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Gerritsen

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[54] **CATHODE-RAY TUBE**

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[51] **Int. Cl.**.....**H01j 29/76**

[58] **Field of Search** 335/210; 313/77, 313/79

[56] **References Cited**

UNITED STATES PATENTS

3,482,137 12/1969 Johnson.....313/77 X

3,534,208 10/1970 Krackhardt et al.....313/77

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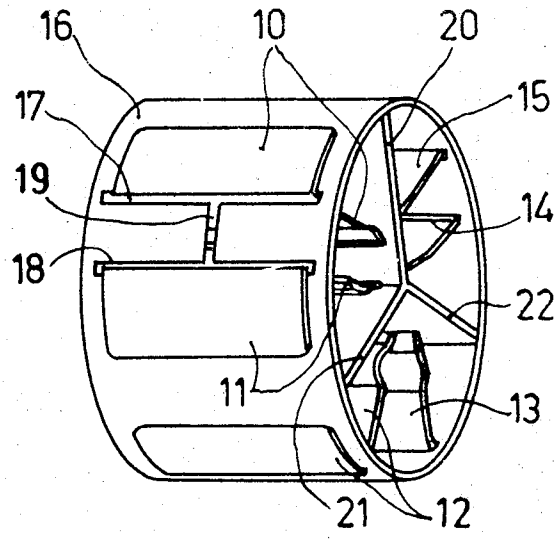
[57] **ABSTRACT**

A cathode-ray tube in which a number of electron beams are produced. The tube comprises a luminescent screen and, at a short distance therefrom, a color selection electrode. The electron beams are converged by means of a magnetic convergence device. The part of the convergence device present inside the tube comprises for each electron beam a pair of plate-shaped pole shoes. Each pole shoe is provided in a cylindrical part of the convergence device through an axial gap. The cylindrical part of the convergence device furthermore comprises gaps in such manner that it holds for each axial gap that no closed electric connection exists around a single gap. As a result of this the occurrence of circulating currents around the axial gaps is counteracted.

5 Claims, 3 Drawing Figures



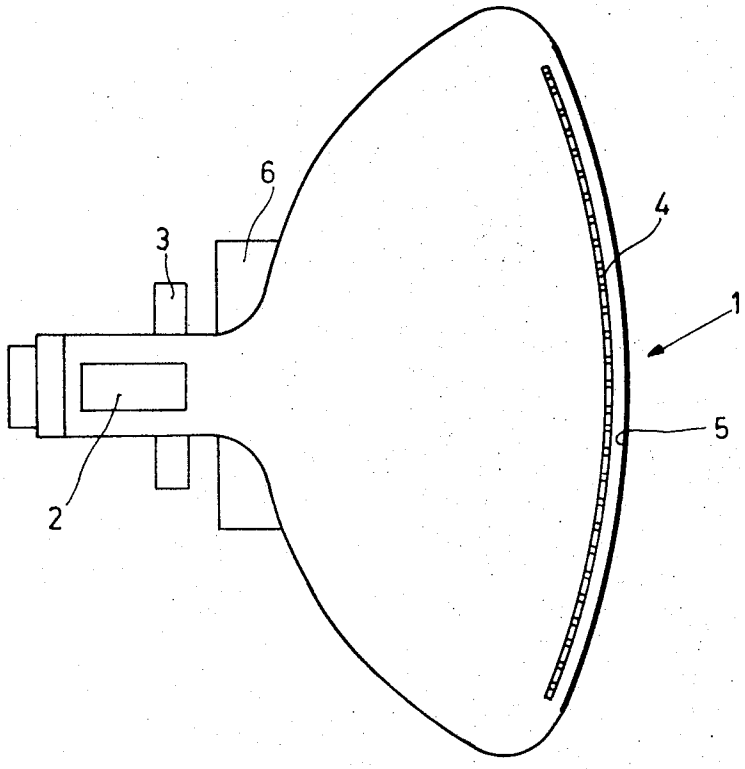


Fig.1

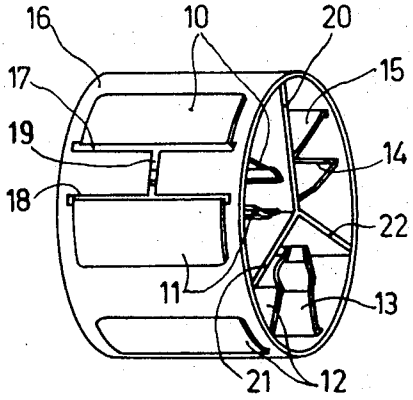


Fig.2

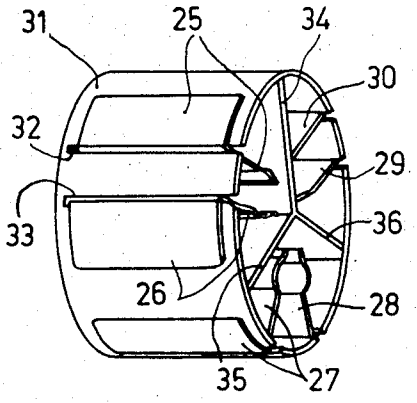


Fig.3

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CATHODE-RAY TUBE

The invention relates to a cathode-ray tube comprising at least one electron gun for producing a number of electron beams, a luminescent screen on the gun side of which is present at a short distance from said screen a color selection electrode in the plane of which the various electron beams are converged, and a convergence device which comprises for each electron beam a pair of plate-shaped pole shoes, each pole shoe being provided in a cylindrical part of the convergence device through an axial gap, the pairs of pole shoes being screened relative to each other by radial partitions.

When using such a tube, in which the electron beams are converged magnetically, an external magnetic convergence device is present around the neck of the tube and produces magnetic fields which are guided to the electron beams by means of the internal plate-shaped pole shoes. The radial partitions screen the magnetic fields relative to each other, while the cylindrical part serves inter alia to screen the electron beams from undesirable electrostatic fields, for example as a result of charging of the wall of the neck of the tube. In order that the electron beams remain converged in the same manner during scanning of this luminescent screen, a convergence system is used which depends upon the deflection of the electron beams so that there is dynamic convergence. For the horizontal deflection of the beams the magnetic field of the dynamic convergence varies approximately parabolically with time, with the line frequency as the recurrence frequency. At the region of the electron beams, a lagging of the parabolic magnetic field occurs relative to the field produced by the external magnetic convergence device, which lagging is approximately 4 microseconds in a normal gun. In order to compensate for this lagging, the field produced by the external magnetic convergence device should lead in phase relative to the deflection. In practice, this is realized to a certain extent by the addition of a sawtooth component to the field, but it is no exact correction for the lagging. When the deflection angle increases, the magnetic fields necessary for the dynamic convergence increase much more than directly proportionally; for a cathode-ray tube having a deflection angle of 110°, for example, these fields are approximately twice as strong as in a cathode-ray tube having a deflection angle of 90°. The result of this is that it becomes even more difficult in a cathode-ray tube having a deflection angle of 110° than in a cathode-ray tube having a deflection angle of 90° to produce a satisfactory form of field to compensate for the lagging. Not counting the fact that it is no exact correction of the lagging, a stronger sawtooth component and hence much extra power is necessary which requires more expensive and possibly active circuit for the production thereof and gives rise to heat evolution.

It has been found that the lagging of the parabolic magnetic field at the region of the electron beams relative to the field produced by the external magnetic convergence device is mainly a result of circulating currents flowing around the axial gaps in the cylindrical part of the internal convergence device; these currents have been found to have a time constant in the order of microseconds. The invention now provides a measure which counteracts the occurrence of the said circulating currents as such.

According to the invention, the cylindrical part of the convergence device comprises gaps in such manner that it holds for each axial gap that no closed electric connection exists around a single such axial gap. Of course, the gaps should be arranged so that the mechanical rigidity of the cylindrical part is maintained. It has been found that in addition to a decrease of the lagging, an increase of the sensitivity of the convergence device is obtained. As a result of this a better convergence of the electron beams can be realized, while the required sawtooth component need be less strong so that a simpler circuit will do and a smaller power need be supplied for the convergence device.

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

FIG. 1 is a sectional view of a cathode-ray tube,

FIG. 2 is an elevation of the internal convergence device, and

FIG. 3 is an elevation of another internal convergence device.

The cathode-ray tube **1** shown in FIG. 1 comprises a system of guns **2** shown diagrammatically and comprising three guns and an internal convergence device. The guns placed in a triangular arrangement each produce an electron beam; the electron beams are converged on a shadow mask **4** by a convergence device consisting of an internal convergence device belonging to the system of guns **2** and a diagrammatically shown external convergence device **3**, after which the beams each impinge upon certain parts of the luminescent screen **5**. The scanning of the screen is effected by a diagrammatically shown deflection device **6**.

FIG. 2 is an elevation of an internal convergence device. It consists for each electron beam of a pair of plate-shaped poleshoes **10** and **11**, **12** and **13**, **14** and **15**. Each plate-shaped pole-shoe is provided in a cylindrical part **16** through an axial gap. The poleshoe **10** is provided through an axial gap **17**, and the poleshoe **11** through another axial gap **18**. The axial gaps **17** and **18** are connected by a gap **19**. As a result of this it is achieved that around the single axial gap **17** no closed electric connection exists which would not be the case in the absence of the gap **19**. The same applies to the single axial gap **18**. As a result of this, the occurrence of circulating currents around the axial gap **17** and around the axial gap **18**, which currents result from the magnetic field induced on the poleshoes **10** and **11**, respectively, by the external convergence device **3**, is counteracted. While a closed electric connection is present around the gaps **17** and **18** collectively, this is permissible because the field of the poleshoe **10** and that of the poleshoe **11** are directed oppositely so that no circulating currents occur around the gaps **17** and **18** collectively. In a given case, in the absence of the gap **19**, a lagging of the parabolic magnetic field at the region of the electron beam relative to the field produced by the external magnetic convergence device of approximately 4 microseconds occurs, while in the presence of the gap **19** this is reduced to approximately 1.5 microseconds. Radial partitions **20**, **21** and **22** screen the pairs of poleshoes relative to each other.

FIG. 3 is an elevation of another internal convergence device. It consists for each electron beam of a

pair of plate-shaped poleshoes **25** and **26**, **27** and **28**, **29** and **30**. Each plate-shaped poleshoe is provided in a cylindrical part **31** through an axial gap. The poleshoe **25** is provided through an axial gap **32** and the poleshoe **26** is provided through another axial gap **33**. The axial gaps **32** and **33** open on one side into the edge of the cylindrical part **31** and are connected by the gap at this edge of the cylindrical part **31**. As a result of this it is achieved that around each axial gap no closed electric connection exists while the mechanical rigidity of the cylindrical part is maintained by the material between the axial gaps and the other edge of the cylindrical part **31**. Radial partitions **34**, **35** and **36** screen the pairs of poleshoes relative to each other.

What is claimed is:

1. A cathode ray tube comprising:

a. an evacuated envelope;

b. electron gun means for producing a plurality of electron beams;

c. a luminescent screen and a color selection electrode located on the gun side of said screen;

d. means for converging said electron beams in the plane of said color selection electrode, said converging means comprising a tubular member including a peripheral portion and a plurality of pairs of pole shoes employed for dynamically converging said electron beams and further comprising means for screening each one of said pairs of pole shoes from others of said pairs, said peripheral portion comprising spaced axial gaps through respective ones of which said pole shoes extend into said tubular member and further comprising a part extending in the space between a pair of said pole shoes, an end of said extending part being separated by a gap from another part of said peripheral portion so as to prevent a closed electric connection around a single one of said paired pole shoes.

2. A cathode ray tube as defined in claim **1**, wherein said gap is located at the ends of one pair of said axial gaps associated therewith.

3. A cathode ray tube as defined in claim **1**, wherein said gap is located at a point intermediate the ends of one pair of said axial gaps associated therewith.

4. A cathode ray tube as defined in claim **1**, wherein said screening means comprises radial partitions within said cylindrical cup.

5. A cathode ray tube as defined in claim **1**, wherein the axis of said gap is substantially transverse to the axes of associated said axial gaps.

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