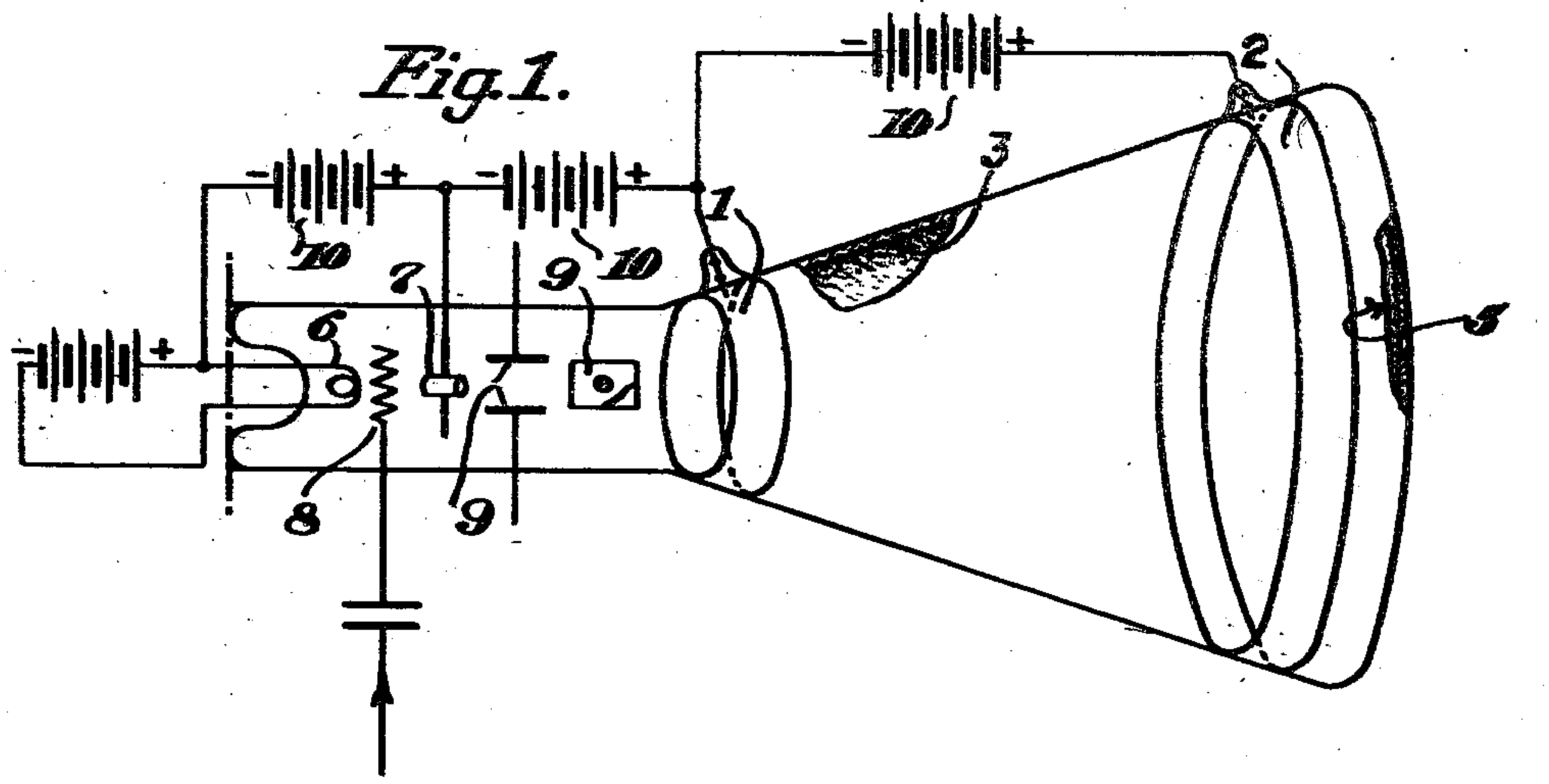
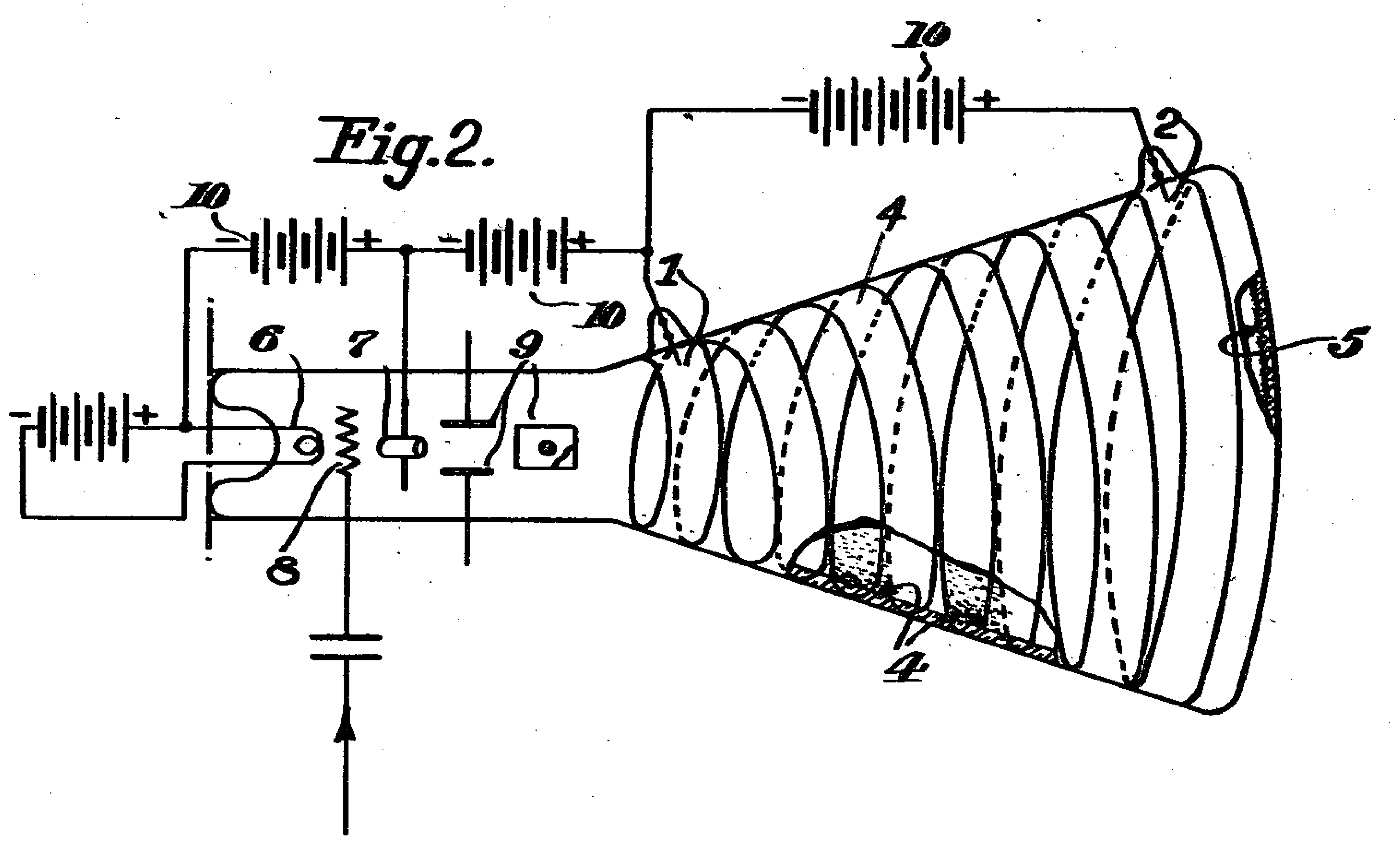
July 12, 1938. E. SCHWARTZ 2,123,636

HIGH VACUUM CATHODE RAY TUBE

Filed Feb. 17, 1933





Inventor:
Erich Schwartz
By B. Singer, Atty

UNITED STATES PATENT OFFICE

2,123,636

HIGH-VACUUM CATHODE RAY TUBE

Erich Schwartz, Berlin, Germany, assignor to firm Fernseh Aktien-Gesellschaft, Zehlendorf, near Berlin, Germany

Application February 17, 1933, Serial No. 657,304
In Germany February 23, 1932

8 Claims. (Cl. 250—27.5)

This invention relates to high vacuum cathode ray tubes, and more particularly to a means for overcoming wall charges.

Whereas in the case of cathode ray tubes with gas concentration undesirable wall charges may be avoided by the migration of ions, particular measures require to be taken to overcome these in cathode ray tubes of the high vacuum type.

Heretofore it has been usual for this purpose to make the walls of metal. Naturally, it would also be possible with equal effect to provide the walls with a metallic coating, for example with an inner reflector. Unfortunately, however, this method, generally speaking, may be adopted only in respect of tube portions which already encompass a space without field, that is to say—the electrons have already passed the attraction potential when they enter this fieldless space surrounded by a metallic conductor. This method in particular would fail entirely in those cases in which the luminous screen itself requires to be charged to attraction potentials (in accordance with the U. S. Patent No. 1,993,565 issued March 5, 1935), as the accelerating field is distorted by the metallic wall.

To avoid these difficulties it has already been proposed in the prior patent above referred to, to provide a plurality of electrodes along the glass wall of the tube, these electrodes each being charged to a certain potential. This method, however, also possesses drawbacks, because on the one hand the potential varies merely in desultory fashion along the wall, and in turn gives rise to distortions of the field, while on the other hand the practical execution of this method is not only complicated but also expensive.

The ideal state of field distribution would exist, for instance, assuming that an anode shutter is employed and the luminous screen is designed to function as attraction anode, if the potential areas were spherical in form, their centre point being situated approximately in the vicinity of the control elements, or possibly, even better, in the shutter aperture of the first anode.

To accomplish this, and above all to preclude all undesirable wall charges, the invention makes provision for a continuous drop in potential on the glass wall, in such fashion that the potential areas are enabled to develop up to the glass wall in undistorted fashion, as called for by the natural distribution of the field. The idea according to the invention may also be utilized in connection with high-vacuum cathode ray tubes, the luminous screens of which are not raised to attraction potential, but which operate with a normal anode and fieldless space between the anode and the luminous screen; in this case, of course, the same must be adapted in appropriate fashion to the field-filled space between the anode and the deflecting plates or filament.

The invention may be performed, for example, in such fashion that the glass envelope of the high-vacuum cathode ray tube is furnished on the interior with a coating of relatively high resistance, and the ends of this coating linked up with the poles of a potential source, whereby an ohmic drop in potential would result at the coating.

By suitable selection of the potential at the ends of the coating, and possibly also by suitable variation of the thickness of the coating (conductivity) along the glass wall, this ohmic drop in potential may be adapted to any potential distribution. It is possible, for example, as potential source for the conductive coating, to make immediate use of the attraction potential, and to connect the ends of the coating with the cathode and the luminous screen. Naturally, however, it is equally possible to connect the ends of the coating with any other suitable electrodes in the tube. Beyond the specific purpose of the conductive coating set forth in the above, it is also possible in accordance with the invention, by means of the drop in potential produced in the conductive coating, to correct any field distortion which may prevail that is not in agreement with the ideal condition.

It might also be conceivable to provide along the wall, in place of a homogeneous conductive layer, say, a spirally wound conductive material, or alternatively to make the wall itself of conductive glass. It is immaterial as regards the new method itself whether the wall is produced from a material of relatively high resistance, or the glass wall coated with a layer of high ohmic resistance, or the inner face of the wall made to be conductive by a suitable chemical treatment. The idea disclosed by the invention may also be realized equally well with the assistance of a very thin metallic reflector, for example a silver reflector, whereby in order to ensure that the consumption of current is low attention must be paid to the fact that the resistance of the conductive layer is made sufficiently high.

The invention will now be described more particularly with reference to the accompanying drawing, which illustrates diagrammatically two possible forms of embodiment for reducing the invention to practice.

Fig. 1 shows a form of embodiment, in which the tube is coated homogeneously on the interior.

Fig. 2 is a modification illustrating a further possible form of coating.

Referring now to Fig. 1, the glass envelope of the cathode ray tube is furnished on the interior with a coating 3 of relatively high resistance, the ends 1 and 2 of this coating being linked up with the poles of a potential source so as to produce an ohmic drop in potential at the said coating 3. Since this potential source does not require to be of a specific nature, the same has not been particularly shown in the drawing.

In the modified form of embodiment according to Fig. 2 the coating 4 is applied about the glass in spiral form, the ends 1 and 2 also being linked up with the poles of a potential source, as in Fig. 1.

In both tubes I prefer to provide the large end of the tube with a fluorescent screen 5 on which an electron beam is projected from a gun cathode 6 accelerated by an apertured anode 7 and controlled by an input grid 8. Deflection may be accomplished in two directions by deflection plates 9 energized by appropriate oscillators, or by any other means well known in the art. The anode and the films may be energized by appropriate sources 10.

It is immaterial in the performance of the invention whether the existing anode potential or possibly other potential sources are applied to the conductive coating. According to the invention, the applied potential may also be so varied, for example with the assistance of regulating resistances, that the most favorable distribution of the field is obtained in practical use. To produce a distribution of the field as desired, it is also possible in accordance with the invention to apply potentials of different value to different points of the coating.

It will be understood that no restriction is made to the particular forms of embodiment illustrated in the drawing, which are quoted solely by way of example. As already stated, it would also be equally possible to make the tube wall itself of conductive glass in place of the conductive coating applied thereto, or to make the inner face of the wall conductive by a special chemical treatment, and numerous other modifications and variations are also possible within the meaning of the above description and the annexed claims without departing from the spirit of the invention.

What I claim as new and desire to secure by Letters Patent is:

1. A high-vacuum cathode ray tube comprising an envelope, a hot cathode, a fluorescent screen, means for focussing the electron beam on said screen, means for deflecting said electron beam, and means adapted to produce a continuous gradient, potential along the inner face of said envelope between said deflecting means and said fluorescent screen by an ohmic drop of voltage.

2. A high-vacuum cathode ray tube having an envelope, a hot cathode, a fluorescent screen, means for focussing the electron beam on said screen, means for deflecting said electron beam, said envelope being provided along its inner face between said deflecting means and said fluorescent screen with a continuous conductive coating, and terminals extending through the wall of the envelope and connected with spaced points of said conductive coating.

3. A high-vacuum cathode ray tube including an envelope, a hot cathode, a fluorescent screen, means for focussing the electron beam on said screen, means for deflecting said electron beam, said envelope being provided at its inner face between said deflecting means and said fluorescent screen with a continuous conductive coating in the shape of a helical band, and terminals extending through the wall of the envelope and connected with the ends of said helically conductive coating.

4. A high-vacuum cathode ray tube including an envelope, a hot cathode, a fluorescent screen, means for focussing the electron beam on said screen, means for deflecting said electron beam, said envelope being provided with means providing an ohmic resistance along the wall in axial direction of said envelope between said deflecting means and said fluorescent screen, and outwardly extending terminals connected conductively at axially spaced points with said ohmic resistance means.

5. A high-vacuum cathode ray tube including an envelope, a hot cathode, a fluorescent screen, means for focussing the electron beam on said screen, means for deflecting said electron beam, a conductive coating on said envelope between said deflecting means and said fluorescent screen, said coating being produced by a deposit of metal, and terminals at spaced points of said coating which is adapted to produce a continuous drop in potential along said envelope upon application of a source of electrical energy to said terminals.

6. A high-vacuum cathode ray tube, including an envelope, an anode, a cathode, a fluorescent screen, a continuous conductive coating along the inner face of said envelope between said anode and said fluorescent screen, and terminals connected with the ends of said coating and extending through the wall of the envelope.

7. A high-vacuum cathode ray tube, including an envelope, an anode, a cathode, a fluorescent screen, a continuous spirally disposed conductive coating on the inner face of said envelope between said anode and said fluorescent screen, and terminals connected with the ends of said spirally disposed conductive coating and extending through the wall of said envelope.

8. A high-vacuum cathode ray tube including an envelope composed of conductive glass, a hot cathode, a fluorescent screen, means for focussing the electron beam on said screen, means for deflecting said electron beam, and terminals secured in axially spaced relation to the walls of said envelope between said deflecting means and said fluorescent screen whereby a continuous drop in potential is produced between said terminals when the same are connected to a source of electrical energy.

ERICH SCHWARTZ.