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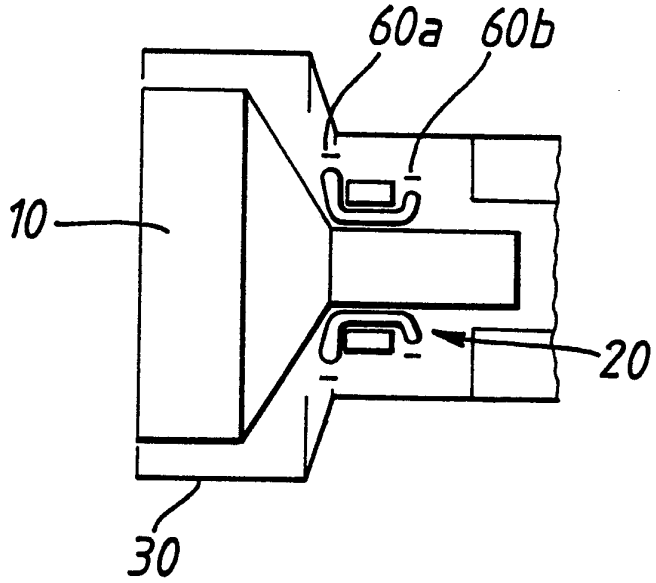

(57) Abstract

A colour cathode ray tube (10) carries a coil (20a) as part of a deflection yoke (20), and is enclosed in a mumetal shield (30). To reduce the effects of the shield (30) on the deflection by the coil (20a), a local shield (60a, 60b) is provided covering at least the ends (20c) of the coil (20a), and shunting or confining the magnetic fields generated thereby so that they are unaffected by the surrounding shield (30).

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CATHODE RAY TUBES

This invention relates to cathode ray tubes and displays incorporating such tubes, and yokes therefor.

Cathode ray tubes, for example colour cathode ray tubes and also monochrome cathode ray tubes, comprise a tube, an electron gun, and a deflection yoke or coil to which a deflection signal is supplied to scan the beam from the electron gun. The coil is fed with a saw tooth scanning current, to scan the beam linearly across the tube, and commonly a non-linear flyback current pulse in the reverse direction is provided between the linear saw teeth to cause a rapid beam return.

In displays for many environments (for example, industrial environments), the cathode ray tube must be screened both to limit the interference in other equipment caused by the electromagnetic radiation from the cathode ray tube and driving circuitry, and likewise to protect the cathode ray tube from any external electromagnetic radiation. Such shields are generally made of a material with a high magnetic permeability so as to provide effective shielding; for example, of nickel iron alloys such as mu-metal. To reduce the volume of

shielding material used, and the space occupied by the display, it is common to make the shape of the shields conform closely with the cathode ray tube. However, for different applications the shield may be shaped differently to fit into a different space.

The proximity of the shield to the deflection yoke or coil interferes with the coil magnetic circuit, and variations in the shape of the shield correspondingly will affect the magnetic circuit of the coil differently, which in turn will lead to variations in the deflection of the electron beam or beams, causing colour errors.

Accordingly, an aspect of the present invention provides an additional shield conforming closely around the deflection yoke, or other magnetic components of the CRT tube and circuit, so as to confine the field generated thereby largely or entirely to lie within the additional shield. This has the advantage that the magnetic fields from the deflection yoke do not reach the mu-metal shield assembly or reach it to a lesser extent, so that variations in its shape and size therefore have a reduced effect or no effect on the cathode ray tube performance.

In another aspect, the present invention provides a yoke for a cathode ray tube, such as a deflection yoke or a purity and convergence yoke, having magnetic shielding means around the radially outer side of at least one end edge.

An embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

FIG 1 shows generally a cathode ray tube;

FIG 2 shows generally a partly cut-away view of a cathode ray tube surrounded by a shield assembly;

FIG 3 shows schematically the position of the deflection coil in FIGS 1 and 2;

FIG 4 shows schematically the magnetic fields set up around a deflection coil;

FIG 5 shows schematically a cathode ray tube and shields according to a preferred embodiment of the invention;

FIG 6 shows schematically the fields confined in that embodiment of the invention; and

FIG 7 shows in more detail a deflection yoke embodying the invention.

Referring to FIG 1, a colour cathode ray tube 10 (for example, a shadow mask tube) carries a deflection yoke 20 (saddle yoke) feedable with scanning and flyback currents, to generate in response a magnetic field for deflecting the electron beams from each of the electron guns through holes in the shadow mask onto respective colour phosphor dots on the screen, in well known fashion. The cathode ray tube 10 also carries a purity and dynamic convergence yoke 21 and a degaussing yoke 22 in a well known manner. The CRT 10 may carry a contrast enhancement panel 40, with radio frequency interference shielding, on its face plate.

Referring to FIG 2, in some applications after manufacture, the cathode ray tube assembly shown in FIG 1 is inserted into a magnetic shield assembly 30 comprising a box made of a metal or other material with a high magnetic permeability; typically, a mu-metal nickel iron alloy. The assembly 30 confines the electromagnetic

fields produced within the CRT 10 and deflection coil 20, and also shields them from external fields. It also provides some mechanical protection and support for the CRT 10. As shown, the shield assembly 30 may, for example, comprise a closely conforming generally hexagonal cross-section tube portion 30a surrounding the CRT 10 and a generally tubular portion 30b surrounding the deflection coil, electron guns and so forth.

The portion 30a may be formed in two sections, between which the CRT 10 is inserted, subsequently secured together. It may carry a flange for mounting to an outer cabinet or panel.

The shield 30 may be joined to the front panel 40 including some electromagnetic interference/radio frequency interference (EMI/RFI) shielding by a suitable gasket seal 50.

Leads for high and low voltage connections, the image signal, and power supply run from the CRT 10 to respective connections 31, passing through the shield assembly 30 where necessary.

Referring to FIG 3, the deflection yoke 20 is positioned at the neck of the CRT 10. At this point, the cylindrical portion 30b of the shield 30 approaches the deflection coil 20 quite closely; particularly the corner between the portion 30b and the portion 30a.

Referring to FIG 4, the deflection coil 20 comprises a tubular core 20a made from, for example, ferrite, shown here with generally rectangular cross-section as an example, running round the CRT 10, and a winding 20b running between the core 20a and the CRT 10. The winding or coil 20b is a so-called "saddle winding". The saddle coil 20b comprises windings wound in, for example, approximately rectangular loops bent so as to conform to the shape of the CRT and/or the core 20a, and consequently having the saddle shape. The loops may run in slots in the inner side of the core 20a. The end edges 20c of the coil are thus proud of the surface of the CRT 10 and the surface contours of the core 20a, and generally rise some way thereabove. Between the upper and lower deflecting coils 20b a magnetic deflection field 26 within the CRT 10 is set up acting to deflect a beam 27 of electrons passing there through from the electron gun. However, at the end edges 20c of the coils 20a, unwanted magnetic fields 28 ("fringing fields") are

set up and the ferrite core 20a provides only partial external shielding of these fringing fields 28. The deflection field 26 and the fringing fields 28 are shown in broken lines in Figure 4.

Referring once more to FIG 3, the shield 30 lies within the periphery of these fields, and effectively shunts the fields altering the magnetic performance of the deflection yoke 20 to an extent depending upon how close the shield 30 is. Depending upon the shape of the shield 30 and the shape and disposition of the deflection yoke 20 and of the electron guns, the electron beams from different colour guns will in general be affected differently.

In any case, the effect of perturbing the magnetic deflection field is to cause convergence errors (failure of an electron beam to pass through the appropriate holes on the shadow mask for its colour) and purity errors (a portion of the electron beam passes through holes in the shadow mask corresponding to other colours). Whilst it may sometimes be possible to correct these errors by manipulating correction coils after the shield 30 has been added, this is tedious and expensive in man-hours; it may in any case not always be possible to correct

fully for both convergence and purity errors. This particularly tends to be the case where there is radial asymmetry between the shield 30 and the deflection yoke 20.

Additionally, perturbation of the magnetic fields can cause position errors in the path of the spot on the scan, distorting the display, even in a monochrome cathode ray tube.

Different shapes of shield 30 will tend to affect the magnetic fields differently, and consequently have different effects on the performance of the CRT 10. The shape of the shield 30 in the region of the deflection yoke 20 is particularly important in this respect.

Referring once more to FIG 3, it will be noted that in many types of cathode ray tube, since the deflection coil 20 is positioned at the neck of the CRT 10, the forward (i.e screenward) end edge 20c of the saddle coil 20a will project further from the electron beam path and further proud of the core 20a than the rearward end and consequently will set up a larger fringing field.

Referring to FIG 5, there is accordingly provided, in this embodiment, a first additional shield 60a lying over the forward end edge $20c_1$ of the saddle coil 20b. The additional shield 60a may simply comprise a strip of mu-metal foil, or of any other material with a suitably high magnetic permeability (such as, a ferrite material) stuck around the windings (assuming the windings are insulated). This is found in practice to be often sufficient to render the deflection yoke 20 insensitive to changes in shape of the mu-metal shield 30 at the region where the portions 30a and 30b intersect.

In some embodiments, however, it may also be desirable to provide a second such additional shield 60b surrounding the rearward end edge $20c_2$ of the coil.

The general effect of this is shown in FIG 6; the fringing fields set up at the end edges 20c of the coils 20a are shunted and thus confined by the local shields 60a, 60b and thus are unaffected by the presence of the shield 30 and variations between different shield shapes. Additionally, the local shields 60a, 60b also appear to allow the settling time of the deflected electron beam following flyback to be improved.

In the foregoing, it will be understood that the cathode ray tube 10 and associated deflection yoke 20 are widely available from a number of manufacturers, for example, a 20 inch colour CRT available from Toshiba has been found suitable for working the invention.

It will be understood that, whilst it is convenient to provide the local or inner shield 60 as two discrete shields (60a,60b) in close proximity to the end edges 20c of the deflection yokes, they could in principle extend over the entire outer side of the deflection yoke 20 and possibly other magnetic components of the CRT if so desired; likewise they could be further spaced apart from the deflection coil, although clearly it is preferable to provide the shield 60 relatively close to the deflection coil 20 to provide the maximum amount of freedom in varying the shape of the outer shield 30.

Preferably, the final alignment and correction of the CRT 10 is performed with the local shield 60 in place, so that the perturbation of the fringing fields of the deflection coil 20b caused by the local shield 60 is taken account of in calibration. Normally, no further calibration after the addition of the outer shield 30 should be necessary.

A more detailed drawing of a yoke embodying the present invention is shown in Figure 7. In Figure 7 a generally horn shaped or conical ferrite core 20a is provided around the deflection coils 20b. Inner shields 60a and 60b are provided around the end edges 20c of the coils 20b, and overlap the ends of the core 20a slightly in the longitudinal direction of the yoke, at each end of the core 20a.

Each of the inner shields 60a, 60b is typically about 0.2mm thick, and may be formed from four turns of mu-metal foil which is 0.05mm thick. The shields 60a, 60b are each supported on respective ring-shaped supports 61, which are provided as epoxy moldings. In Figure 7 each of the supports 61 and local shields 60a, 60b have been partially cut away at the top, to allow the construction to be seen. Each support 61 comprises an axially extending support cylinder 61a, on which the respective shield 60a, 60b rests. The support cylinder 61a extends between radially extending walls 61b. Each wall 61b extends slightly radially outwardly beyond the support cylinder 61a, so as to provide a flange to hold the shield 60a, 60b in place.

Electric supply leads 32 for the coils 20b extend through one of the walls 61b of one of the supports 61.

Although the embodiment has been described with reference to the deflection yoke 20 of the cathode ray tube 10, similar local shielding 60 can be provided for other yokes, such as the purity and convergence yoke 21.

The inner shield 60 does not have to be formed of mu-metal in all cases, but may be formed of any suitable high permeability material. In some cases, the inner shield 60 may be ferrite.

It will be appreciated that the inventive principle could be applied to other apparatus than cathode ray tubes which involve sensitive magnetic components.

CLAIMS

1. A cathode ray tube device including a coil, characterised by means provided proximate said coil to confine the field generated by said coil to reduce the effect thereon of any additional shield in proximity thereto.

2. A cathode ray tube device including a magnetic field generating component, a first magnetic shield around said component, and a second magnetic shield spaced from and around said first.

3. A method of reducing the effects on a cathode ray tube of a surrounding magnetic shield characterised by providing a local magnetic shield around magnetic components thereof.

4. A device according to claim 1 or 2 in which the means or first shield comprises a nickel iron alloy.

5. A device according to claim 4 in which the alloy is mu-metal.

6. A device according to claim 1 or claim 2 in which the means or first shield comprises ferrite.

7. A device according to claim 1 in which the deflection coil is saddle shaped and includes a forward end nearer the screen and a rearward end, in which the means comprises a shield surrounding the said forward end.

8. A device according to claim 7 in which the shield also surrounds the said rearward end.

9. A yoke for a cathode ray tube, comprising field generating means for generating a field, characterised by means to provide shielding for the said field radially outwardly of the field generating means, at least at one end edge thereof.

10. A yoke according to claim 9 in which the field generating means is a magnetic field generating means.

11. A yoke according to claim 9 in which the field generating means is a coil.

12. A yoke according to claim 9 which is a beam deflection yoke.

13. A yoke according to claim 9 which is a purity and/or convergence yoke.

FIG.1

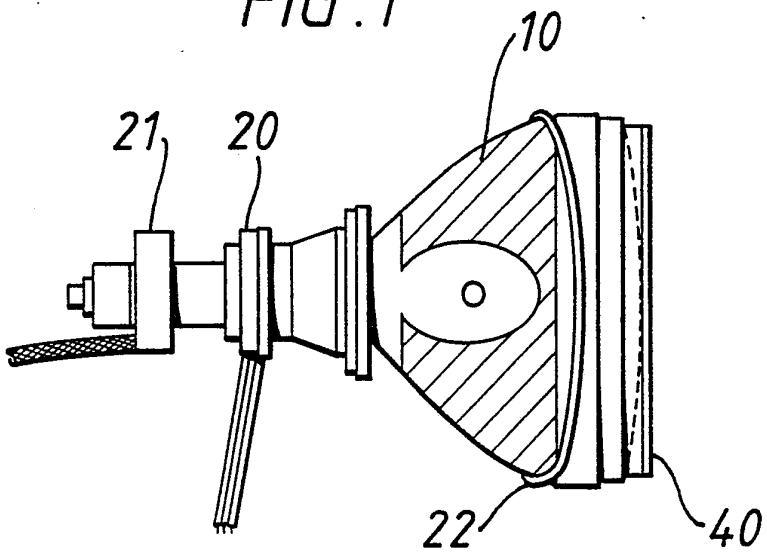
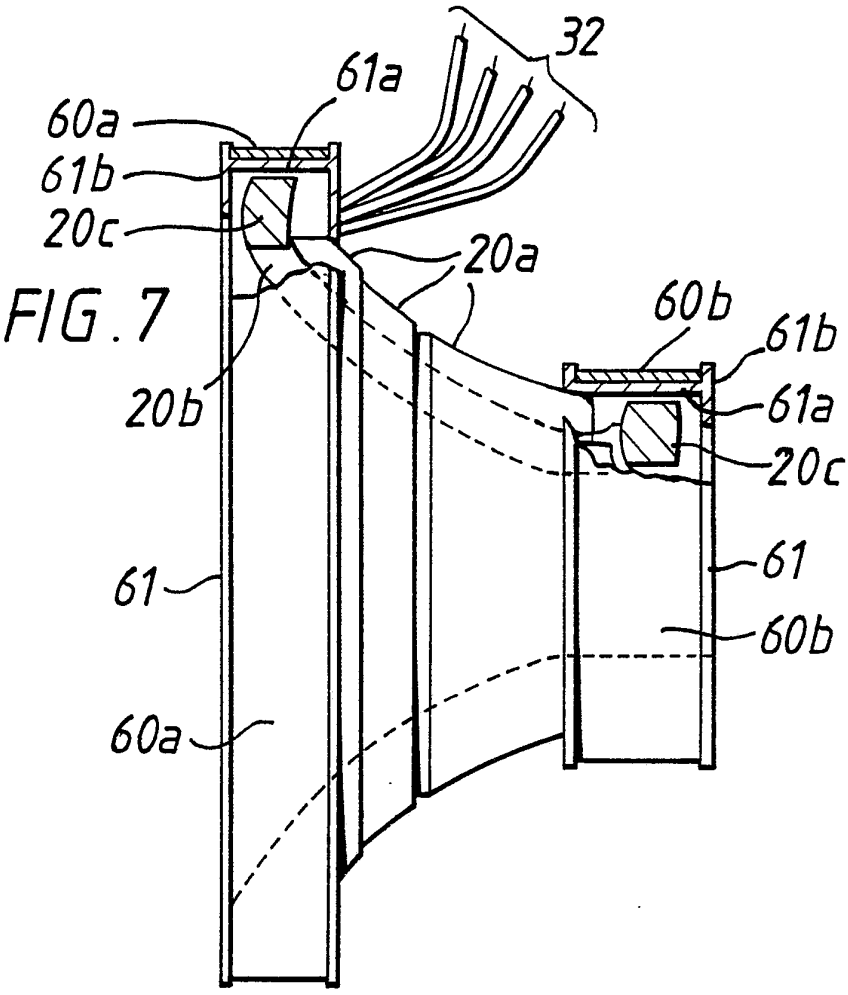

10
21
20
22
40

FIG.7


32
61a
60a
61b
20c
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60b
61b
61a
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20b
61
61
60b
60a

FIG. 2

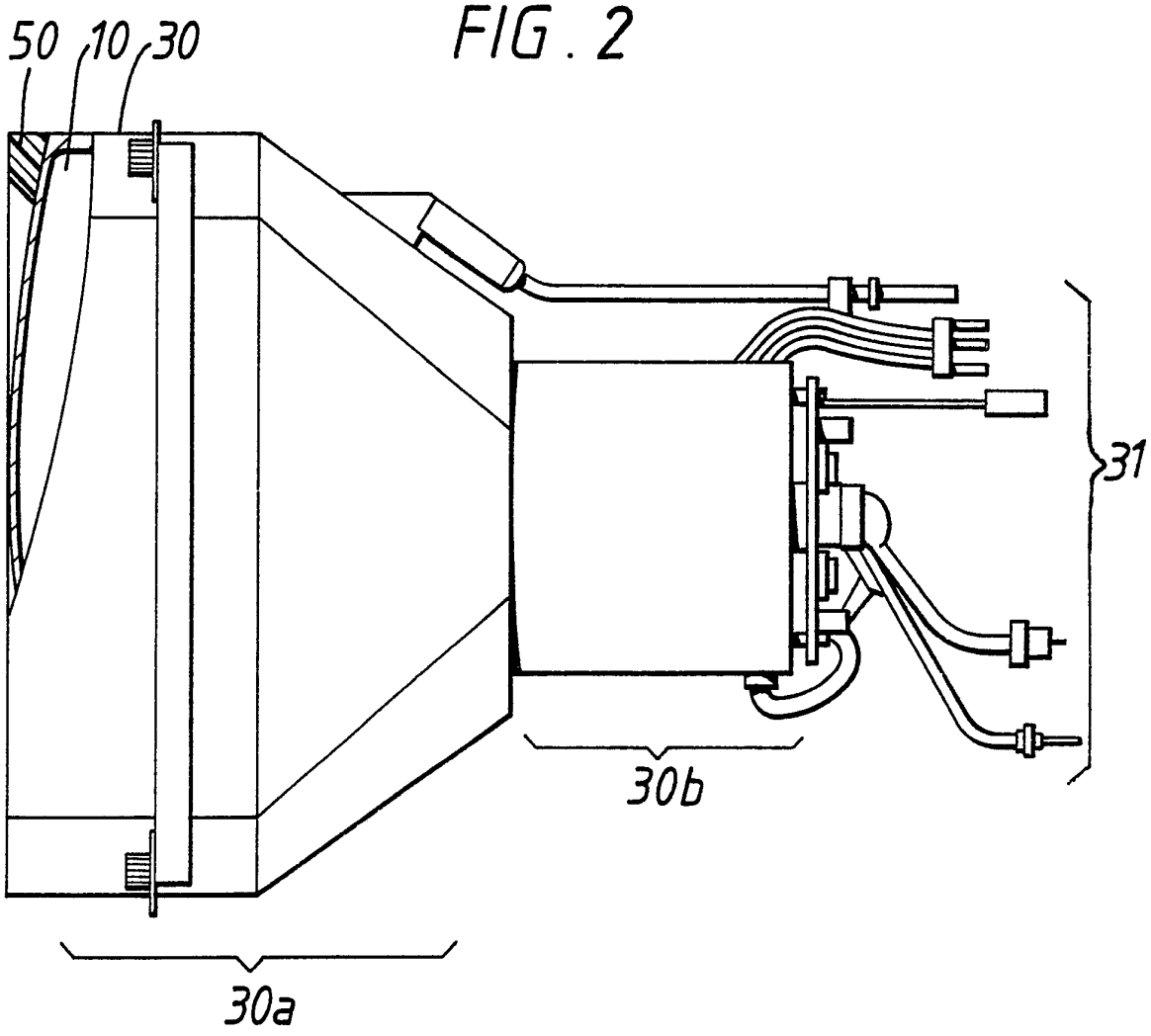


FIG. 3

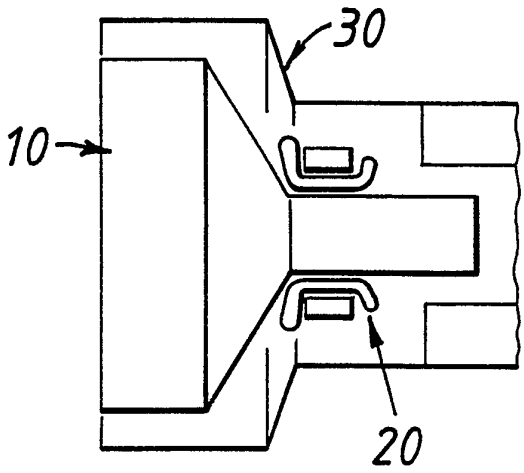


FIG. 4

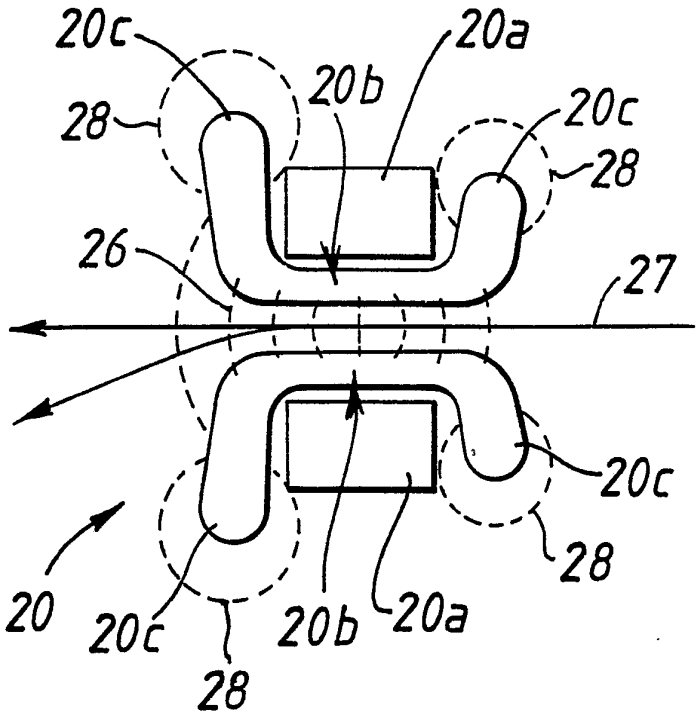


FIG. 5

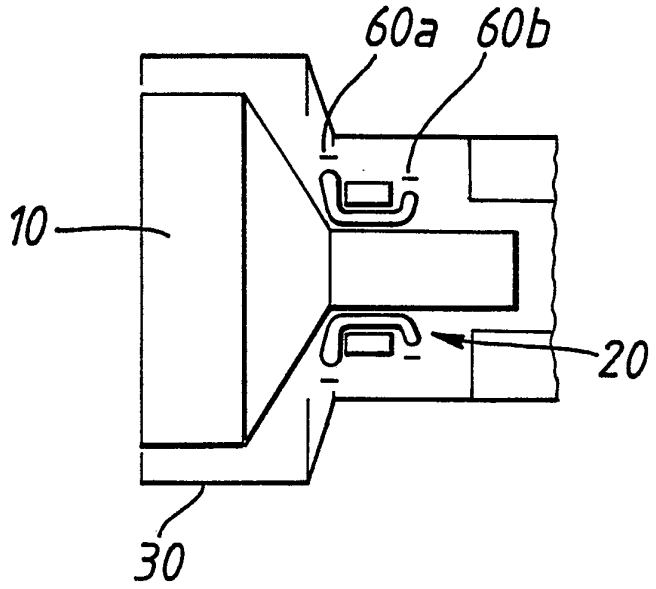
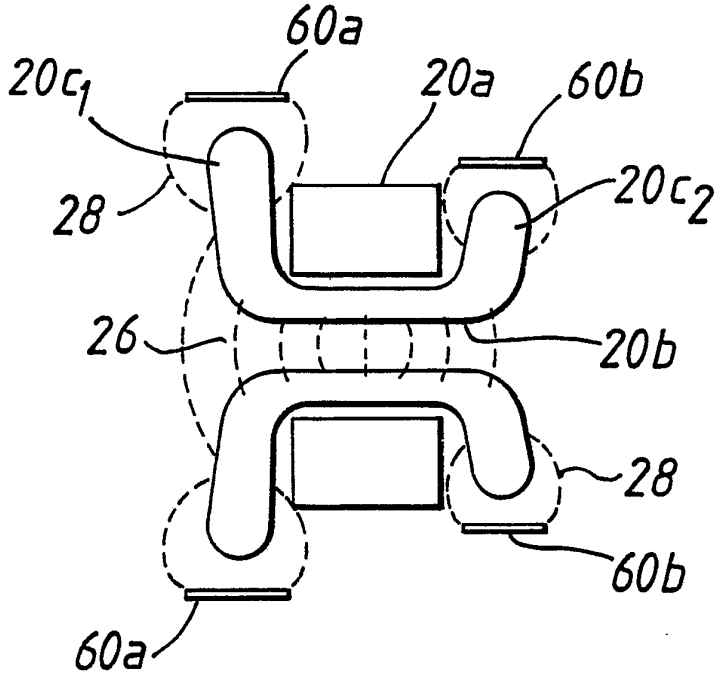


FIG. 6



INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 92/00706

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[5]: H 01 J 29/06,H 01 J 29/76

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC[5]	H 01 J 29/00,H 01 J 1/00

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
X	EP, A1, 0 418 126 (TUBES ELECTRONIQUES) 20 March 1991 (20.03.91), see column 4, line 56 - column 5, line 26.	1,2,3; 4-6;9-12
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A	DE, A1, 2 806 844 (HITACHI) 23 November 1978 (23.11.78),	1,2,3, 9

* Special categories of cited documents: [10]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
17 July 1992	04 AUG 1992
International Searching Authority	**Signature of Authorized Officer**
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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, ** with indication, where appropriate, of the relevant passages	Relevant to Claim No.
	see page 5, lines 6-29.	
A	DE, A1, 3 625 770 (RCA) 12 February 1987 (12.02.87), see column 5, lines 1-23.	1,2,3, 9

ANHANG — ANNEX — ANNEXE

zum internationalen Recherchenbericht über die internationale Patentanmeldung Nr.

to the International Search Report to the International Patent Application No.

au rapport de recherche international relatif á la demande de brevet international n°

PCT/GB 92/00706 SAE 58469

In diesem Anhang sind die Mitglieder der Patentfamilien der im obengenannten internationalen Recherchenbericht angeführten Patentdokumente angegeben. Diese Angaben dienen nur zur Unterrichtung und erfolgen ohne Gewähr.

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The Office is in no way liable for these particulars which are given merely for the purpose of information.

La présente annexe indique les membres de la famille de brevets relatifs aux documents de brevets cités dans le rapport de recherche international visée ci-dessus. Les reseignements fournis sont donnés á titre indicatif et n'engagent pas la responsibilité de l'Office.

Im Recherchenbericht angeführtes Patentdokument Patent document cited in search report Document de brevet cité dans le rapport de recherche	Datum der Veröffentlichung Publication date Date de publication	Mitglied(er) der Patentfamilie Patent family member(s) Membre(s) de la famille de brevets	Datum der Veröffentlichung Publication date Date de publication
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