

PATENT SPECIFICATION

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DRAWINGS ATTACHED



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(54) COLOUR DISPLAY CATHODE-RAY TUBE

- (71) We, PHILIPS ELECTRONIC AND ASSOCIATED INDUSTRIES LIMITED, of Abacus House, 33 Gutter Lane, London, E.C.2., a British Company, 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:—
- 10 This invention relates to a colour display cathode-ray tube comprising at least one electron gun for producing a plurality of electron beams, a luminescent screen adjacent the gun side of which is a colour section electrode and a convergence device for converging the various electron beams at said electrode, said converging device comprising for each electron beam a pair of pole-shoe plates, each of which extends through an individual slot in a cylindrical part of said device, said slots extending in the axial gap direction of said part and the pairs of pole shoes being screened from each other by partitions extending in the radial direction of said part.
- 15 When using such a tube in which the electron beams are converged magnetically, an external magnetic convergence device is normally present around a neck portion of the evacuated tube envelope and produces magnetic fields which are guided to the electron beams by means of the internal pole shoes. The radial partitions stop the magnetic fields from interacting while the cylindrical part serves *inter alia* to screen the electron beams from undesirable electrostatic fields, (which may arise for example as a result of the wall of the neck portion of the envelope becoming charged). In order that the electron beams should remain converged in the same manner when they are caused to scan the luminescent screen, a dynamic convergence system is used which depends upon the deflection of the beams.
- [Price 25p]
- For the line deflection of the beams the dynamic convergence magnetic field varies approximately parabolically with time at the line frequency. The field at the region of the electron beams tends to lag relative to the field produced by the external magnetic convergence device. The lag may be approximately 4 micro seconds in a normal gun. In order to compensate for this lag it is usual to cause the field produced by the external magnetic convergence device to lead in phase relative to the deflection. This may be realized to a certain extent by the addition of a sawtooth component to the convergence field, but this does not give exact correction for the lag. The magnetic fields necessary for dynamic convergence increase much more than directly proportionally with increasing deflection angle; for a cathode-ray tube having a deflection angle of 110°, for example, these fields are approximately twice those required in a cathode-ray tube having a deflection angle of 90°. The result of this is that with increasing deflection angle, it becomes even more difficult to produce a satisfactory form of field to compensate for the lag. Not counting the fact that it does not in any case give exact correction of the lag, a larger sawtooth component and hence much extra power becomes necessary, which may require the provision of a more expensive circuit for the production thereof and give rise to increased heat dissipation.
- It has been found that the reason the parabolic magnetic field at the region of the electron beams lags relative to the field produced by the external magnetic convergence device is mainly because circulating currents flow around the axial slots in the cylindrical part of the internal convergence device; these currents have been found to have a time constant in the order of micro-seconds.
- It is an object of the invention to provide

a way of counteracting the occurrence of said circulating currents as such.

The invention provides a colour display cathode-ray tube comprising at least one electron gun for producing a plurality of electron beams, a luminescent screen adjacent the gun side of which is a colour selection electrode, and a convergence device for converging the various electron beams at said electrode, said convergence device comprising for each electron beam a pair of pole shoe plates each of which extends through an individual slot in a cylindrical part of said device, said slots extending in the axial direction of said part and the pairs of pole shoes being screened from each other by partitions extending in the radial direction of said part, gaps being present in said cylindrical part in such manner that no closed electric path exists around each slot singly.

Of course, the gaps should preferably be arranged so that the mechanical rigidity of the cylindrical part is maintained. It has been found that such a construction can give both reduced lag and an increase in the sensitivity of the convergence device. As a result of this better convergence of the electron beams can be realized while reducing the required sawtooth component so that a simpler circuit using less power will do.

In order that the invention may be readily carried into effect, embodiments thereof will now be described in greater detail, by way of example, with reference to the accompanying diagrammatic drawing, in which:—

Figure 1 is a longitudinal section of a cathode-ray tube;

Figure 2 is an elevation of an internal convergence device, and

Figure 3 is an elevation of another internal convergence device.

The cathode-ray tube 1 shown in Figure 1 includes a system of three guns 2 (shown diagrammatically) which are situated in a triangular arrangement and each produce one electron beam. The resulting three electron beams are converged on a shadow mask 4 by a convergence device consisting of an internal convergence device incorporated in the system of guns 2 and an external convergence device 3, also shown diagrammatically, after which the beams each impinge upon certain parts of a luminescent screen 5. Scanning of the screen by the beams is effected by a deflection device 6.

The internal convergence device of Figure 2 consists for each electron beam of a pair of pole shoe plates 10 and 11, 12 and 13, 14 and 15. Each pole shoe extends through a similar slot in a cylindrical part 16, which slot extends parallel to the axis

of the part 16. The pole shoe 10 extends through a slot 17, and the pole shoe 11 through a slot 18. A gap 19 extends between the slots 17 and 18, as a result of which the closed electric path which would otherwise exist around each slot 17 and 18 singly is broken (similarly for the other pairs of slots). The occurrence of circulating currents around the slot 17 and around the slot 18 as a result of a magnetic field induced on the pole shoes 10 and 11 by the external convergence device is therefore counteracted. A closed electric path is still present around the slots 17 and 19 collectively, it is true, but this is permissible because the fields at the pole shoes 10 and 11 in operation are directed oppositely so that no circulating currents need occur around the slots 17 and 18 collectively. In a given case, in the absence of the gap 19 a parabolic magnetic field at the region of an electron beam lagged relative to a field produced by the external magnetic convergence device by approximately 4 micro-seconds. In the presence of the gap 19 this was reduced to approximately 1.5 microseconds. Radial partitions 20, 21 and 22 screen the pairs of pole shoes from each other.

The internal convergence device of Figure 3 consists for each electron beam of a pair of pole shoe plates 25 and 26, 27 and 28, 29 and 30. Each pole shoe again extends through a similar slot in a cylindrical part 31 which slot extends parallel to the axis of the part 31. The pole shoe 25 extends through a slot 32 and the pole shoe 26 extends through a slot 33. The slots 32 and 33 (and the other slots) open at one end into the edge of the cylindrical part 31. As a result of this the closed electrical path which would otherwise exist around each slot is broken, the mechanical rigidity of the cylindrical part being maintained by the material between the slots and the other edge of said part. Radial partitions 34, 35 and 36 screen the pairs of pole shoes from each other.

WHAT WE CLAIM IS:—

1. A colour display cathode-ray tube comprising at least one electron gun for producing a plurality of electron beams, a luminescent screen adjacent the gun side of which is a colour selection electrode, and a convergence device for the various electron beams at said electrode, said convergence device comprising for each electron beam a pair of pole shoe plates, each of which extends through an individual slot in a cylindrical part of said device, said slots extending in the axial direction of said part and the pairs of pole shoes being screened from each other by partitions extending in the radial direction of said part, gaps being



a way of counteracting the occurrence of said circulating currents as such.

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Of course, the gaps should preferably be arranged so that the mechanical rigidity of the cylindrical part is maintained. It has been found that such a construction can give both reduced lag and an increase in the sensitivity of the convergence device. As a result of this better convergence of the electron beams can be realized while reducing the required sawtooth component so that a simpler circuit using less power will do.

In order that the invention may be readily carried into effect, embodiments thereof will now be described in greater detail, by way of example, with reference to the accompanying diagrammatic drawing, in which:—

Figure 1 is a longitudinal section of a cathode-ray tube;

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The cathode-ray tube 1 shown in Figure 1 includes a system of three guns 2 (shown diagrammatically) which are situated in a triangular arrangement and each produce one electron beam. The resulting three electron beams are converged on a shadow mask 4 by a convergence device consisting of an internal convergence device incorporated in the system of guns 2 and an external convergence device 3, also shown diagrammatically, after which the beams each impinge upon certain parts of a luminescent screen 5. Scanning of the screen by the beams is effected by a deflection device 6.

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of the part 16. The pole shoe 10 extends through a slot 17, and the pole shoe 11 through a slot 18. A gap 19 extends between the slots 17 and 18, as a result of which the closed electric path which would otherwise exist around each slot 17 and 18 singly is broken (similarly for the other pairs of slots). The occurrence of circulating currents around the slot 17 and around the slot 18 as a result of a magnetic field induced on the pole shoes 10 and 11 by the external convergence device is therefore counteracted. A closed electric path is still present around the slots 17 and 19 collectively, it is true, but this is permissible because the fields at the pole shoes 10 and 11 in operation are directed oppositely so that no circulating currents need occur around the slots 17 and 18 collectively. In a given case, in the absence of the gap 19 a parabolic magnetic field at the region of an electron beam lagged relative to a field produced by the external magnetic convergence device by approximately 4 micro-seconds. In the presence of the gap 19 this was reduced to approximately 1.5 microseconds. Radial partitions 20, 21 and 22 screen the pairs of pole shoes from each other.

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present in said cylindrical part in such manner that no closed electric path exists around each slot singly.

2. A colour display cathode-ray tube, substantially as herein described with reference to Figures 1 and 2, or Figures 1 and 3 of the accompanying drawing.

C. A. CLARK,
Chartered Patent Agent,
Century House,
Shaftesbury Avenue,
London W.C.2.

Agent for the Applicants.

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