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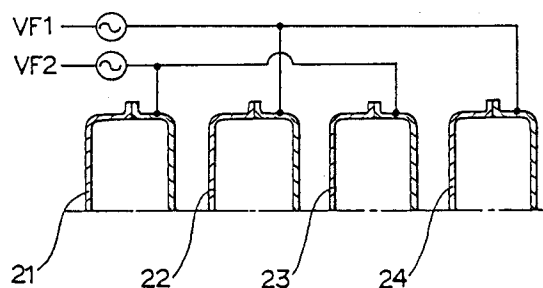
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D-81541 München (DE)(54) **Electron gun for a color picture tube.**

(57) The gun according to present invention has a triple electrodes part as a source of the electron beam, and prefocusing and main lens part for focusing and accelerating the beam. The prefocusing lens part includes a plurality of focusing electrodes (21,22,23,24) for forming at least one quadrapole lens in which the intensity of vertical lens is weaker than that of horizontal lens. According to the present invention, the effect of the spherical aberration to the beam entering the main lens can be reduced.

FIG.2**EP 0 655 763 A1**

FIELD OF THE INVENTION

The present invention relates to an electron gun for a color picture tube, and particularly to an in-line type electron gun for a color picture tube.

BACKGROUND OF THE INVENTION

An electron gun for a color picture tube is mounted in the neck of the tube and generates thermions. It generally comprises a triple electrodes part having one or more cathodes as the source of thermions, a prefocusing lens part and a main lens part for forming electromagnetic lens by the potential difference.

As a relatively higher voltage is applied to electrodes for the main lens part comparing with other electrodes, the magnification of the main electromagnetic lens formed therebetween, is enlarged to inflict a large spherical aberration to the electron beam passing therethrough. To reduce the spherical aberration of the main lens part, it has been generally adopted a rim electrode 10 having a large beam passing hole 11 through which three beams concurrently pass, to weaken the magnification of the electromagnetic lens and reduce the spherical aberration. But in this case, the reduced magnification of the main lens cannot sufficiently focus the electron beam, thus the prefocusing lens part is fabricated between the main lens part and the triple electrodes part to stepwisely focus the electron beam from the triple electrodes.

In a typical prefocusing lens part, a plurality of focusing electrodes having beam passing holes for forming a plurality of quadrupole lenses are fabricated between the triple electrodes part and the main lens part, and a voltage applying to the triple electrodes part or a high voltage applying to an anode electrode, which constitutes the main lens part, is selectively applied to those electrodes to focus the electron beam. But the application of relatively high or low voltage to electrodes of the prefocusing lens part as described above, results in a formation of a large magnification electromagnetic lens between those electrodes to increase the spherical aberration component of the lens and cause an arc discharge between electrodes.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide an electron gun for a color picture tube capable of reducing the effect of the spherical aberration to the electron beam passing the prefocusing lens part and preventing the transverse deformation of the beam to obtain a uniform beam spot all over the screen.

It is another object of the present invention to provide an electron gun for a color picture tube to improve the assembly precision of the electrodes to bead glasses.

To achieve the above objects, an electron gun for a color picture tube according to the present invention, having a triple electrodes part as a source of the electron beam, a prefocusing lens part coaxially fabricated with the triple electrodes part for focusing and accelerating the electron beam from the triple electrodes part, and a main lens part, is characterized in that:

the prefocusing lens part includes a plurality of focusing electrodes to which two different focusing voltages selectively applied, for forming at least one quadrupole lens in which the intensity of the vertical electromagnetic lens is weaker than that of horizontal lens.

According to one aspect of the present invention, those two focusing voltages fall into the range of 20% to 25% of the anode voltage of the main lens part.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and advantages of the present invention will be more apparent from the following detailed description, with reference to the accompanying drawings, in which:

FIG. 1 is a perspective view illustrating an electrode of a conventional electron gun for a color picture tube, for forming a large aperture lens;

FIG. 2 is a sectional view of a prefocusing lens part of an electron gun for a color picture tube according to the present invention, showing the application of voltages;

FIG. 3 are schematic drawings, illustrating shapes of beam passing holes at the incident side and the departing side of the electrode constituting the prefocusing lens part as shown in FIG. 2;

FIG. 4 is a drawing for showing trails of electron beams being horizontally focused by the prefocusing lens part of the gun according to the present invention; and

FIG. 5 is a drawing for showing trails of electron beams being vertically by the prefocusing lens part of the gun according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

An electron gun for a color picture tube according to the present invention comprises: a triple electrodes part containing a cathode as a source of thermions, a control electrode and a screen electrode; a prefocusing lens part having a plurality of focusing electrodes to which respectively different

focusing voltages are selectively applied, to form at least one quadrapole lens in which the intensity of vertical lens is stronger than that of horizontal lens; and a main lens part fabricated coaxially with the prefocusing lens part and having an anode electrode to which an anode voltage is applied, to form a main lens.

In the prefocusing lens part for focusing and accelerating the electron beam to enter the main lens part, the first to fourth electrodes 21, 22, 23, 24 are fabricated successively from the triple electrodes part as shown in FIG. 2, and the first focusing voltage VF1 of 6,000 to 7,000V is applied to the second and fourth focusing electrode 22, 24, and the second focusing voltage VF2 of 7,000 to 9000V is applied to the first and third electrode 21, 23.

Here, the first and second focusing voltages VF1, VF2 is preferably not being charged by above described voltages but preferably applied thereto the voltage in the range of 20 to 25% of anode voltage, for example about 30KV, which is applied to the anode electrodes for forming the main lens. And those two focusing voltages VF1, VF2 is preferably synchronized with the deflection signal.

At each of the first to fourth focusing electrodes 21, 22, 23, 24, there are respectively formed beam passing holes to form electromagnetic lenses as follows.

Referring to FIG. 3, at the incident side and departing side of the first focusing electrode 21, and at the incident side of the fourth focusing electrode 24, there are respectively formed three circular beam passing holes (21R, 21G, 21B), (21R', 21G', 21B'), (22R, 22G, 22B). And at the departing side of the second focusing electrode 22 and the incident side of the fourth electrode 24, there are respectively formed an vertically elongated beam passing hole 22G', 24G at the center, and two circular beam passing holes(22R', 22B'), (24R, 24B) at each wings. And at the incident and departing sides of the third focusing electrode 23, and the departing side of the fourth electrode 24, there are respectively formed a circular beam passing hole(23G, 23G'), 24G' at the center, and two transversely elongated beam passing holes-(23R, 23B), (23R', 23B'), (24R', 24B') at each wings. In the above, the upper and lower ends of vertically elongated holes 22G', 24G and each side ends of transeversely elongated holes (23R, 23B), (23R, 23B'), (24R', 24B') are preferably formed at shapes of curves having prescribed curvatures. And centers of passing holes(23R, 23B), (23R', 23B') formed at two sides of the third focusing electrode 23, is outwardly deviated by a prescribed distance comparing with those of holes 22R', 22B' of the second focusing electrode 22. And centers of transversely elongated holes 24R', 24B' formed at the departing side of the fourth focusing elec-

trode 24, are inwardly deviated by a prescribed distance comparing with those of adjacent electrodes. Among beam passing holes formed at each focusing electrodes, diameters of circular holes and the heights of transversely elongated holes of wings are preferably formed in the manner of that sizes thereof are gradually increased or same from the first focusing electrodes. And at least one couple of three holes formed at facing sides of adjacent electrodes, is preferably formed in the same diameter or height.

The operation of the electron gun according to the present invention will now be described.

The electron beam emitted from the cathode of the triple electrodes part is preliminarily focused and accelerated in the prefocusing lens part, then, enters the main lens part. At the prefocusing lens part, the first to fourth focusing electrodes 21, 22, 23, 24 are successively arranged, and the first focusing voltage VF1 is applied to the second and fourth focusing electrodes 22, 24, and the second focusing voltage VF2 to the first and third focusing electrodes 21, 23 to form bi-potential type electromagnetic lenses as shown in FIG. 4 and 5. As the potential difference between the first and second voltages VF1, VF2 being applied to each electrodes is not so large, thus electromagnetic lenses formed between each electrodes have relatively small magnifications.

As the result, the electron beam passing electromagnetic lenses formed between each focusing electrodes 21, 22, 23, 24, suffers small spherical aberrations. Especially, as vertically elongated holes 22G', 24G and transversely elongated holes-(23R, 23B), (23R', 23B') are fabricated between the first to fourth focusing electrodes 21, 22, 23, 24 to form quadrapole lenses, horizontal components of the electron beam suffers larger converging than diverging, and vertical components of the beam suffers larger diverging than converging as shown in FIG. 4.

As the result, when the beam enters the main lens(not shown), the horizontal component of the beam passes through the central portion of the main lens and the vertical component passes through the peripheral portion of the main lens, thus the vertical component suffers more spherical aberration than the horizontal component to form the beam spot landing on the screen to be circular.

Moreover, diameters of heights of beam passing holes of the first to fourth focusing electrodes 21, 22, 23, 24 for constituting the prefocusing lens part of the gun, are successively increased from the first focusing electrode 21 or maintained same, the alignment of each focusing electrodes in assembly can be improved. In a general assembly of component electrodes into the gun, one or more support rods are inserted through beam passing

holes of each electrodes, and then two bead glasses are pressed from each sides of electrodes to embed supports of electrodes therein. According to the present invention, the support rod can be reduced in diameter stepwisely to fix each electrodes without any gap to improve the alignment of the assembly.

As described above, the electron gun for a color picture tube according to the present invention, forms a plurality of electromagnetic lenses in the prefocusing lens and focuses the electron beam in multi-step, to reduce the spherical aberration of passing beam, and reduces the incident angle of the main lens part to improve the focusing characteristics of the electron beam landing on the screen.

Claims

1. An electron gun for a color picture tube having a triple electrodes part as a source of the electron beam, and a prefocusing lens part and a main lens part for focusing and accelerating said beam from said triple electrodes part, characterized in that:

said prefocusing lens part includes a plurality of focusing electrodes for forming at least one quadrapole lens in which the intensity of the vertical electromagnetic lens is weaker than that of horizontal lens.

2. An electron gun as claimed in claim 1, wherein said prefocusing lens part for forming said quadrapole lens includes the first to fourth focusing electrodes successively arranged from said triple electrodes part, for forming said quadrapole lens in which the intensity of the vertical electromagnetic lens is weaker than that of horizontal lens; and

a first focusing voltage is applied to said second and fourth focusing electrodes, and a second focusing voltage higher than said first focusing voltage is applied to said first and third electrodes.

3. An electron gun as claimed in claim 2, wherein said first and second focusing voltages fall into the range of 20 to 25% of an anode voltage which applies to electrodes of main lens part.

4. An electron gun as claimed in anyone of claim 1 or 2, wherein

said quadrapole lens is formed by the effect of vertically elongated beam passing holes formed at the center of departing side of said second focusing electrode and the incident side of said fourth focusing electrode, and

transversely elongated beam passing holes at each wings of the departing side of said fourth focusing electrode.

5. An electron gun as claimed in claim 4, wherein centers of said transversely elongated beam passing holes formed at said departing side of said fourth focusing electrode, are inwardly deviated comparing with centers of beam passing holes formed at the incident side thereof.

6. An electron gun as claimed anyone of claim 2 or 3, wherein
said first focusing voltage is in the range of 6,000 to 7,000 V; and
said second focusing voltage is in the range of 7,000 to 9,000V.

7. An electron gun as claimed in claim 4, wherein diameters or heights of said beam passing holes of said first to fourth focusing electrodes, are gradually increased from said first focusing electrode or maintained same.

8. An electron gun as claimed in claim 4, wherein diameters or breadths of at least one couple of beam passing holes of two adjacent focusing electrodes among said first to fourth focusing electrodes, is same

9. An electron gun as claimed in claim 4, wherein centers of said transversely elongated beam passing holes formed at each wings of the incident and departing sides of said third focusing electrode, are outwardly deviated comparing with centers of beam passing for of said second focusing electrode.

10. An electron gun as claimed in claim 2, wherein among three beam passing holes formed at the departing side of said fourth focusing electrode adjacent to said main lens part, two wing holes are transversely elongated and center hole is circular.

11. An electron gun as claimed in claim 10, wherein
centers of said transversely elongated holes formed at said departing side of said fourth focusing electrode, are inwardly deviated comparing with centers of holes formed at the incident side thereof.

FIG.1

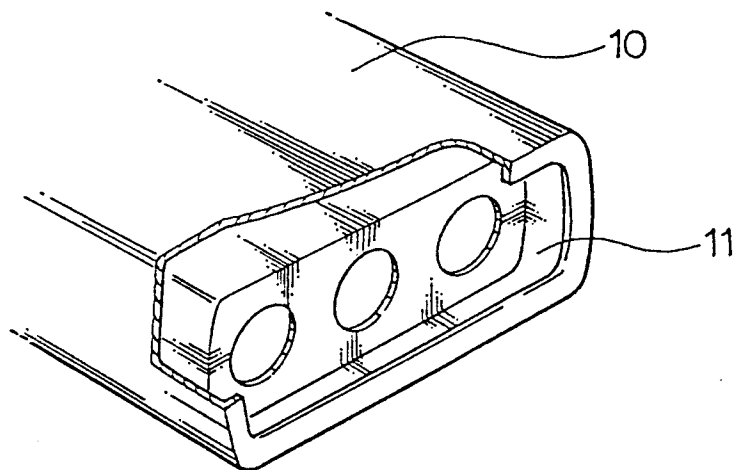


FIG.2

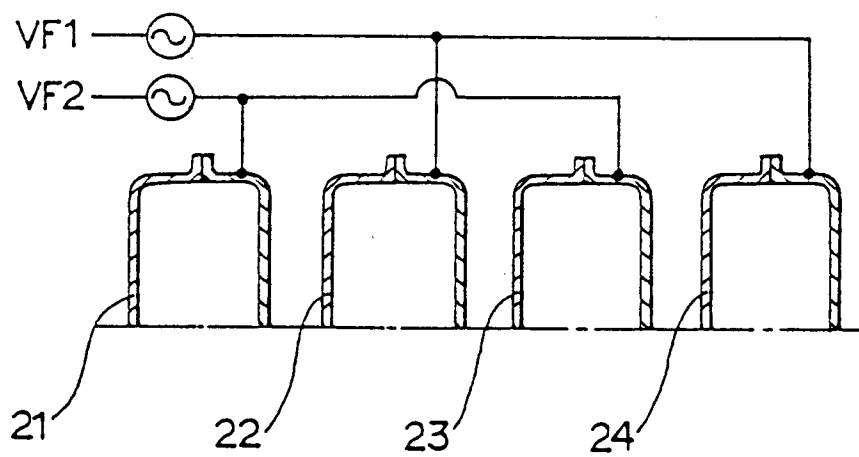


FIG. 3

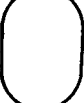
1st FOCUSING ELECTRODE	INCIDENT SIDE	21R 	21G 	21B 
	DEPARTING SIDE	21R' 	21G' 	21B' 
2nd FOCUSING ELECTRODE	INCIDENT SIDE	22R 	22G 	22B 
	DEPARTING SIDE	22R' 	22G' 	22B' 
3rd FOCUSING ELECTRODE	INCIDENT SIDE	23R 	23G 	23B 
	DEPARTING SIDE	23R' 	23G' 	23B' 
4th FOCUSING ELECTRODE	INCIDENT SIDE	24R 	24G 	24B 
	DEPARTING SIDE	24R' 	24G' 	24B' 

FIG.4

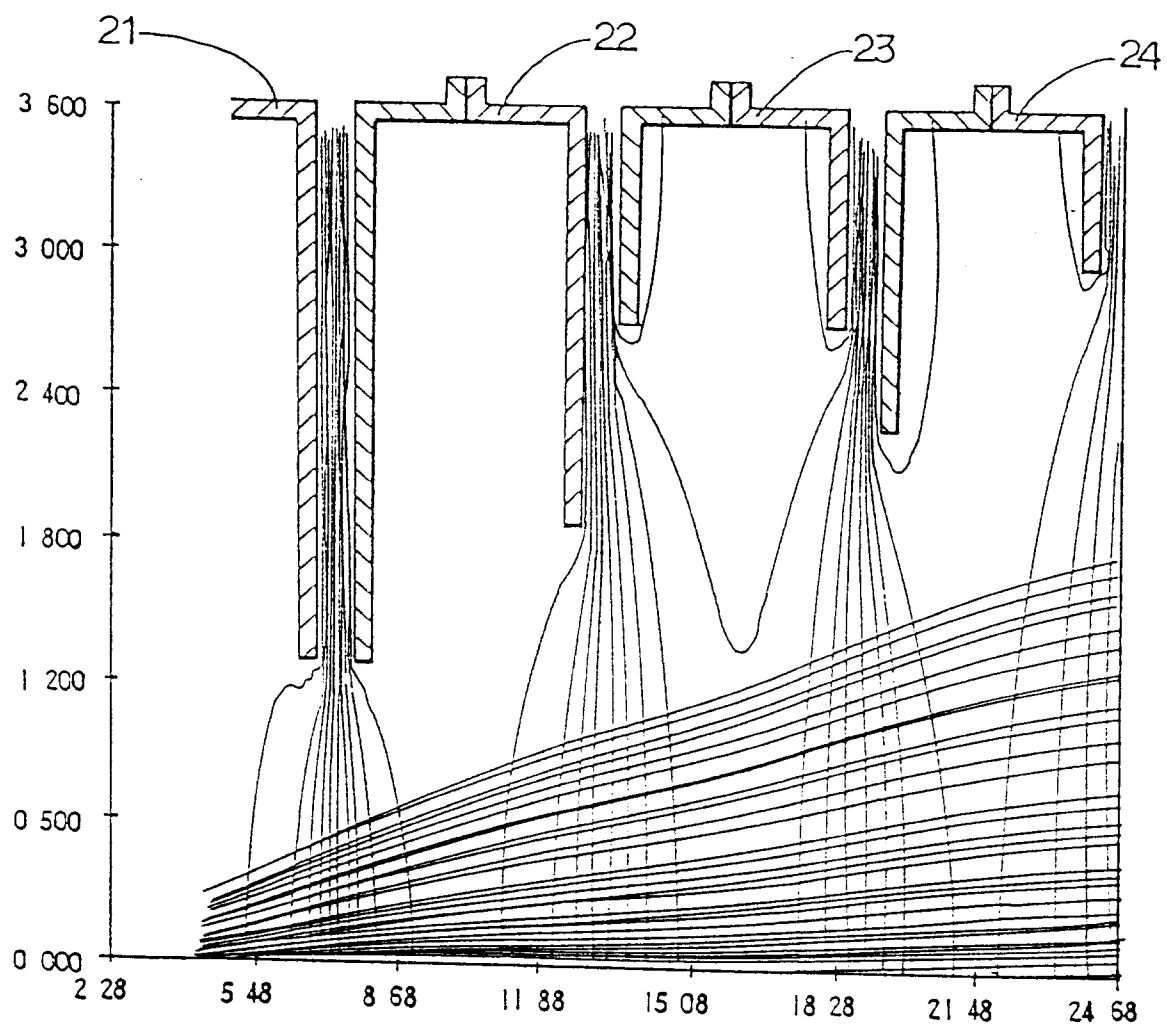
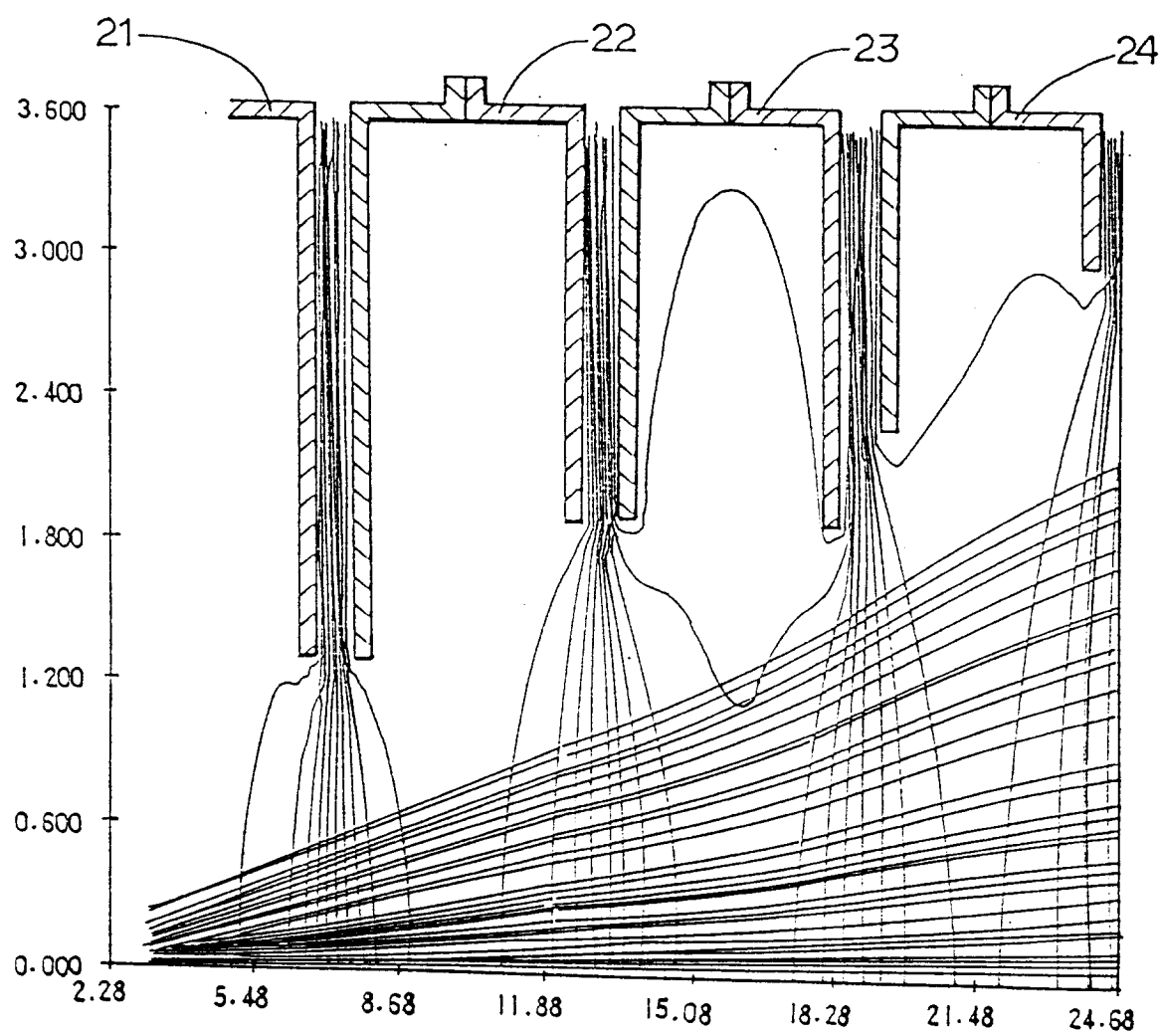


FIG.5





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EUROPEAN SEARCH REPORT

Application Number
EP 94 11 8716

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US-A-4 641 058 (SHINPEI KOSHIGU ET AL.) * claims 1-11 * ---	1	H01J29/50
P,A	US-A-5 281 896 (MIN-CHEOL BAE ET AL.) ---	1,2	
A	GB-A-2 224 883 (SAMSUNG ELECTRON DEVICES) * claims 1-7 * ---	1	
A	DE-A-42 33 955 (SAMSUNG ELECTRON DEVICES) * claims 1,2 * -----	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			H01J
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 17 March 1995	Examiner Van den Bulcke, E
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			