W.

According to the invention, a chamber V provided with a light-transparent glass G is connected to the window F transparent to electrons. This chamber contains a gas which is illuminated at T under the action of the electrons assembled at I. It is necessary to localise this light to the maximum, and this is achieved by employing a high-pressure gas. The pressure to be employed depends upon the speed of the electrons of the beam, upon the gas and upon the definition to be attained. It may vary from several atmospheres to several dozen atmospheres. The use of high pressures may also be considered, according to the resistance of the window F, of which the invention provides a particularly preferred means of application.

By reason of its very function, the window F must be thin. It could, for example, consist of aluminum one-hundredth of a millimeter thick;

this light metal is relatively easy to obtain without pitting.

This window must have sufficient dimensions to permit of obtaining an image with a good definition and at least with the substances at present known, this sheet could not withstand the pressure difference between the two containers C and V. According to the invention, this window is constructed with the aid of a resistant grid, the mesh 1 of which is illustrated in Figure 3*a*, the window 2 (section 3*b*) being stuck thereto or supported thereby. At 3*c* is shown the section of an element of this cellular structure. One improvement consists in directing the sides of the mesh towards the region of rotation of the beam in the tube, so that the beam is not too greatly intercepted on the sides of the image. The transparent sheet may thus consist of light material, either metallic or semi-insulating. The first category will include aluminium, for example, and the second will include sheets of plastic material, which can be obtained in very small thickness at least down to 100 μ.

The grid itself may be fine if it is constructed from suitable metals such as high-resistance steel wires criss-crossing to form a mesh. The actual form of the grid may be either that of a squared pattern, or it may be limited to parallel wires.

Finally, the ensemble of the window and of its grid may be produced in a single operation by moulding, so as to obtain a goffered sheet, the depth of the meshes of which may be determined as a function of the pressure to be withstood. The goffering may also be formed on the two sides of the part transparent to electrons (Figures 4*a* and 4*b*). The moulding may be carried out on a metal grid, which gives a particularly resistant window. That part of the meshes *c* which faces towards the tube C may also be metallised so that its potential is well defined, which is advantageous as compared with fluorescent screens acting by transparency. This construction affords the possibility of a very fine mesh, having sides of the order of $\frac{1}{10}$ mm., so that a screen having sides of from several centimetres to one decimetre gives a suitable image.

It will be observed that the texture of the image may be given by the mesh of the window and that it will not be necessary to have too high a definition of the cathode spot, which affords the advantage of facilitating the construction of the tube.

The colour of the image is defined by the nature of the gas, and the apparatus according to the invention thus makes available to the person skilled in the art a very extensive range of colours as well as a "screen" which, by its very nature, is not liable to change colour or show fatigue.

The tubes according to the invention are therefore suitable not only for all applications in which it is desired to convert energy of particles into a luminous energy of one colour, but also for colour television. To this end, several tubes—for example three—one for each of the fundamental colours may be simultaneously employed by superposing their projections on a screen by means of suitable optical systems.

It is even possible to use a single cathode system exciting four gas chambers disposed, for example, as shown in Figure 5, which represents the complex tube seen from the side of the face of the chambers. The mean position of the beam is determined by a polarisation of the deflecting systems, which brings the scanning into the desired colour zone, each chamber giving the colour necessary for the superposition of the four colours to give a white. A four-lens projection system (not shown) ensures the superposed projection of the four coloured images on to a screen.

A tube of a given colour, constructed in accordance with the invention, can receive all necessary improvements on the cathode side. In particular, in accordance with a known method, in order to maintain a suitable scanning sensitivity in spite of the great speed of the electrons which is required, the scanning may be effected on slow electrons, for example 4,000 to 10,000 volts, and an additional acceleration to 100,000 or 500,000 volts will be effected by a combination of electric lenses. Figure 6 shows diagrammatically a tube according to the invention provided with this improvement.

This figure shows at K the emitting cathode, a first electric system L_1, L_2 which gives by scanning through the fields M_1 and M_2 an intermediate image I_1 owing to the modulation of the beam by the electrode W. The system V_1, V_0 gives the final image I_2 on the window F after acceleration of the electrons to the desired voltage. The goffering of the window is shown on a scale much larger than the true scale in order to reproduce the structure described in Figure 4*b*. The voltage difference between V_0 and K may be, for example, from 100,000 to 500,000 volts, the distribution of the voltages between the various electrodes being effected according to the optical requirements of the system. The gas chamber is illustrated at V. The inner face of the window will preferably be metallised on the thicker parts of the goffering so that the potential of the region of the final image may be well defined.

In the description of the invention the expression "electronic" has been employed, but it is understood that it is applicable to beams of other charged particles.

I claim:

1. Television receiving tube comprising inside of an evacuated vessel an electron gun producing an electron beam, means for modulating said beam in intensity means for deflecting the beam, means for impressing on the beam a high acceleration, said mentioned means being arranged in cascade at the beginning of the electron gun, a thin wall of material permeable to electrons closing tightly the said vessel, said wall being arranged within the sweep range of the beam, a metallic grill of large mechanical resistance attached to said wall so as to render it more rigid, a chamber in part bounded by said wall and filled with gas under suitable pressure and a transparent wall closing said chamber through which the produced luminosity is observable.

2. Apparatus according to claim 1, in which the wall permeable to electrons is made of aluminum.

3. Apparatus according to claim 1, in which the wall permeable to electrons is metallic.

4. Television receiving tube comprising inside of an evacuated vessel an electron gun producing an electron beam, means for modulating said beam in intensity, means for deflecting the beam, means for impressing on the beam a high acceleration, said mentioned means being arranged in cascade along the beam path at the beginning portion of the electron gun, a thin wall of material permeable to electrons closing tightly the said vessel, a metallic grill of large mechanical resistance located close to the said wall on the side opposite the beam impact, said wall being arranged within the sweep range of the beam, a chamber in part bounded by said wall and filled

with gas under pressure of over one atmosphere and a transparent wall closing said chamber through which the produced luminosity is observable.

5. Apparatus according to claim 4, wherein the said wall consists of a thin sheet of molded material coating the said grill.

MAURICE PONTE.

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