PATENT SPECIFICATION (11) 1 563 864

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(21) Application No. 38365/77 (22) Filed 14 Sept. 1977
(31) Convention Application No. 7 610 353 (32) Filed 17 Sept. 1976 in
(33) Netherlands (NL)
(44) Complete Specification published 2 April 1980
(51) INT. CL.³ H01J 9/00 29/76
(52) Index at acceptance
H1D 34 4A4 4A7 4B4 4C1 4C2X 4CY 4K4 4K7D 4K7Y 4K8 4X5 9D 9Y
G3N 269 277B 2

(54) POSITIONING TELEVISION DEFLECTION UNITS

(71) We, N.V. PHILIPS' GLOEILAMPENFABRIEKEN, a limited liability Company, organised and established under the laws of the Kingdom of the Netherlands, of Emmasingel 29, Eindhoven, the Netherlands, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

The invention relates to a method of positioning references for the location of the magnetic deflection unit which in the operating condition is provided around the neck and the conical part of the envelope of a colour display tube of the "in-line gun" type, said neck including three electron guns situated with their axes in one plane, a display screen being situated at the opposite end of said display tube to said electron guns.

The invention also relates to a display tube provided with reference points according to the method, a device for carrying out the method, and a display tube manufactured by means of the device.

Such a method is known from Netherlands Patent Application 7,500,853 laid open to public inspection in which it is disclosed that in the display tube factory reference points are provided on the neck and/or the conical part of the envelope by means of a so-called standard deflection unit. The standard deflection unit is a deflection unit whose deflection properties are accurately determined, for example, with Hall probe measurements. Such an envelope should then be combined with a deflection unit which is also provided with reference points on a standard display tube. The drawback of this method is that the adjustment of the deflection units is related with the adjustment of a standard deflection unit and not with the place and the direction of an electron beam. Great inaccuracies may occur due to asymmetry in the deflection unit and/or due to the not entirely correct positioning of the electron guns in the neck during sealing. It is therefore the object of the invention to provide a method which does not exhibit these drawbacks and in which the adjustment of the deflection unit by means of reference points on the envelope is determined by the position and direction of the electron beam axis of the electron beam of the central electron gun.

According to the invention, a method of the kind mentioned in the first paragraph is characterized in that the electron beam of the central electron gun is adjusted to produce on the display screen a colour-pure display by means of a colour purity magnet, a dynamic magnetic multipole field being then generated in a plane substantially normal to the longitudinal axis of the colour display tube around the neck of the colour display tube near the electron gun after which the colour display tube is moved relative to said multipole field in the plane normal to the axis of said colour display tube until a dot is obtained on the display screen, after which the references are provided on the neck of the tube and/or the conical part of the envelope which locate the position and the direction of the electron beam axis of the central electron gun which are determined by the line joining the centre of the multipole field and the dot on the display screen.

The great advantage of this method is that the references locate and can be used to indicate the position and the direction of the electron beam axis of the central gun of the tube. As a result it is possible to adjust an accurately manufactured deflection unit by moving it against the reference points, as a result of which the electron optical axis of the deflection unit coincides with the electron beam axis of the central

gun. For less accurately manufactured deflection units a small correction will be sufficient to cause the axes to coincide.

The magnetic multipole is preferably a dynamic magnetic four-pole field.

A device for carrying out the method according to the invention is characterized in that said device comprises a holder for the colour display tube with which it can be tilted and moved substantially in the plane normal to the axis of the colour display tube, a dynamic multipole magnet which can be placed around the neck of the colour display tube, an instrument for observing and localizing the dot on the display screen, and means for positioning the references.

The instrument for localizing the point on the display screen may be a simple monocular. It is alternatively possible, however, to use for this purpose a matrix of photosensitive elements, for example photodiodes. As a matter of fact, this can be connected to a process computer which controls the movement of the holder for the colour display tube and/or the means for positioning the references. The means for positioning the references may comprise a number of elements. It is possible, for example, to provide the reference points by spraying or pouring a quantity of thermoplastic material or a material with a hardener between a deflection unit and the neck and/or cone. In thast case, the means comprises a spraying or pouring device.

Another possibility is to provide a ring or a number of thickenings around the neck and/or the conical part of the envelope which are ground by means of a cutting device dependent on the direction and position of the electron beams.

By means of said spraying or pouring device or cutting device, the position of the deflection unit in the direction of the axis of the colour display tube can be fixed.

The invention will now be described in greater detail with reference to a drawing, in which:—

Figure 1 explains the method,

Figure 2 shows a matrix of photosensitive elements, and

Figures 3 and 4 show two units for producing four-poles magnetic fields,

Figure 1 is a sectional view of a colour display tube. The glass envelope 1 has a neck 2, a conical part 3 and a display window 4. On the inside of the display window 4 is provided a display screen 5 which, in a colour display tube of the "in-line" gun type, usually consists of a large number of triplets of stripe-shaped phosphor regions. Provided in the neck 2 of the enevlope are three electron guns 6, 7 and 8 which are situated with their axes in one pane and which generate three electron beams which pass through apertures 9 in a shadow mask 10 at a small angle to each other so that they consequently each impinge only on stripe-shaped phosphor regions of one colour. When this happens the tube is adjusted in a colour-pure manner. The adjustment in a colour-pure manner is produced by means of colour purity magnet 11. The colour display tube is held in a device in which the method may be carried out by means of a holder of which the parts 12 which clamp the tube are shown in the Figure, in such manner that tilting and moving the tube is possible. Around the neck of the envelope is provided a device for providing a dynamic four pole 13 field in such manner that the tube can move in a plane normal to the tube axis 14 with respect to this four-pole field. A matrix 15 of photosensitive elements is provided against the display window 4, by means of which matrix the position of the dot on the display screen can be located.

The method according to the invention is performed as follows:—By means of the colour purity magnet 11 and the energised central electron gun 7, the electron beam generated by this electron gun is adjusted on the display screen in a colour-pure manner. The magnetic four-pole 13 is energized with an alternating voltage so that a dynamic magnetic four-pole field is generated. If the electron beam does not pass through the centre of the four-pole, it is deflected, which becomes visible on the display screen 5 in such a manner that a curved line is usually obtained. This can be established by means of the matrix 15. The dynamic four-pole 13 is now moved with respect to the envelope in a plane normal to the tube axis 14 until a dot is obtained on the screen 5. This is established again by the matrix 15 or by means of a monocular. The axis of the electron beam of the central gun is now established by the position of the dot on the display screen and the centre 16 (see Figures 3 and 4) of the dynamic four-pole field. The position and direction of the electron beam axis are fully determined by the relative positions of the holder 12 and the four-pole 13, which together fix the position of the centre 16, and the position of the dot on the display screen 5 fixed by the matrix 15. This information is applied to a process computer 17 which controls a tool for positioning the reference surfaces. This may be done, for example, by providing a ring 20 around the conical part 3 of the envelope 1 and/or around the neck 2. This ring has such dimensions that by trimming the ring by means of the reshaping tools 18 and 19 which are controlled by the process computer 17 the references are positioned. In this case the references form the reference faces 21 and 22. By means

of reference face 22 the position of the deflection unit in the direction of the tube axis 14 is also established. However, it is alternatively possible to use three cams instead of a ring and the references are adjusted by grinding or adding materials from or to the cams. It is not essential to use matrix 15. Finding out whether a dot is displayed and the localization may also be done by means of a simple monocular.

Another known possibility of positioning the references is by means of adjusting screws or by gluing space plates against the neck 2 and/or the conical part 3 of the envelope 1.

The gist of the invention is to locate the position and the direction of the electron beam axis by means of a dynamic magnetic multipole, preferably four-pole, through the line through the centre of the multipole field and the resulting dot on the display screen.

Figure 2 shows the matrix 15 comprising a large number of photodiodes 23. When a line is displayed on the display screen light impinges upon several photodiodes. The tube is then moved in the multiple field until light impinges upon only one photodiode. In that case a dot is displayed on the display screen. The photodiode also fixes the position of the dot in the system of axes X-Y.

Figures 3 and 4 show two possibilities for generating a dynamic magnetic four-pole field. Figure 3 shows a toroidal coil construction, the four-pole field being determined by the magnetic field lines 24 and is generated by passing an alternating current such as a sawtooth current with a frequency equal to the usual deflection frequency through the turns 25 of the coils wound around a yoke ring 26. It is also possible to use alternating currents with another frequency e.g. a sinusoidal current of 50 or 60 Hz.

Figure 4 shows a dynamic four-pole field having radially situated coils 27. As is known, there are many more possibilities to generate a dynamic magnetic four-pole field. Moreover, the invention is not restricted to a four-pole, but a six-pole, a eight-pole and so on may also be used successfully. A great advantage is that, if the references are related with the position and direction of the electron beam axes, deflection units of different types, for example using two pairs of saddle-shaped coil, toroidal coils or a combination of the two types of coil, can simply be adjusted on one type of envelope by causing the longitudinal axis thereon to coincide with the electron beam axis fixed by references.

WHAT WE CLAIM IS:—

1. A method of positioning references for the location of the magnetic deflection unit which in the operating condition is provided around the neck and the conical part of the envelope of a colour display tube of the "in-line gun" type, said neck including three electron guns situated with their axes in one plane, a display screen being situated at the opposite end of said display tube to said electron guns, characterized in that the electron beam of the central electron gun is adjusted to produce on the display screen a colour-pure display by means of a colour purity magnet, a dynamic magnetic multipole field being then generated in a plane substantially normal to the longitudinal axis of the colour display tube around the neck of the colour display tube near the electron gun, after which the colour display tube is moved relative to said multiple field substantially in the plane normal to the axis of said colour display tube until a dot is obtained on the display screen, after which the references are provided on the neck of the tube and/or the conical part of the envelope which locate the position and the direction of the electron beam axis of the central electron gun which are determined by the line joining the centre of the multipole field and the dot on the display screen.

2. A method as claimed in Claim 1, characterized in that the dynamic magnetic multiple field is a dynamic magnetic four-pole field.

3. A method for positioning references substantially as herein described with reference to the accompanying drawings.

4. A device for carrying out the method as claimed in Claim 1, 2 or 3, characterized in that said device comprises a holder for the colour display tube with which it can be tilted and moved substantially in the plane normal to the axis of the colour display tube, a dynamic multipole magnet which can be placed around the neck of the colour display tube, an instrument for observing and localizing the dot on the display screen, and means for positioning the references.

5. A device as claimed in Claim 4, characterized in that the instrument is a monocular.

6. A device as claimed in Claim 4, characterized in that the instrument consists of a matrix of photo-sensitive elements.

7. A device as claimed in Claim 6, characterized in that said matrix of photo-

sensitive elements controls movement of the holder and/or the positioning means by means of a process computer.

8. A device as claimed in Claim 4, 6 or 7, characterized in that the positioning means is a cutting device.

9. A device for carrying out the method as claimed in claim 1, substantially as herein described with reference to the accompanying drawings.

10. A colour display tube having references for the magnetic deflection unit positioned according to the method as claimed in Claim 1, 2 or 3.

11. A colour display tube having references for the magnetic deflection unit positioned by means of the device as claimed in Claim 4, 5, 6, 7, 8 or 9.

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Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1980
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained

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2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

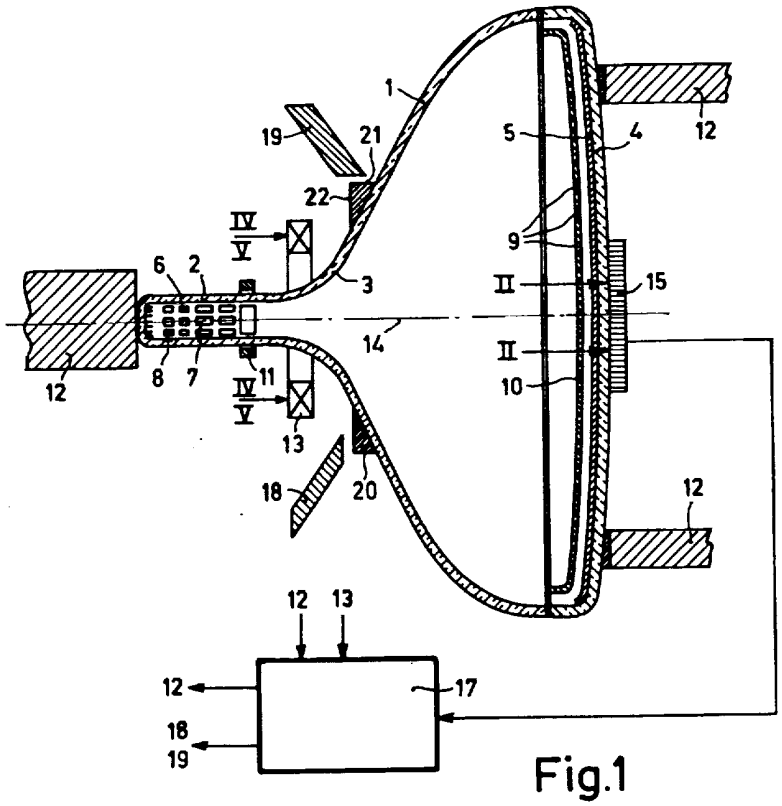

Fig.1

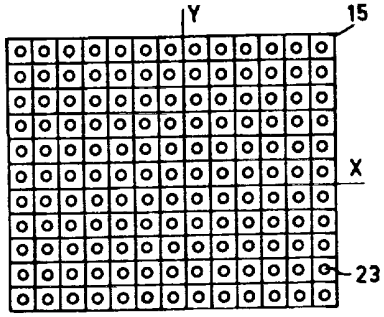

Fig.2

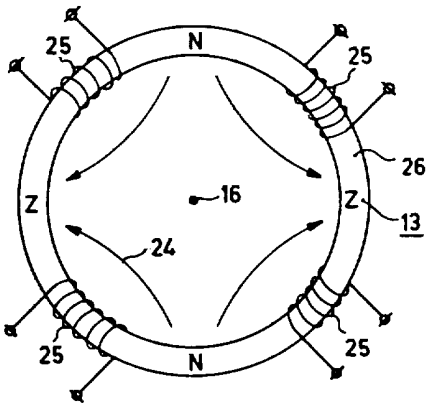

Fig.3

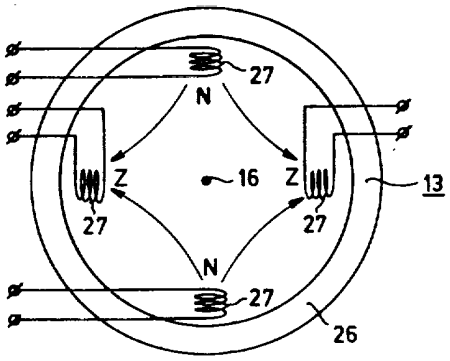

Fig.4