IN THE HIGH COURT OF JUSTICE
CHANCERY DIVISION
PATENTS COURT

Claim No: HP-2016-000046

B E T W E E N:

(1) PHILIPS LIGHTING NORTH AMERICA CORPORATION
(a company incorporated under the laws of the USA)

(2) PHILIPS LIGHTING HOLDING B.V.
(a company incorporated under the laws of the Netherlands)

Claimants

-and-

(1) MEGAMAN (UK) LIMITED

(2) NEONLITE INTERNATIONAL LIMITED

(3) NEONLITE ELECTRONIC & LIGHTING (HK) LIMITED
(a company incorporated under the laws of Hong Kong)

Defendants

ANNEX B – SCHEDULE OF AMENDMENTS OF THE FIRST REQUEST

The proposed conditional amendments to European Patent (UK) No. 2 407 009 (the "**Patent**") of the First Request are as follows:-

Conditional Amendments to the Claims of the Patent		
Old Claim	**New Claim**	**Conditional Amendment**
1	1	Lighting device (100), comprising: an LED driver (101) capable of receiving an input mains voltage and acting as a current source to convert the input mains voltage so as to generat~~inge~~ dimmed LED current suitable for driving an LED array consisting of LEDs;

		a two-terminal LED module (110; 300; 400; 500; 600), having two input terminals (111, 112) for receiving the dimmed LED current as an input current (Iin) from the LED driver (101) and comprising: a first LED group (113) comprising at least one first type LED for producing light having a first color temperature; a second LED group (114) comprising at least one second type LED for producing light having a second color temperature different from the first color temperature; wherein the module is capable of supplying LED currents to the LED groups, these LED currents being derived from the input current (Iin); wherein the LED module produces a light output having at least a light output contributions from the first LED group (113) and from the second LED group (114); ~~and~~ wherein the module is designed to vary the individual LED currents in the individual LED groups in dependency of the average magnitude of the received input current (Iin), such that the color point of the light output of the module varies as a function of the input current magnitude~~,~~; and ~~characterized in that~~ wherein the LED module comprises an electronic division circuit (115) capable of controlling a ratio of the LED currents (I1, I2) in said first and second LED groups (113, 114) as a function of the input current level received at the input of the LED module.
2	2	Lighting device according to claim 1, wherein the LED module is designed to vary the individual LED currents in the individual LED groups such that the color point of the light output of the module on dimming follows a black body curve.
3	3	Lighting device according to claim 1, wherein the LED module is designed to vary the individual LED currents in the individual LED groups such that the color behavior of the light output of the module on dimming resembles the color behavior of an incandescent lamp.

4	4	Lighting device according to claim 1, wherein the lighting device is configured to produce light with a color temperature CT at an average current of x%, CT(x%), supplied to the terminals following the relationship: CT (x%) = CT(100%)*(x/100)1/9.5
5	5	Lighting device according to claim 1, wherein the first group of LEDs has a varying first luminous flux output as a function of junction temperature of the first type LED, and the second group of LEDs has a varying second luminous flux output as a function of junction temperature of the second type LED, and wherein, at varying junction temperatures, the ratio of the first luminous flux output to the second luminous flux output varies; and wherein the first color temperature is lower than the second color temperature, while, at decreasing junction temperatures, the ratio of the first luminous flux output to the second luminous flux output increases, and vice versa.
6	6	Lighting device according to claim 1, wherein a gradient of the first luminous flux output as a function of junction temperature of the first type LED differs from a gradient of the second luminous flux output as a function of junction temperature of the second type LED; and wherein the first color temperature is lower than the second color temperature, while the absolute value of the gradient of the first luminous flux output as a function of temperature of the first type LED is higher than the gradient of the second luminous flux output as a function of temperature of the second type LED.
7	7	Lighting device according to claim 1, wherein a thermal resistance to ambient of the first group of LEDs differs from the thermal resistance to ambient of the second group of LEDs; and wherein the first color temperature is lower than the second color temperature, while the thermal resistance to ambient of the first group of LEDs is higher than the thermal resistance to ambient of the second group of LEDs.

8	8	Lighting device according to claim 1, wherein the first group of LEDs has a first dynamic electrical resistance, and the second group of LEDs has a second dynamic electrical resistance.
9	9	Lighting device ~~according to claim 1,~~comprising: an LED driver (101) capable of generating dimmed LED current; and a two-terminal LED module (110; 300; 400; 500; 600), having two input terminals (111, 112) for receiving the dimmed LED current as an input current (Iin) from the LED driver (101) and comprising: a first LED group (113) comprising at least one first type LED for producing light having a first color temperature; a second LED group (114) comprising at least one second type LED for producing light having a second color temperature different from the first color temperature; wherein the module is capable of supplying LED currents to the LED groups, these LED currents being derived from the input current (Iin); wherein the LED module produces a light output having at least a light output contributions from the first LED group (113) and from the second LED group (114); wherein the module is designed to vary the individual LED currents in the individual LED groups in dependency of the average magnitude of the received input current (Iin), such that the color point of the light output of the module varies as a function of the input current magnitude; wherein the LED module comprises an electronic division circuit (115) capable of controlling a ratio of the LED currents (I1, I2) in said first and second LED groups (113, 114) as a function of the input current level received at the input of the LED module; and wherein at least one of the first group of LEDs and the second group of LEDs is connected in series with a resistor, and wherein this first series arrangement is connected in parallel to the other one of the first group of LEDs and the second group of LEDs, and wherein this parallel

		arrangement is connected between the two input terminals (111, 112) of the LED module~~;~~. ~~and wherein the resistor is a negative temperature coefficient, NTC, type resistor.~~
	10	Lighting device according to claim 9, wherein the other one of the first group of LEDs and the second group of LEDs is comprised in a second series arrangement; the first series arrangement in said parallel arrangement has a first dynamic electrical resistance and the second series arrangement has a second dynamic electrical resistance; and the first dynamic electrical resistance is different from the second dynamic electrical resistance.
	11	Lighting device according to claim 9 or 10, wherein the LED module consists of LEDs and at least one resistor.
	12	Lighting device of claim 9, wherein the resistor is a negative temperature coefficient, NTC, type resistor.
~~10~~	13	Lighting device according to any of ~~the preceding~~ claims 1-9 or 12, wherein the first type LED is an AlInGaP type LED, and/or wherein the second type LED is an In- GaN type LED.
~~11~~	14	Lighting device according to claim 1, wherein the electronic division circuit is capable of supplying the two groups of LEDs with constant current and of controlling the LED currents (I1, I2) such that the following formulas apply: I1 = p•Iin and I2 = q•Iin, and p + q = 1 with Iin denoting the input current magnitude, I1 denoting the current magnitude in the first group of LEDs, I2 denoting the current magnitude in the second group of LEDs; wherein there is at least a range of input current magnitudes where dp/d(Iin) is always positive and dq/d (Iin) is always negative.
~~12~~	15	Lighting device according to claim ~~11~~14, wherein the LED module comprises:

		a current regulating element (320) arranged in series with one of said groups of LEDs, this series arrangement being coupled in parallel to another of said groups of LEDs; a current sensing element (350) arranged for sensing the input current received at the input terminals of the LED module; and a regulator driver (310) receiving a sense output signal from the sensing element and driving the current regulating element on the basis of this sense output signal.
~~13~~	16	Lighting device according to claim 1, wherein the electronic division circuit (515) comprises a controllable switch (501) for temporally dividing de received input current (Iin) between the two groups of LEDs; a control device (520) for controlling the switch (501) at a switching period T such that the input current is passed on to the first group of LEDs for a first time duration t1 and the input current is passed on to the second group of LEDs for a second time duration t2, with t1+t2=T; a current sensing element (116) arranged for sensing the input current received at the input terminals of the LED module; the control device being coupled to receive a sense output signal from the sensing element and being designed to vary the ratio t1/t2 of the switching of the switch on the basis of said sense output signal, such that there is at least a range of input current magnitudes where dt1(Iin) is always positive and dt2 (Iin) is always negative.
~~14~~	17	Lighting device according to claim 1, wherein the second group of LEDs (114) is supplied by a current converter (601) having its input terminals connected in parallel to the first group of LEDs (113); wherein the current converter comprises a control circuit (620) receiving a sense output signal from a current sensing element (116) sensing the input cur- rent of the LED module; and wherein this control circuit (620) is designed to control the current converter (601) on the basis of the sense output signal received from the current sensing element (116).

~~15~~	18	Lighting device according to claim 1, wherein the first group of LEDs (113) is supplied by a first current converter (730) and the second group of LEDs (114) is supplied by a second current converter (740), and wherein these two current converter have their input terminals connected in series; wherein the LED module comprises a control circuit (720) receiving a sense output signal from a current sensing element (116) sensing the input current of the LED module; and wherein this control circuit (720) is designed to control the current converters (730, 740) on the basis of the sense output signal received from the current sensing element (116).

Conditional Amendments to the Description of the Patent		
Old Page	**New Page**	**Conditional Amendment**
3	3	The device known from US 2006/0273331 receives an input voltage signal that carries power and a control signal. In the device, the control signal is taken from the input signal and transferred to the intelligent control device, that controls the individual current sources on the basis of the received control data. By changing the ratio between the respective light outputs, the relative contributions to the overall light output is changed and hence the overall color of the overall light output, as perceived by an observer, is changed. Such lighting device, therefore, requires a separate control input signal. In LED lighting devices, a behavior of the color temperature of the LED light can be obtained which, in dimming conditions, is similar to that of an incandescent lamp, but until now only at the expense of extensive current control, such as e.g. known from DE10230105. The necessity of adding controls to the LED lighting device for the desired color temperature behavior increases the number of components, increases the complexity of the lighting device, and increases costs. These effects are

		undesirable. Further relevant prior art is described in US 2008/224631 and WO 2007/093927. SUMMARY OF THE INVENTION The present invention aims to provide a LED circuit for such LED lighting device, and a LED lighting device comprising such LED circuit, wherein an intelligent control can be omitted and wherein a feedback sensor can be omitted. It would be desirable to provide an LED lighting device having a color temperature behavior, when dimmed, resembling or approaching the color temperature behavior of an incandescent lamp, when dimmed. It would also be desirable to provide an LED lighting device having an incandescent lamp color temperature behavior, when dimmed, without the need of extensive controls. To better address one or more of these concerns, in an aspect of the invention an LED lighting device is provided, comprising an LED driver capable of receiving an input mains voltage and acting as a current source to convert the input mains voltage so as to generat~~inge~~ dimmed LED current suitable for diving an LED array consisting of LEDs;~~,~~ and a two-terminal LED module, having two input terminals for receiving the dimmed LED current as an input current from the LED driver. The LED module comprises a first LED group comprising at least one first type LED for producing light having a first color temperature, and a second LED group comprising at least one second type LED for producing light having a second color temperature different from the first color temperature. The LED module is capable of supplying LED currents to the LED groups, these LED currents being derived from the input current. The LED module produces a light output
4	4	having at least a light output contributions from the first LED group and from the second LED group. The LED module is designed to vary the individual LED currents in the individual LED groups in dependency of the average magnitude of the received input current, such that the color point of the light output of the module varies as a function of the input

		current magnitude. The LED module comprises an electronic division circuit capable of controlling a ratio of the LED currents in said first and second LED groups as a function of the input current level received at the input of the LED module. ~~According to an aspect of the present invention, an LED lighting device comprises a single dimmable current source and an LED module receiving current from the current source.~~ The LED module behaves as a load to the current source, similar to an array ~~existing~~ consisting of LEDs only. In embodiments, ~~W~~within the LED module, an electronic circuit senses the current magnitude of the input current, and distributes the current to different LED sections of the LED module on the basis of the sensed current magnitude. No intelligent current control is needed in the current source. ~~In an aspect of the invention an LED lighting device is provided, comprising a plurality of LEDs, and two terminals for supplying current to the lighting device. The lighting device comprise a first set of at least one LED of a first type producing light having a first color temperature, and a second color temperature different from the first color temperature.~~ The first set and the second set ~~are~~may be connected in series or in parallel between the terminals. In embodiments, ~~T~~the lighting device is configured to produce light with a color point varying in accordance with a blackbody curve at a variation of an average current supplied to the terminals. A color temperature behavior of an incandescent lamp may be described by the following relationship: $$CT(x\%) = CT(100\%) * (x/100)^{\frac{1}{9.5}}$$ where CT(100%) is the color temperature of the light at full power (100% current) of the lamp, CT(x%) is the color temperature of the light at x% dimming of the lamp (x% current, with $0 < x < 100$).
4a	4a	In an embodiment, the first set has a varying first luminous flux output as a function of junction temperature of the LED of the first type,

and the second set has a varying second luminous flux output as a function of junction temperature of the LED of the second type, and wherein, at varying junction temperatures, the ratio of the first luminous flux output to the second luminous flux output varies. In particular, when the first color temperature is lower than the second color temperature, the lighting device is configured such that, at decreasing junction temperatures, the ratio of the first luminous flux output to the second luminous flux output increases, and vice versa. In such a configuration, e.g. having the first set connected in series with the second set, the first luminous flux output increases relative to the second flux output when the lighting device is dimmed, thereby producing light having a lower color temperature.

In an embodiment, the first set has a first dynamic electrical resistance, and the second set has a second dynamic electrical resistance. When e.g. the first set is connected in parallel with the second set, different luminous flux outputs of the first set and the second set result, which can be designed to produce light having a lower color temperature when dimmed.

According to another aspect of the present invention, there is provided a lighting device comprising an LED driver capable of generating dimmed LED current; and a two-terminal LED module, having two input terminals for receiving the dimmed LED currentas an input current from the LED driver and comprising a first LED group comprising at least one first type LED for producing light having a first color temperature; a second LED group comprising at least one second type LED for producing light having a second color temperature different from the first color temperature; wherein the module is capable of supplying LED currents to the LED groups, these LED currents being derived from the input current; wherein the LED module produces a light output having at least a light output contributions from the first LED group and from the second LED group; and wherein the module is designed to vary the individual LED currents in the individual LED groups in dependency of the average magnitude of the received input current, such that the color point of the light output of the module varies

		as a function of the input current magnitude; wherein the LED module comprises an electronic division circuit capable of controlling a ratio of the LED currents in said first and second LED groups as a function of the input current level received at the input of the LED module; wherein one of the first group of LEDs and the second group of LEDs is connected in series with a resistor, and wherein this series arrangement is connected in parallel to the other one of the first group of LEDs and the
	4b	second group of LEDs, and wherein this parallel arrangement is connected between the two input terminals of the LED module. ~~In another aspect of the present invention, a lighting kit of parts is provided, comprising a dimmer having input terminals adapted to be connected to an electrical power supply, and having output terminals adapted to provide a variable electrical power.~~ An embodiment of the lighting device according to the present invention has terminals configured to be connected to the output terminals of the dimmer. Further advantageous elaborations are mentioned in the dependent claims. BRIEF DESCRIPTION OF THE DRAWINGS These and other aspects, features and advantages of the present invention will be further explained by the following description of one or more preferred embodiments with reference to the drawings, in which same reference numerals indicate same or similar parts, and in

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Claimants

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(3) NEONLITE ELECTRONIC & LIGHTING (HK) LIMITED
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Defendants

ANNEX C – SCHEDULE OF AMENDMENTS OF THE SECOND REQUEST

The proposed conditional amendments to European Patent (UK) No. 2 407 009 (the "**Patent**") of the Second Request are as follows:-

Conditional Amendments to the Claims of the Patent		
Old Claim	**New Claim**	**Conditional Amendment**
1	1	Lighting device (100), comprising: an LED driver (101) capable of receiving an input mains voltage and acting as a current source to convert the input mains voltage so as to generat~~inge~~ dimmed LED current suitable for driving an LED array consisting of LEDs;

		a two-terminal LED module (110; 300; 400; 500; 600) for replacing the LED array, the two-terminal LED module having two input terminals (111, 112) for receiving an input current (Iin) from the LED driver (101) and comprising: a first LED group (113) comprising at least one first type LED for producing light having a first color temperature; a second LED group (114) comprising at least one second type LED for producing light having a second color temperature different from the first color temperature; wherein the module is capable of supplying LED currents to the LED groups, these LED currents being derived from the input current (Iin); wherein the LED module produces a light output having at least a light output contributions from the first LED group (113) and from the second LED group (114); ~~and~~ wherein the module is designed to vary the individual LED currents in the individual LED groups in dependency of the average magnitude of the received input current (Iin), such that the color point of the light output of the module varies as a function of the input current magnitude~~,~~; and ~~characterized in that~~ wherein the LED module comprises current sensor means (116) arranged to sense an input current level of the input current (Iin), and an electronic division circuit (115) capable of controlling a ratio of the LED currents (I1, I2) in said first and second LED groups (113, 114) by distributing the input current to the first and second LED groups as a function of the input current level ~~received at the input of the LED module~~ sensed by the current sensor means.
2		Lighting device according to claim 1, wherein the LED module is designed to vary the individual LED currents in the individual LED groups such that the color point of the light output of the module on dimming follows a black body curve.
3		Lighting device according to claim 1, wherein the LED module is designed to vary the individual LED currents in the individual LED

		groups such that the color behavior of the light output of the module on dimming resembles the color behavior of an incandescent lamp.
4		Lighting device according to claim 1, wherein the lighting device is configured to produce light with a color temperature CT at an average current of x%, CT(x%), supplied to the terminals following the relationship: CT (x%) = CT(100%)*(x/100)1/9.5
5		Lighting device according to claim 1, wherein the first group of LEDs has a varying first luminous flux output as a function of junction temperature of the first type LED, and the second group of LEDs has a varying second luminous flux output as a function of junction temperature of the second type LED, and wherein, at varying junction temperatures, the ratio of the first luminous flux output to the second luminous flux output varies; and wherein the first color temperature is lower than the second color temperature, while, at decreasing junction temperatures, the ratio of the first luminous flux output to the second luminous flux output increases, and vice versa.
6		Lighting device according to claim 1, wherein a gradient of the first luminous flux output as a function of junction temperature of the first type LED differs from a gradient of the second luminous flux output as a function of junction temperature of the second type LED; and wherein the first color temperature is lower than the second color temperature, while the absolute value of the gradient of the first luminous flux output as a function of temperature of the first type LED is higher than the gradient of the second luminous flux output as a function of temperature of the second type LED.
7		Lighting device according to claim 1, wherein a thermal resistance to ambient of the first group of LEDs differs from the thermal resistance to ambient of the second group of LEDs; and wherein the first color temperature is lower than the second color temperature, while the thermal resistance to ambient of the first

		group of LEDs is higher than the thermal resistance to ambient of the second group of LEDs.
8		Lighting device according to claim 1, wherein the first group of LEDs has a first dynamic electrical resistance, and the second group of LEDs has a second dynamic electrical resistance.
9		Lighting device ~~according to claim 1,~~ comprising: an LED driver (101) capable of generating dimmed LED current; and a two-terminal LED module (110; 300; 400; 500; 600), having two input terminals (111, 112) for receiving the dimmed LED current as an input current (Iin) from the LED driver (101) and comprising: a first LED group (113) comprising at least one first type LED for producing light having a first color temperature; a second LED group (114) comprising at least one second type LED for producing light having a second color temperature different from the first color temperature; wherein the module is capable of supplying LED currents to the LED groups, these LED currents being derived from the input current (Iin); wherein the LED module produces a light output having at least a light output contributions from the first LED group (113) and from the second LED group (114); wherein the module is designed to vary the individual LED currents in the individual LED groups in dependency of the average magnitude of the received input current (Iin), such that the color point of the light output of the module varies as a function of the input current magnitude; wherein the LED module comprises an electronic division circuit (115) capable of controlling a ratio of the LED currents (I1, I2) in said first and second LED groups (113, 114) as a function of the input current level received at the input of the LED module; wherein one of the first group of LEDs and the second group of LEDs is connected in series with a resistor, and wherein this first series arrangement is connected in parallel to a second series arrangement

		comprising the other one of the first group of LEDs and the second group of LEDs, and wherein this parallel arrangement is connected between the two input terminals (111, 112) of the LED module; and wherein the first series arrangement in said parallel arrangement has a first dynamic electrical resistance and the second series arrangement has a second dynamic electrical resistance, and the first dynamic electrical resistance is different from the second dynamic electrical resistance, so that as a result the ratio of the LED currents (I1, I2) in said first and second LED groups (113,114) is variable. ~~and wherein the resistor is a negative temperature coefficient, NTC, type resistor.~~
	10	Lighting device according to claim 9, wherein the resistor is a negative temperature coefficient, NTC, type resistor.
~~10~~	11	Lighting device according to any of the preceding claims, wherein the first type LED is an AlInGaP type LED, and/or wherein the second type LED is an In- GaN type LED.
	12	Lighting device according to claim 9, wherein the LED module consists of LEDs and at least one resistor.
~~11~~	13	Lighting device according to claim 1, wherein the electronic division circuit is capable of supplying the two groups of LEDs with constant current and of controlling the LED currents (I1, I2) such that the following formulas apply: I1 = p•Iin and I2 = q•Iin, and p + q = 1 with Iin denoting the input current magnitude, I1 denoting the current magnitude in the first group of LEDs, I2 denoting the current magnitude in the second group of LEDs; wherein there is at least a range of input current magnitudes where dp/d(Iin) is always positive and dq/d (Iin) is always negative.
~~12~~	14	Lighting device according to claim ~~11~~13, wherein the LED module comprises: a current regulating element (320) arranged in series with one of said groups of LEDs, this series arrangement being coupled in parallel to another of said groups of LEDs;

		~~a current sensing element (350) arranged for sensing the input current received at the input terminals of the LED module;~~ and a regulator driver (310) receiving a sense output signal from the current sensing means ~~element~~ providing information on the sensed input current level, and driving the current regulating element on the basis of this sense output signal.
~~13~~	15	Lighting device according to claim 1, wherein the electronic division circuit (515) comprises a controllable switch (501) for temporally dividing de received input current (Iin) between the two groups of LEDs; a control device (520) for controlling the switch (501) at a switching period T such that the input current is passed on to the first group of LEDs for a first time duration t1 and the input current is passed on to the second group of LEDs for a second time duration t2, with t1+t2=T; a current sensing element (116) arranged for sensing the input current received at the input terminals of the LED module; the control device being coupled to receive a sense output signal from the sensing element and being designed to vary the ratio t1/t2 of the switching of the switch on the basis of said sense output signal, such that there is at least a range of input current magnitudes where dt1(Iin) is always positive and dt2 (Iin) is always negative.
~~14~~	16	Lighting device according to claim 1, wherein the second group of LEDs (114) is supplied by a current converter (601) having its input terminals connected in parallel to the first group of LEDs (113); wherein the current converter comprises a control circuit (620) receiving a sense output signal from a current sensing element (116) sensing the input cur- rent of the LED module; and wherein this control circuit (620) is designed to control the current converter (601) on the basis of the sense output signal received from the current sensing element (116).
~~15~~	17	Lighting device according to claim 1, wherein the first group of LEDs (113) is supplied by a first current converter (730) and the second group of LEDs (114) is supplied by a second current converter (740), and

		wherein these two current converter have their input terminals connected in series; wherein the LED module comprises a control circuit (720) receiving a sense output signal from a current sensing element (116) sensing the input current of the LED module; and wherein this control circuit (720) is designed to control the current converters (730, 740) on the basis of the sense output signal received from the current sensing element (116).

Conditional Amendments to the Description of the Patent		
Old Page	**New Page**	**Conditional Amendment**
3	3	The device known from US 2006/0273331 receives an input voltage signal that carries power and a control signal. In the device, the control signal is taken from the input signal and transferred to the intelligent control device, that controls the individual current sources on the basis of the received control data. By changing the ratio between the respective light outputs, the relative contributions to the overall light output is changed and hence the overall color of the overall light output, as perceived by an observer, is changed. Such lighting device, therefore, requires a separate control input signal. In LED lighting devices, a behavior of the color temperature of the LED light can be obtained which, in dimming conditions, is similar to that of an incandescent lamp, but until now only at the expense of extensive current control, such as e.g. known from DE10230105. The necessity of adding controls to the LED lighting device for the desired color temperature behavior increases the number of components, increases the complexity of the lighting device, and increases costs. These effects are undesirable. Further relevant prior art is described in US 2008/224631 and WO 2007/093927. SUMMARY OF THE INVENTION

		The present invention aims to provide a LED circuit for such LED lighting device, and a LED lighting device comprising such LED circuit, wherein an intelligent control can be omitted and wherein a feedback sensor can be omitted. It would be desirable to provide an LED lighting device having a color temperature behavior, when dimmed, resembling or approaching the color temperature behavior of an incandescent lamp, when dimmed. It would also be desirable to provide an LED lighting device having an incandescent lamp color temperature behavior, when dimmed, without the need of extensive controls. To better address one or more of these concerns, in an aspect of the invention an LED lighting device is provided, comprising an LED driver capable of receiving an input mains voltage and acting as a current source to convert the input mains voltage so as to generat~~inge~~ dimmed LED current suitable for driving an LED array consisting of LEDs;~~,~~ and a two-terminal LED module for replacing the LED array, the two-terminal module having two input terminals for receiving the dimmed LED current as an input current from the LED driver. The LED module comprises a first LED group comprising at least one first type LED for producing light having a first color temperature, and a second LED group comprising at least one second type LED for producing light having a second color temperature different from the first color temperature. The LED module is capable of supplying LED currents to the LED groups, these LED currents being derived from the input current. The LED module
4	4	produces a light output having at least a light output contributions from the first LED group and from the second LED group. The LED module is designed to vary the individual LED currents in the individual LED groups in dependency of the average magnitude of the received input current, such that the color point of the light output of the module varies as a function of the input current magnitude. The LED module comprises current sensor means arranged to sense an input current level of the input current, and an electronic division circuit capable of controlling a ratio of the LED currents in said first and second LED groups by distributing the

		input current to the first and second LED groups as a function of the input current level sensed by the current sensor means~~received at the input of the LED module~~. ~~According to an aspect of the present invention, an LED lighting device comprises a single dimmable current source and an LED module receiving current from the current source.~~ The LED module behaves as a load to the current source, similar to an array existing of LEDs only. Within the LED module, an electronic circuit senses the current magnitude of the input current, and distributes the current to different LED sections of the LED module on the basis of the sensed current magnitude. No intelligent current control is needed in the current source. ~~In an aspect of the invention an LED lighting device is provided, comprising a plurality of LEDs, and two terminals for supplying current to the lighting device. The lighting device comprises a first set of at elast one LED of a first type producing light having a first color temperature, and a second color temperature different from the first color temperature.~~ The first set and the second ~~are~~ may be connected in series or in parallel between the terminals. ~~T~~In embodiments, the lighting device is configured to produce light with a color point varying in accordance with a blackbody curve at a variation of an average current supplied to the terminals. A color temperature behavior of an incandescent lamp may be described by the following relationship: $$CT(x\%) = CT(100\%) * (x/100)^{\frac{1}{9.5}}$$ where CT(100%) is the color temperature of the light at full power (100% current) of the lamp, CT(x%) is the color temperature of the light at x% dimming of the lamp (x% current, with 0 < x < 100).
4a	4a	In an embodiment, the first set has a varying first luminous flux output as a function of junction temperature of the LED of the first type, and the second set has a varying second luminous flux output as a function of junction temperature of the LED of the second type, and wherein, at

varying junction temperatures, the ratio of the first luminous flux output to the second luminous flux output varies. In particular, when the first color temperature is lower than the second color temperature, the lighting device is configured such that, at decreasing junction temperatures, the ratio of the first luminous flux output to the second luminous flux output increases, and vice versa. In such a configuration, e.g. having the first set connected in series with the second set, the first luminous flux output increases relative to the second flux output when the lighting device is dimmed, thereby producing light having a lower color temperature.

In an embodiment, the first set has a first dynamic electrical resistance, and the second set has a second dynamic electrical resistance. When e.g. the first set is connected in 15 parallel with the second set, different luminous flux outputs of the first set and the second set result, which can be designed to produce light having a lower color temperature when dimmed.

According to another aspect of the present invention, there is provided a lighting device comprising an LED driver capable of generating dimmed LED current; and a two-terminal LED module, having two input terminals for receiving the dimmed LED current as an input current from the LED driver and comprising: a first LED group comprising at least one first type LED for producing light having a first color temperature; a second LED group comprising at least one second type LED for producing light having a second color temperature different from the first color temperature; wherein the module is capable of supplying LED currents to the LED groups, these LED currents being derived from the input current; wherein the LED module produces a light output having at least a light output contributions from the first LED group and from the second LED group; and wherein the module is designed to vary the individual LED currents in the individual LED groups in dependency of the average magnitude of the received input current, such that the color point of the light output of the module varies as a function of the input current magnitude; wherein the LED module comprises an electronic division circuit capable of controlling a ratio of

		the LED currents in said first and second LED groups as a function of the input current level received at the input of the LED module; wherein one of the first group of LEDs and the second group of LEDs is connected in series with a resistor, and wherein this first series
	4b	arrangement is connected in parallel to a second series arrangement comprising the other one of the first group of LEDs and the second group of LEDs, and wherein this parallel arrangement is connected between the two input terminals of the LED module; and wherein the first series arrangement has a first dynamic electrical resistance and the second series arrangement has a second dynamic electrical resistance, and the first dynamic electrical resistance is different from the second dynamic electrical resistance, so that as a result the ratio of the LED currents in said first and second LED groups is variable. ~~In another aspect of the present invention, a lighting kit of parts is provided, comprising a dimmer having input terminals adapted to be connected to an electrical power supply, and having output terminals adapted to provide a variable electrical power.~~ An embodiment of the lighting device according to the present invention has terminals configured to be connected to the output terminals of the dimmer. Further advantageous elaborations are mentioned in the dependent claims. BRIEF DESCRIPTION OF THE DRAWINGS These and other aspects, features and advantages of the present invention will be further explained by the following description of one or more preferred embodiments with reference to the drawings, in which same reference numerals indicate same or similar parts, and in

IN THE HIGH COURT OF JUSTICE
CHANCERY DIVISION
PATENTS COURT

Claim No: HP-2016-000046

B E T W E E N:

(1) PHILIPS LIGHTING NORTH AMERICA CORPORATION
(a company incorporated under the laws of the USA)

(2) PHILIPS LIGHTING HOLDING B.V.
(a company incorporated under the laws of the Netherlands)

Claimants

-and-

(1) MEGAMAN (UK) LIMITED

(2) NEONLITE INTERNATIONAL LIMITED

(3) NEONLITE ELECTRONIC & LIGHTING (HK) LIMITED
(a company incorporated under the laws of Hong Kong)

Defendants

ANNEX D – SCHEDULE OF AMENDMENTS OF THE THIRD REQUEST

The proposed conditional amendments to European Patent (UK) No. 2 407 009 (the "**Patent**") of the Third Request are as follows:-

Conditional Amendments to the Claims of the Patent		
Old Claim	**New Claim**	**Conditional Amendment**
1	1	Lighting device (100), comprising: an LED driver (101) capable of generating dimmed LED current; a two-terminal LED module (110; 300; 400; 500; 600), having two input terminals (111, 112) for receiving an input current (Iin) from the LED driver (101) and comprising:

		a first LED group (113) comprising at least one first type LED for producing light having a first color temperature; a second LED group (114) comprising at least one second type LED for producing light having a second color temperature different from the first color temperature; a current regulating element (320) arranged in series with one of said groups of LEDs, this series arrangement being coupled in parallel to another of said groups of LEDs; a current sensing element (350) arranged for sensing the input current received at the input terminals of the LED module; and a regulator driver (310) receiving a sense output signal from the sensing element and driving the current regulating element on the basis of this sense output signal; wherein the module is capable of supplying LED currents to the LED groups, these LED currents being derived from the input current (Iin); wherein the LED module produces a light output having at least a light output contributions from the first LED group (113) and from the second LED group (114); ~~and~~ wherein the module is designed to vary the individual LED currents in the individual LED groups in dependency of the average magnitude of the received input current (Iin), such that the color point of the light output of the module varies as a function of the input current magnitude~~,~~; ~~characterized in that~~ wherein the LED module comprises an electronic division circuit (115) capable of controlling a ratio of the LED currents (I1, I2) in said first and second LED groups (113, 114) as a function of the input current level received at the input of the LED module~~.~~; and wherein the electronic division circuit is capable of supplying the two groups of LEDs with constant current and of controlling the LED currents (I1, I2) such that the following formulas apply: I1 = p•Iin and I2 = q•Iin, and p + q = 1, with Iin denoting the input current magnitude, I1

		denoting the current magnitude in the first group of LEDs, and I2 denoting the current magnitude in the second group of LEDs.
2		Lighting device according to claim 1, wherein the LED module is designed to vary the individual LED currents in the individual LED groups such that the color point of the light output of the module on dimming follows a black body curve.
3		Lighting device according to claim 1, wherein the LED module is designed to vary the individual LED currents in the individual LED groups such that the color behavior of the light output of the module on dimming resembles the color behavior of an incandescent lamp.
4		Lighting device according to claim 1, wherein the lighting device is configured to produce light with a color temperature CT at an average current of x%, CT(x%), supplied to the terminals following the relationship: CT (x%) = CT(100%)*(x/100)1/9.5
5		Lighting device according to claim 1, wherein the first group of LEDs has a varying first luminous flux output as a function of junction temperature of the first type LED, and the second group of LEDs has a varying second luminous flux output as a function of junction temperature of the second type LED, and wherein, at varying junction temperatures, the ratio of the first luminous flux output to the second luminous flux output varies; and wherein the first color temperature is lower than the second color temperature, while, at decreasing junction temperatures, the ratio of the first luminous flux output to the second luminous flux output increases, and vice versa.
6		Lighting device according to claim 1, wherein a gradient of the first luminous flux output as a function of junction temperature of the first type LED differs from a gradient of the second luminous flux output as a function of junction temperature of the second type LED; and wherein the first color temperature is lower than the second color temperature, while the absolute value of the gradient of the first luminous flux output as a function of temperature of the first type LED is

		higher than the gradient of the second luminous flux output as a function of temperature of the second type LED.
7		Lighting device according to claim 1, wherein a thermal resistance to ambient of the first group of LEDs differs from the thermal resistance to ambient of the second group of LEDs; and wherein the first color temperature is lower than the second color temperature, while the thermal resistance to ambient of the first group of LEDs is higher than the thermal resistance to ambient of the second group of LEDs.
8		Lighting device according to claim 1, wherein the first group of LEDs has a first dynamic electrical resistance, and the second group of LEDs has a second dynamic electrical resistance.
9		Lighting device ~~according to claim 1,~~ comprising: an LED driver (101) capable of generating dimmed LED current; and a two-terminal LED module (110; 300; 400; 500; 600), having two input terminals (111, 112) for receiving an input current (Iin) from the LED driver (101) and comprising: a first LED group (113) comprising at least one first type LED for producing light having a first color temperature; a second LED group (114) comprising at least one second type LED for producing light having a second color temperature different from the first color temperature; wherein the module is capable of supplying LED currents to the LED groups, these LED currents being derived from the input current (Iin); wherein the LED module produces a light output having at least a light output contributions from the first LED group (113) and from the second LED group (114); and wherein the module is designed to vary the individual LED currents in the individual LED groups in dependency of the average magnitude of the received input current (Iin), such that the color point of

		the light output of the module varies as a function of the input current magnitude; wherein the LED module comprises an electronic division circuit (115) capable of controlling a ratio of the LED currents (I1, I2) in said first and second LED groups (113, 114) as a function of the input current level received at the input of the LED module; wherein one of the first group of LEDs and the second group of LEDs is connected in series with a resistor, and wherein this series arrangement is connected in parallel to the other one of the first group of LEDs and the second group of LEDs, and wherein this parallel arrangement is connected between the two input terminals (111, 112) of the LED module~~;~~. ~~and wherein the resistor is a negative temperature coefficient, NTC, type resistor.~~
	10	Lighting device according to claim 9, wherein the resistor is a negative temperature coefficient, NTC, type resistor.
~~10~~	11	Lighting device according to any of the preceding claims, wherein the first type LED is an AlInGaP type LED, and/or wherein the second type LED is an In- GaN type LED.
~~11~~	12	Lighting device according to claim 1, ~~wherein the electronic division circuit is capable of supplying the two groups of LEDs with constant current and of controlling the LED currents (I1, I2) such that the following formulas apply:~~ ~~I1 = p•Iin and I2 = q•Iin, and p + q = 1~~ ~~with Iin denoting the input current magnitude,~~ ~~I1 denoting the current magnitude in the first group of LEDs,~~ ~~I2 denoting the current magnitude in the second group of LEDs;~~ wherein there is at least a range of input current magnitudes where dp/d(Iin) is always positive and dq/d(Iin) is always negative.
~~12~~		~~Lighting device according to claim 11, wherein the LED module comprises:~~

		a current regulating element (320) arranged in series with one of said groups of LEDs, this series arrangement being coupled in parallel to another of said groups of LEDs; a current sensing element (350) arranged for sensing the input current received at the input terminals of the LED module; and a regulator driver (310) receiving a sense output signal from the sensing element and driving the current regulating element on the basis of this sense output signal.
13		Lighting device according to claim 1, wherein the electronic division circuit (515) comprises a controllable switch (501) for temporally dividing de received input current (Iin) between the two groups of LEDs; a control device (520) for controlling the switch (501) at a switching period T such that the input current is passed on to the first group of LEDs for a first time duration t1 and the input current is passed on to the second group of LEDs for a second time duration t2, with t1+t2=T; a current sensing element (116) arranged for sensing the input current received at the input terminals of the LED module; the control device being coupled to receive a sense output signal from the sensing element and being designed to vary the ratio t1/t2 of the switching of the switch on the basis of said sense output signal, such that there is at least a range of input current magnitudes where dt1(Iin) is always positive and dt2 (Iin) is always negative.
14		Lighting device according to claim 1, wherein the second group of LEDs (114) is supplied by a current converter (601) having its input terminals connected in parallel to the first group of LEDs (113); wherein the current converter comprises a control circuit (620) receiving a sense output signal from a current sensing element (116) sensing the input cur- rent of the LED module; and wherein this control circuit (620) is designed to control the current converter (601) on the basis of the sense output signal received from the current sensing element (116).

~~15~~		~~Lighting device according to claim 1, wherein the first group of LEDs (113) is supplied by a first current converter (730) and the second group of LEDs (114) is supplied by a second current converter (740), and wherein these two current converter have their input terminals connected in series;~~ ~~wherein the LED module comprises a control circuit (720) receiving a sense output signal from a current sensing element (116) sensing the input current of the LED module;~~ ~~and wherein this control circuit (720) is designed to control the current converters (730, 740) on the basis of the sense output signal received from the current sensing element (116).~~

Conditional Amendments to the Description of the Patent		
Old Page	**New Page**	**Conditional Amendment**
3	3	The device known from US 2006/0273331 receives an input voltage signal that carries power and a control signal. In the device, the control signal is taken from the input signal and transferred to the intelligent control device, that controls the individual current sources on the basis of the received control data. By changing the ratio between the respective light outputs, the relative contributions to the overall light output is changed and hence the overall color of the overall light output, as perceived by an observer, is changed. Such lighting device, therefore, requires a separate control input signal. In LED lighting devices, a behavior of the color temperature of the LED light can be obtained which, in dimming conditions, is similar to that of an incandescent lamp, but until now only at the expense of extensive current control, such as e.g. known from DE10230105. The necessity of adding controls to the LED lighting device for the desired color temperature behavior increases the number of components, increases the complexity of the lighting device, and increases costs. These effects are

		undesirable. Further relevant prior art is described in US 2008/224631 and WO 2007/093927. SUMMARY OF THE INVENTION The present invention aims to provide a LED circuit for such LED lighting device, and a LED lighting device comprising such LED circuit, wherein an intelligent control can be omitted and wherein a feedback sensor can be omitted. It would be desirable to provide an LED lighting device having a color temperature behavior, when dimmed, resembling or approaching the color temperature behavior of an incandescent lamp, when dimmed. It would also be desirable to provide an LED lighting device having an incandescent lamp color temperature behavior, when dimmed, without the need of extensive controls. To better address one or more of these concerns, in an aspect of the invention an LED lighting device is provided, comprising an LED driver capable of generating dimmed LED current, and a two-terminal LED module, having two input terminals for receiving an input current from the LED driver. The LED module comprises: a first LED group comprising at least one first type LED for producing light having a first color temperature, ~~and~~ a second LED group comprising at least one second type LED for producing light having a second color temperature different from the first color temperature, a current regulating element arranged in series with one of said groups of LEDs, this series arrangement being coupled in parallel to another at said groups of LEDs, a current sensing element arranged for sensing the input current received at the input terminals of the LED module, and a regulator
4	4	driver receiving a sense output signal from the sensing element and driving the current regulating element on the basis of this sense output signal. The LED module is capable of supplying LED currents to the LED groups, these LED currents being derived from the input current. The LED module produces a light output having at least a light output contributions from the first LED group and from the second LED group.

		The LED module is designed to vary the individual LED currents in the individual LED groups in dependency of the average magnitude of the received input current, such that the color point of the light output of the module varies as a function of the input current magnitude. The LED module comprises an electronic division circuit capable of controlling a ratio of the LED currents in said first and second LED groups as a function of the input current level received at the input of the LED module. The electronic division circuit is capable of suppling the two groups of LEDs with constant current and of controlling the LED currents such that the following formulas apply: $I1 = p \cdot Iin$ and $I2 = q \cdot Iin$, and $p + q = 1$, with Iin denoting the input current magnitude. I1 denoting the current magnitude in the first group of LEDs, and I2 denoting the current magnitude in the second group of LEDs. ~~According to an aspect of the present invention, an LED lighting device comprises a single dimmable current source and an LED module receiving current from the current source.~~ The LED module behaves as a load to the current source, similar to an array existing of LEDs only. Within the LED module, an electronic circuit senses the current magnitude of the input current, and distributes the current to different LED sections of the LED module on the basis of the sensed current magnitude. No intelligent current control is needed in the current source. ~~In an aspect of the invention an LED lighting device is provided, comprising a plurality of LEDs, and two terminals for supplying current to the lighting device. The lighting device comprises a first set of at least one LED of a first type producing light having a first color temperature, and a second set of at least one LED of a second type producing light having a second color temperature different from the first color temperature.~~ The first set and the second set ~~are~~may be connected in series or in parallel between the terminals. ~~T~~In embodiments, the lighting device is configured to produce light with a color point varying in accordance with a blackbody curve at a variation of an average current supplied to the terminals.

		A color temperature behavior of an incandescent lamp may be described by the following relationship:
4a	4a	$$CT(x\%) = CT(100\%) * (x/100)^{\frac{1}{9.5}}$$ where CT(100%) is the color temperature of the light at full power (100% current) of the lamp, CT(x%) is the color temperature of the light at x% dimming of the lamp (x% current, with $0 < x < 100$). In an embodiment, the first set has a varying first luminous flux output as a function of junction temperature of the LED of the first type, and the second set has a varying second luminous flux output as a function of junction temperature of the LED of the second type, and wherein, at varying junction temperatures, the ratio of the first luminous flux output to the second luminous flux output varies. In particular, when the first color temperature is lower than the second color temperature, the lighting device is configured such that, at decreasing junction temperatures, the ratio of the first luminous flux output to the second luminous flux output increases, and vice versa. In such a configuration, e.g. having the first set connected in series with the second set, the first luminous flux output increases relative to the second flux output when the lighting device is dimmed, thereby producing light having a lower color temperature. In an embodiment, the first set has a first dynamic electrical resistance, and the second set has a second dynamic electrical resistance. When e.g. the first 20 set is connected in parallel with the second set, different luminous flux outputs of the first set and the second set result, which can be designed to produce light having a lower color temperature when dimmed. According to another aspect of the present invention, there is provided a lighting device comprising: an LED driver capable of generating dimmed LED current; and a two-terminal LED module, having two input terminals for receiving an input current from the LED driver and comprising: a first LED group comprising at least one first type LED for producing light having a first color temperature; a second LED

		group comprising at least one second type LED for producing light having a second color temperature different from the first color temperature; wherein the module is capable of suppling LED currents to the LED groups, these LED currents being derived from the input current; wherein the LED module produces a light output having at least a light output contributions from the first LED group and from the second LED group; and wherein the module is designed to vary the individual LED currents in the individual LED groups in dependency of the average magnitude of the received input current, such that the color point of the light output of the module varies as a
	4b	function of the input current magnitude; wherein the LED module comprises an electronic division circuit capable of controlling a ratio of the LED currents in said first and second LED groups as a function of the input current level received at the input of the LED module; wherein one of the first group of LEDs and the second group of LEDs in connected in series with a resistor, and wherein this series arrangement is connected in parallel to the other one of the first group of LEDs and the second group of LEDs, and wherein this parallel arrangement is connected between the two input terminals of the LED module. ~~In another aspect of the present invention, a lighting kit of parts is provided, comprising a dimmer having input terminals adapted to be connected to an electrical power supply, and having output terminals adapted to provide a variable electrical power.~~ An embodiment of the lighting device according to the present invention has terminals configured to be connected to the output terminals of the dimmer. Further advantageous elaborations are mentioned in the dependent claims. BRIEF DESCRIPTION OF THE DRAWINGS These and other aspects, features and advantages of the present invention will be further explained by the following description of one or more preferred embodiments with reference to the drawings, in which same reference numerals indicate same or similar parts, and in

IN THE HIGH COURT OF JUSTICE
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Claim No: HP-2016-000046

B E T W E E N:

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(a company incorporated under the laws of the USA)

(2) PHILIPS LIGHTING HOLDING B.V.
(a company incorporated under the laws of the Netherlands)

Claimants

-and-

(1) MEGAMAN (UK) LIMITED

(2) NEONLITE INTERNATIONAL LIMITED

(3) NEONLITE ELECTRONIC & LIGHTING (HK) LIMITED
(a company incorporated under the laws of Hong Kong)

Defendants

ANNEX E – SCHEDULE OF AMENDMENTS OF THE FOURTH REQUEST

The proposed conditional amendments to European Patent (UK) No. 2 407 009 (the "**Patent**") of the Fourth Request are as follows:-

Conditional Amendments to the Claims of the Patent		
Old Claim	**New Claim**	**Conditional Amendment**
~~1~~		~~Lighting device (100), comprising:~~ ~~an LED driver (101) capable of generating dimmed LED current;~~ ~~a two-terminal LED module (110; 300; 400; 500; 600), having two input terminals (111, 112) for receiving an input current (Iin) from the LED driver (101) and comprising:~~

		~~a first LED group (113) comprising at least one first type LED for producing light having a first color temperature;~~ ~~a second LED group (114) comprising at least one second type LED for producing light having a second color temperature different from the first color temperature;~~ ~~wherein the module is capable of supplying LED currents to the LED groups, these LED currents being derived from the input current (Iin);~~ ~~wherein the LED module produces a light output having at least a light output contributions from the first LED group (113) and from the second LED group (114);~~ ~~and wherein the module is designed to vary the individual LED currents in the individual LED groups in dependency of the average magnitude of the received input current (Iin), such that the color point of the light output of the module varies as a function of the input current magnitude,~~ ~~characterized in that the LED module comprises an electronic division circuit (115) capable of controlling a ratio of the LED currents (I1, I2) in said first and second LED groups (113, 114) as a function of the input current level received at the input of the LED module.~~
~~2~~		~~Lighting device according to claim 1, wherein the LED module is designed to vary the individual LED currents in the individual LED groups such that the color point of the light output of the module on dimming follows a black body curve.~~
~~3~~		~~Lighting device according to claim 1, wherein the LED module is designed to vary the individual LED currents in the individual LED groups such that the color behavior of the light output of the module on dimming resembles the color behavior of an incandescent lamp.~~
~~4~~		~~Lighting device according to claim 1, wherein the lighting device is configured to produce light with a color temperature CT at an average current of x%, CT(x%), supplied to the terminals following the relationship:~~ ~~CT (x%) = CT(100%)*(x/100)1/9.5~~

~~5~~		~~Lighting device according to claim 1, wherein the first group of LEDs has a varying first luminous flux output as a function of junction temperature of the first type LED, and the second group of LEDs has a varying second luminous flux output as a function of junction temperature of the second type LED, and wherein, at varying junction temperatures, the ratio of the first luminous flux output to the second luminous flux output varies;~~ ~~and wherein the first color temperature is lower than the second color temperature, while, at decreasing junction temperatures, the ratio of the first luminous flux output to the second luminous flux output increases, and vice versa.~~
~~6~~		~~Lighting device according to claim 1, wherein a gradient of the first luminous flux output as a function of junction temperature of the first type LED differs from a gradient of the second luminous flux output as a function of junction temperature of the second type LED;~~ ~~and wherein the first color temperature is lower than the second color temperature, while the absolute value of the gradient of the first luminous flux output as a function of temperature of the first type LED is higher than the gradient of the second luminous flux output as a function of temperature of the second type LED.~~
~~7~~		~~Lighting device according to claim 1, wherein a thermal resistance to ambient of the first group of LEDs differs from the thermal resistance to ambient of the second group of LEDs;~~ ~~and wherein the first color temperature is lower than the second color temperature, while the thermal resistance to ambient of the first group of LEDs is higher than the thermal resistance to ambient of the second group of LEDs.~~
~~8~~		~~Lighting device according to claim 1, wherein the first group of LEDs has a first dynamic electrical resistance, and the second group of LEDs has a second dynamic electrical resistance.~~
~~9~~	1	Lighting device ~~according to claim 1,~~comprising: an LED driver (101) capable of generating dimmed LED current; and

		a two-terminal LED module (110; 300; 400; 500; 600), having two input terminals (111, 112) for receiving an input current (Iin) from the LED driver (101) and comprising: a first LED group (113) comprising at least one first type LED for producing light having a first color temperature; a second LED group (114) comprising at least one second type LED for producing light having a second color temperature different from the first color temperature; wherein the module is capable of supplying LED currents to the LED groups, these LED currents being derived from the input current (Iin); wherein the LED module produces a light output having at least a light output contributions from the first LED group (113) and from the second LED group (114); and wherein the module is designed to vary the individual LED currents in the individual LED groups in dependency of the average magnitude of the received input current (Iin), such that the color point of the light output of the module varies as a function of the input current magnitude; wherein the LED module comprises an electronic division circuit (115) capable of controlling a ratio of the LED currents (I1, I2) in said first and second LED groups (113, 114) as a function of the input current level received at the input of the LED module; wherein one of the first group of LEDs and the second group of LEDs is connected in series with a resistor, and wherein this series arrangement is connected in parallel to the other one of the first group of LEDs and the second group of LEDs, and wherein this parallel arrangement is connected between the two input terminals (111, 112) of the LED module; and wherein the electronic division circuit (115) consists of an electronic circuit with passive electronic components and wherein the electronic circuit design defines a relationship between the input current

		(Iin) and the ratio of the LED currents in said first and second LED groups (113, 114). ~~and wherein the resistor is a negative temperature coefficient, NTC, type resistor.~~
	2	Lighting device according to claim 1, wherein a memory function is implemented in the electronic circuit design as an integral part of the electronic division circuit, the memory function defining the relationship between the input current (Iin) and the ratio of the LED currents in said first and second LED groups (113, 114).
~~10~~		~~Lighting device according to any of the preceding claims, wherein the first type LED is an AlInGaP type LED, and/or wherein the second type LED is an In- GaN type LED.~~
~~11~~		~~Lighting device according to claim 1, wherein the electronic division circuit is capable of supplying the two groups of LEDs with constant current and of controlling the LED currents (I1, I2) such that the following formulas apply:~~ ~~I1 = p•Iin and I2 = q•Iin, and p + q = 1~~ ~~with Iin denoting the input current magnitude,~~ ~~I1 denoting the current magnitude in the first group of LEDs,~~ ~~I2 denoting the current magnitude in the second group of LEDs;~~ ~~wherein there is at least a range of input current magnitudes where dp/d(Iin) is always positive and dq/d (Iin) is always negative.~~
~~12~~		~~Lighting device according to claim 11, wherein the LED module comprises:~~ ~~a current regulating element (320) arranged in series with one of said groups of LEDs, this series arrangement being coupled in parallel to another of said groups of LEDs;~~ ~~a current sensing element (350) arranged for sensing the input current received at the input terminals of the LED module;~~ ~~and a regulator driver (310) receiving a sense output signal from the sensing element and driving the current regulating element on the basis of this sense output signal.~~

~~13~~		~~Lighting device according to claim 1, wherein the electronic division circuit (515) comprises a controllable switch (501) for temporally dividing de received input current (Iin) between the two groups of LEDs;~~ ~~a control device (520) for controlling the switch (501) at a switching period T such that the input current is passed on to the first group of LEDs for a first time duration t1 and the input current is passed on to the second group of LEDs for a second time duration t2, with t1+t2=T;~~ ~~a current sensing element (116) arranged for sensing the input current received at the input terminals of the LED module;~~ ~~the control device being coupled to receive a sense output signal from the sensing element and being designed to vary the ratio t1/t2 of the switching of the switch on the basis of said sense output signal, such that there is at least a range of input current magnitudes where dt1(Iin) is always positive and dt2 (Iin) is always negative.~~
~~14~~		~~Lighting device according to claim 1, wherein the second group of LEDs (114) is supplied by a current converter (601) having its input terminals connected in parallel to the first group of LEDs (113);~~ ~~wherein the current converter comprises a control circuit (620) receiving a sense output signal from a current sensing element (116) sensing the input cur- rent of the LED module;~~ ~~and wherein this control circuit (620) is designed to control the current converter (601) on the basis of the sense output signal received from the current sensing element (116).~~
~~15~~		~~Lighting device according to claim 1, wherein the first group of LEDs (113) is supplied by a first current converter (730) and the second group of LEDs (114) is supplied by a second current converter (740), and wherein these two current converter have their input terminals connected in series;~~ ~~wherein the LED module comprises a control circuit (720) receiving a sense output signal from a current sensing element (116) sensing the input current of the LED module;~~

		~~and wherein this control circuit (720) is designed to control the current converters (730, 740) on the basis of the sense output signal received from the current sensing element (116).~~

Conditional Amendments to the Description of the Patent		
Old Page	**New Page**	**Conditional Amendment**
3	3	The device known from US 2006/0273331 receives an input voltage signal that carries power and a control signal. In the device, the control signal is taken from the input signal and transferred to the intelligent control device, that controls the individual current sources on the basis of the received control data. By changing the ratio between the respective light outputs, the relative contributions to the overall light output is changed and hence the overall color of the overall light output, as perceived by an observer, is changed. Such lighting device, therefore, requires a separate control input signal. In LED lighting devices, a behavior of the color temperature of the LED light can be obtained which, in dimming conditions, is similar to that of an incandescent lamp, but until now only at the expense of extensive current control, such as e.g. known from DE10230105. The necessity of adding controls to the LED lighting device for the desired color temperature behavior increases the number of components, increases the complexity of the lighting device, and increases costs. These effects are undesirable. Further relevant prior art is described in US 2008/224631 and WO 2007/093927. SUMMARY OF THE INVENTION The present invention aims to provide a LED circuit for such LED lighting device, and a LED lighting device comprising such LED circuit, wherein an intelligent control can be omitted and wherein a feedback sensor can be omitted.

		It would be desirable to provide an LED lighting device having a color temperature behavior, when dimmed, resembling or approaching the color temperature behavior of an incandescent lamp, when dimmed It would also be desirable to provide an LED lighting device having an incandescent lamp color temperature behavior, when dimmed, without the need of extensive controls. To better address one or more of these concerns, in an aspect of the invention an LED lighting device is provided, comprising a lighting device comprising: an LED driver capable of generating dimmed LED current~~,~~; and a two-terminal LED module, having two input terminals for receiving an input current from the LED driver~~. The LED module comprises~~ and comprising: a first LED group comprising at least one first type LED for producing light having a first color temperature~~, and~~; a second LED group comprising at least one second type LED for producing light having a second color temperature different from the first color temperature~~. The LED~~; wherein the module is capable of supplying LED currents to the LED groups, these LED currents being derived from the input current~~. The~~; wherein the LED module produces a light output
4	4	having at least a light output contributions from the first LED group and from the second LED group~~. The LED~~; and wherein the module is designed to vary the individual LED currents in the individual LED groups in dependency of the average magnitude of the received input current, such that the color point of the light output of the module varies as a function of the input current magnitude~~. The~~; wherein the LED module comprises an electronic division circuit capable of controlling a ratio of the LED currents in said first and second LED groups as a function of the input current level received at the input of the LED module~~.~~; wherein one of the first group of LEDs and the second group of LEDs is connected in series with a resistor, and wherein this series arrangement is connected in parallel to the other one of the first group of LEDs and the second group of LEDs and wherein this parallel arrangement is connected between the two input terminals or the LED module; and

		wherein the electronic division circuit consists of an electronic circuit with passive electronic components and wherein the electronic circuit design defines a relationship between the input current and the ratio of the LED currents in said first and second LED groups. ~~According to an aspect of the present invention, an LED lighting device comprises a single dimmable current source and an LED module receiving current from the current source. The LED module behaves as a load to the current source, similar to an array existing of LEDs only. Within the LED module, an electronic circuit senses the current magnitude of the input current, and distributes the current to different LED sections of the LED module on the basis of the sensed current magnitude. No intelligent current control is needed in the current source.~~ ~~In an aspect of the invention an LED lighting device is provided, comprising a plurality of LEDs, and two terminals for supplying current to the lighting device. The lighting device comprise a first set of at least one LED of a first type producing light having a first color temperature, and a second color temperature different from the first color temperature. The first set and the second set are connected in series or in parallel between the terminals.~~ ~~The lighting device is configured to produce light with a color point varying in accordance with a blackbody curve at a variation of an average current supplied to the terminals.~~ ~~A color temperature behavior of an incandescent lamp may be described by the following relationship:~~
4a	4a	~~$CT(x\%) = CT(100\%) * (x/100)^{\frac{1}{0.5}}$~~ ~~where CT(100%) is the color temperature of the light at full power (100% current) of the lamp, CT(x%) is the color temperature of the light at x% dimming of the lamp (x% current, with $0 < x < 100$).~~ ~~In an embodiment, the first set has a varying first luminous flux output as a function of junction temperature of the LED of the first type, and the second set has a varying second luminous flux output as a function of junction temperature of the LED of the second type, and wherein, at varying junction temperatures, the ratio of the first luminous flux output~~

~~to the second luminous flux output varies. In particular, when the first color temperature is lower than the second color temperature, the lighting device is configured such that, at decreasing junction temperatures, the ratio of the first luminous flux output to the second luminous flux output increases, and vice versa. In such a configuration, e.g. having the first set connected in series with the second set, the first luminous flux output increases relative to the second flux output when the lighting device is dimmed, thereby producing light having a lower color temperature.~~

~~In an embodiment, the first set has a first dynamic electrical resistance, and the second set has a second dynamic electrical resistance. When e.g. the first set is connected in parallel with the second set, different luminous flux outputs of the first set and the second set result, which can be designed to produce light having a lower color temperature when dimmed.~~

~~In another aspect of the present invention, a lighting kit of parts is provided, comprising a dimmer having input terminals adapted to be connected to an electrical power supply, and having output terminals adapted to provide a variable electrical power. An embodiment of the lighting device according to the present invention has terminals configured to be connected to the output terminals of the dimmer.~~

A ~~F~~further advantageous elaborations ~~are~~is mentioned in the dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other aspects, features and advantages of the present invention will be further explained by the following description of one or more preferred embodiments with reference to the drawings, in which same reference numerals indicate same or similar parts, and in