(11) Application No. AU 2006280899 B2

(19) AUSTRALIAN PATENT OFFICE

(54) Title

High-pressure discharge lamp operating device

(51)[6] International Patent Classification(s)

H05B 41/18 (2006.01) 0BHJP H05B

H05B 41/24 (2006.01) 41/24

H05B 41/18 20060101ALI2007051

20060101AFI2007051 0BHJP

PCT/JP2006/314686

(21) Application No: 2006280899 (22) Application Date: 2006.07.25

(87) WIPO No: WO07/020776

(30) Priority Data

(31) Number	(32) Date	(33) Country
2005-236379	2005.08.17	JP

(43) Publication Date : 2007.02.22

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(56) Related Art

JP 2005-004980

JP 7-114994

JP 5-266984

JP 7-211473

JP 7-014690

(12) 特許協力条約に基づいて公開された国際出願

訂正版

(19) 世界知的所有権機関
国際事務局

(43) 国際公開日
2007 年2 月22 日 (22.02.2007)

PCT

(10) 国際公開番号
WO 2007/020776 A1

(51) 国際特許分類:
H05B 41/18 (2006.01) *H05B 41/24* (2006.01)

(21) 国際出願番号: PCT/JP2006/314686

(22) 国際出願日: 2006 年7 月25 日 (25.07.2006)

(25) 国際出願の言語: 日本語

(26) 国際公開の言語: 日本語

(30) 優先権データ:
特願2005-236379 2005 年8 月17 日 (17.08.2005) JP

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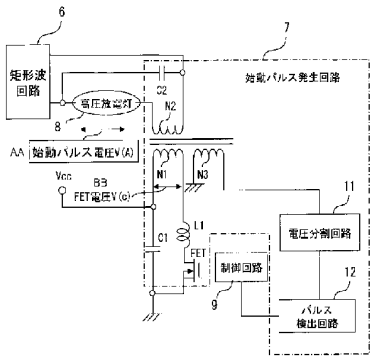
(81) 指定国 (表示のない限り、全ての種類の国内保護が可能): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HN, HR, HU, ID, IL, IN, IS, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH,

[続葉有]

(54) **Title:** HIGH-PRESSURE DISCHARGE LAMP OPERATING DEVICE

(54) 発明の名称: 高圧放電灯点灯装置



6... RECTANGULAR WAVE CIRCUIT
8... HIGH-PRESSURE DISCHARGE LAMP
7... START PULSE GENERATING CIRCUIT
AA... START PULSE VOLTAGE V(A)
BB... FET VOLTAGE V(G)
11... VOLTAGE DIVIDING CIRCUIT
9... CONTROL CIRCUIT
12... PULSE DETECTING CIRCUIT

(57) Abstract: A high-pressure discharge lamp operating device is capable of maintaining a start pulse voltage within a specific value by feeding back the start pulse voltage and making it constant even when the output capacity increases because of an output wiring length increase. A high-pressure discharge lamp operating device comprising a high pressure discharge lamp (8), a start pulse generating circuit (7) for supplying a starting high voltage to the high-pressure discharge lamp (8), and a control circuit (9) for controlling the start pulse generating circuit (7) is characterized in that the start pulse generating circuit (7) comprises a transformer (T1) for stepping up the pulse voltage generated by turning on/off a FET, a feedback voltage detecting winding (N3) provided in the transformer (T1), a voltage dividing circuit (11) for dividing the voltage generated in the feedback voltage detecting winding (N3), and a pulse detecting circuit (12) for detecting a start pulse voltage component from the output of the voltage dividing circuit (11) and feeding back the start pulse voltage component to the control circuit (9), and that the control circuit (9) maintains the voltage stepped up by the transformer (T1) at a predetermined value.

(57) 要約: 始動パルス電圧をフィードバックして一定化することにより、出力配線長が増加して出力容量が増えても、始動パルス電圧を規定値内に維持することができる高圧放電灯点灯装置を提供することを目的とする。 高圧放電灯８と、この高圧放電灯８に始動用高電圧を供給する始動パルス発生回路７と、この始動パルス発生回路７を制御する制御回路９とを備えた高圧放電灯点灯装置において、始動パルス発生回路７は、ＦＥＴのオン／オフにより発生するパルス電圧を昇圧するトランスＴ１と、このトランスＴ１に設けられたフィードバック電圧検出巻線Ｎ３と、フィードバック電圧検出巻線Ｎ３に発生する電圧を分割する電圧分割回路１１と、この電圧分割回路１１の出力から始動パルス電圧成分を検出し、制御回路９にフィードバックするパルス検出回路１２とを備え、制御回路９は、トランスＴ１の昇圧後の電圧を所定値に維持することを特徴とする。

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PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) 指定国(表示のない限り、全ての種類の広域保護が可能): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), ユーラシア (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), ヨーロッパ (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

添付公開書類:
— 国際調査報告書

(48) この訂正版の公開日: 2007年5月10日

(15) 訂正情報:
PCTガゼットのNo.19/2007 (2007年5月10日)を参照

2文字コード及び他の略語については、定期発行される各*PCT*ガゼットの巻頭に掲載されている「コードと略語のガイダンスノート」を参照。

SPECIFICATION

HIGH-PRESSURE DISCHARGE LAMP LIGHTING DEVICE

Technical Field

[0001] The present invention relates to a high-pressure discharge lamp lighting device and, more particularly, to a high-pressure discharge lamp lighting device provided with a starting pulse generation circuit capable of extending the length of output line.

Background Technique

[0002] Fig. 7 is a block diagram showing a conventional high-pressure discharge lamp lighting device. The high-pressure discharge lamp lighting device is constituted in such a manner that, when a commercial power supply 1 is turned on, a control power supply circuit 10 produces a control power supply to operate a control circuit 9, which then transmits a control signal to a voltage-boosting inverter 3, a voltage-dropping inverter 4, a rectangular wave circuit 6 and a starting pulse generation circuit 7, and then, these devices start to operate, respectively. The voltage-boosting inverter 3 boosts the output which has

been rectified by a rectifier circuit 2, to a normal voltage level, and the voltage-dropping inverter 4 adjusts its output so that the current to a high-pressure discharge lamp 8 can become a normal current. A rectangular wave circuit 6 outputs an AC rectangular wave voltage of a normal frequency to a high-pressure discharge lamp 8. The starting pulse generation circuit 7 generates a high-voltage pulse to start the high-pressure discharge lamp 8.

[0003] Fig. 8 is a detail diagram showing in detail the starting pulse generation circuit 7. The starting pulse generation circuit 7 operates to produce a high-voltage pulse only when the high-pressure discharge lamp 8 is to be started. The starting pulse generation circuit 7 comprises a transformer T1, a FET (field-effect transistor) being a switching element which can be turned on or off by an external control signal, a capacitor C1 which is charged with a DC voltage Vcc which has been boosted by a voltage-boosting inverter 3, an inductance L1 which performs the over-current protection of the FET, and a capacitor C2 which serves to block the high-voltage pulses, which are produced across the transformer T1, from running around into the

rectangular wave circuit 6.

Patent Literature 1: JP Patent Application Disclosure No. (Hei) 11-307285.

Patent Literature 2: JP Patent Application Disclosure No. 2000-306688.

Patent Literature 3: JP Patent Application Disclosure No. 2002-75673.

Disclosure of the Invention

Problems to be solved by the Invention

[0004] In case of a high-pressure discharge lamp such as a high-intensity and high-pressure discharge lamp or the like, the starting pulse voltage is prescribed to be 3 to 5 kVp, for example. In case of the high-pressure discharge lamp lighting device, if the output wiring is lengthened, the starting pulse voltage is attenuated by the resulting increase of the output capacity and thus becomes lower than the normal voltage level of the starting pulse voltage of the lamp, so that, in case the output wiring length is 10 m for example, there occurs the problem that the lamp cannot start. Therefore, there is the rule according to which the

output wiring length of a high-pressure discharge lamp lighting device must be 2 meters or less; and this serves as a restriction on the make-up of said system (See Fig. 9). If a high-pressure discharge lamp lighting device is constructed in such a manner that a starting pulse voltage of 4 kVp is outputted at a point of the output wiring length which point lies 10 meters ahead, then it is accepted, but, if this high-pressure discharge lamp lighting device is operated within the distance of 2 meters, then the starting pulse voltage becomes higher than 5.6 kVp, and then, there could be a possible danger that a leak is caused in the wiring, the socket, the high-pressure discharge lamp and so on.

[0005] The present invention has been made in order to give a solution to the above-mentioned problem, the objective of the present invention is to provide a high-pressure discharge lamp lighting device constructed in such a manner that, by feeding back a starting pulse voltage, said starting pulse voltage is stabilized, whereby the starting pulse voltage can be maintained within a normal range even if the output wiring is lengthened to enhance the output capacity.

[0006] The high-pressure discharge lamp lighting device according to the present invention, which comprises a high-pressure discharge lamp, a starting pulse generation circuit which feeds a high starting voltage to said high-pressure discharge lamp, and a control circuit for controlling said starting pulse generation circuit, characterized in that said starting pulse generation circuit comprises a boosting transformer for raising the pulse voltage generated by the ON/OFF operation of a switching element, a feedback voltage detection winding provided to said transformer, a voltage division circuit for dividing the voltage produced across said feedback voltage detection winding, and a pulse detection circuit for detecting the starting pulse voltage component from the output delivered from said voltage division circuit and feeding back the thus detected pulse voltage component to said control circuit.

Effect of the Invention

[0007] The high-pressure discharge lamp lighting device can maintain the starting pulse voltage within the normal range of values.

5

Brief Description of the Drawings

[0008] [Fig. 1] shows Embodiment 1 of the present invention, wherein there is shown, particularly, the output voltage of the starting pulse generation circuit which (output voltage) is measured when the output wiring length is altered.

[Fig. 2] shows Embodiment 1 of the present invention, wherein there is shown, particularly, the result of the measurement of the starting pulse voltage when the wiring length is altered.

[Fig. 3] shows Embodiment 1 of the present invention, wherein there is shown, particularly, the result of the measurement of the starting pulse voltage when the wiring length is altered.

[Fig. 4] shows Embodiment 1, wherein there are shown, particularly, the results of measuring the FET voltage V(C) and the starting pulse voltage V(B) when the wiring length is altered.

[Fig. 5] shows Embodiment 1 of the present invention, wherein there are shown, particularly, the result of measuring the FET voltage V(C) and the starting pulse voltage VB when the wiring length is altered.

[Fig. 6] shows Embodiment 1 of the present invention,

wherein, particularly, the starting pulse generation circuit is shown in detail.

[Fig. 7] is a block diagram showing the conventional high-pressure discharge lamp igniting system.

[Fig. 8] shows the conventional starting pulse generation circuit 7 in detail.

[Fig. 9] shows the relationship between the conventional high-pressure discharge lamp lighting device and the starting pulse voltage thereof.

Explanation of Reference Numerals

[0009] 1: Commercial power supply, 2: Rectifier circuit, 3: Voltage-boosting inverter , 4: Voltage-lowering inverter, 5: Current-detecting resistor, 6: Rectangular wave circuit, 7: Starting pulse generation circuit, 8: High-pressure discharge lamp, 9: Control circuit, 10: Control power supply circuit, 11: Voltage division circuit, 12: Pulse detection circuit.

Most desirable Embodiment for Execution of the Invention

[0010] Embodiment 1

Figs. 1 to 6 show Embodiment 1 of the present invention, of which Fig. 1 shows the output voltage measurement

of the starting pulse generation circuit 7 when the output wiring length is altered, Figs. 2 and 3 show the measurement results of the starting pulse voltage when the wiring length is altered, Fig. 4 and 5 show the voltage V(C) of the FET (Field-effect transistor) and the measurement result of the starting pulse voltage V(B) when the wiring length is altered, and Fig. 6 shows in detail the starting pulse generation circuit 7.

[0011] Additionally, the overall arrangement of the high-pressure discharge lamp igniting system is the same as that of the conventional high-pressure discharge lamp lighting device; however, the feature of this embodiment of the present invention lies in the starting pulse generation circuit 7.

[0012] As stated in the foregoing part, entitled "Background Technique", of this specification, if the output wiring length is increased, then the starting pulse voltage level falls; and thus, if the starting pulse voltage level comes to fall below the starting voltage of the high-pressure discharge lamp, then there is caused, in some cases, even the inconvenience that the

high-pressure discharge lamp does not start. Generally, in the case of a high-pressure discharge lamp lighting device, the output wiring length is stipulated to be two meters or shorter. The starting of the high-pressure discharge lamp becomes irregular in case the starting pulse voltage level is 3.5 kVp, and, in case the starting pulse voltage level is 3.0 kVp, the high-pressure discharge lighting device does not start.

[0013] According to the present patent application, there is proposed a starting system constructed in such a manner that, by feeding back the starting pulse voltage, a reliable starting voltage level is secured, so that no failure is caused in the starting of the lamp.

[0014] For the realization of the above-mentioned starting system, it is indispensable to assure that the below-stated two conditional points be satisfied:
(1) The first point is that the values, at a point A and a point B, of the output voltage from a starting pulse generation circuit 7 are approximately equal to each other. For example, in case the voltage at the point B is 3 kVp even if the voltage at the point A

is 5 kVp, the lamp is not started even if the output voltage (which has a value approximately the same value as the voltage level at the point A) of the starting pulse generation circuit is fed back.

(2) In the case of controlling the starting pulse voltage, the starting pulse voltage is a high voltage of 3 to 5 kVp, and thus, it is necessary to use a large number of high voltage-withstanding parts, so that the structure is large-sized. Further, even if such high voltage-withstanding parts are mounted, they will prove to be useless at the ordinary lighting time. The voltage to be fed back is suitably 10 Vp or so. In the starting pulse generator circuit 7 shown in Fig. 8, a transformer T1 is used, but, if there is a correlation between the FET voltage V(C) before the voltage is boosted and the starting pulse voltage V(B) being the voltage at a point B positioned ahead of the output wiring length, then the voltage at the point B located ahead of the output wiring length becomes controllable by controlling the FET voltage V(C) which is the lower voltage.

[0015] Thus, the starting pulse voltage V(A) and the starting pulse voltage V(B) at the point A and the point B in

Fig. 1 referred to in the above Item (1) were measured by varying the output wiring length. The wiring used in this experiment is a VVF cable. The result of this measurement is shown in Figs. 2 and 3. Concerning the output wiring lengths, 0, 0.5, 1, 2, 4, 6, 8 and 10 meters, the starting pulse voltage V(A) and the starting pulse voltage V(B) at point A and point B were measured. As a result, it was confirmed that, as shown in Figs. 2 and 3, the starting pulse voltage V(A) and the starting pulse voltage V(B) at the point A and at the point B are approximately equal to each other irrelevantly to the output wiring length. Accordingly, if, for example, the starting pulse voltage V(A) is controlled to 4 kVP, then the starting pulse voltage V(B) can also be controlled to approximately 4 kVp.

[0016] Next, in order to confirm what is stated in above Item (2), the FET voltage V(C) and the starting voltage V(A) before the boosting by the transformer T1 were measured; and the result thus obtained is shown in Figs. 4 and 5.

[0017] It has been found that, as shown in Figs. 4 and 5, the

FET voltage V(C) and the starting pulse voltage V(A) are correlated to each other; that is, by controlling the FET voltage V(C) which is low in voltage level, the starting pulse voltage V(A) can be controlled. The FET voltage V(C) is less than 1/10 of the starting pulse voltage V(A). It is sufficient to feed back a voltage which is lower than 1/10 of the starting pulse voltage V(A); and thus, the system can be made of a small-sized circuit. The FET voltage V(C) is higher than the desirable voltage, 10 VP which is desirable for the feedback, but, if said FET voltage V(C) is sufficient to be about 300 Vp though it is greater than 10 Vp desirable for the feedback, then the feedback circuit can be composed by the use of a plurality, yet small in number, of circuit parts.

[0018] By referring to Fig. 6, explanation will now be made concerning the starting pulse generation circuit 7 according to this embodiment of the present invention. To a transformer T1, a feedback voltage detection winding N3 is added. More concretely, if, for example, a primary winding N1 is made of 6 turns of a wire, a secondary winding N2 is made of 88 turns of a wire, and a feedback voltage detection winding N3 is made

of 1 turn of a wire, then it results that the FET voltage V(C) = 300 Vp, the starting pulse voltage (A) = 4.4 kVp, and the feedback voltage V(F) = 50 Vp.

[0019] To the feedback voltage detection winding N3, a voltage division circuit 11 is connected. The voltage division circuit 11 is made of, e.g. a resistor, whereby the given voltage is divided to arbitrary voltages. As the feedback voltage, it is also possible to lower the given voltage to the order of 10 Vp.

[0020] Moreover, to the voltage division circuit 11, a pulse detection circuit 12 is connected. In the output of the voltage division circuit 11, various voltage components are contained in addition to the necessary starting pulse voltage component. The pulse detection circuit 12 detects the starting pulse voltage component from among these voltage components.

[0021] Then the output from the pulse detection circuit 12 is fed back to a control circuit 9. This control circuit 9 controls the FET voltage V(C) so that the starting pulse voltage V(A) may become a fixed voltage of, for example, 4 kVp.

[0022] As mentioned above, according to this embodiment of the present invention, a low voltage (for example, 50 Vp) across the feedback voltage winding N3 provided in the transformer T1 is further divided, by the voltage division circuit 11, to a still lower voltage, whereby a necessary starting pulse voltage component is detected by the pulse detection circuit 12 and fed back to the control circuit 9; and therefore, the starting pulse voltage V(A) can be maintained at, e.g. 4 kVp. It has been confirmed that, up to about 10 meters in length of the output wiring, the starting pulse voltage remains approximately the same without regard to the output wiring length, so that, if the starting pulse voltage V(A) is maintained at the above-mentioned 4 kVp, then the starting pulse voltage at a point 10 meters ahead can also be held at approximately the same voltage level.

2006280899 18 Mar 2011

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A high-pressure discharge lamp lighting device which has a high-pressure discharge lamp, a starting pulse generation circuit for feeding a starting high-voltage to said high-pressure discharge lamp, and a control circuit for controlling said starting pulse generation circuit, wherein said starting pulse generation circuit includes a transformer for boosting the pulse voltage produced by the ON/OFF operation of a switching element, a feedback voltage detection winding provided to said transformer, a voltage division circuit for dividing the voltage produced across said feedback voltage detection winding, and a pulse detection circuit which detects a starting pulse voltage component from the output of said voltage division circuit and feeds it back to said control circuit, wherein said control circuit maintains, at a predetermined value, the voltage after it is boosted by said transformer.

2. A high-pressure discharge lamp lighting device substantially as herein described with reference to any one of the embodiments illustrated in the accompanying figures 1 to 6.

PATENT-TREUHAND-GESELLSCHAFT FÜR ELEKTRISCHE GLÜHLAMPEN MBH

WATERMARK PATENT & TRADE MARK ATTORNEYS

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COMS ID No: ARCS-314125 Received by IP Australia: Time (H:m) 14:50 Date (Y-M-d) 2011-03-18

EDITORIAL NOTE

APPLICATION NO.: 2006280899

This specification does not contain a page numbered 16.

The Drawings pages have been numbered 17 to 19, followed by pages 1 to 7.

100: Fig. 1.

7: Starting pulse generation circuit

100-1: Point A

100-2: Point B

100-3: About 30 cm

100-4: Output wiring length

200: Fig. 2.

200-1: Starting pulse voltage (Unit: kVp)

200-2: Output wiring length (m)

300: Fig. 3.

300-1: Output wiring length - Starting pulse voltage

300-2: Output wiring length (m)

300-3: Starting pulse voltage (kVp)

400: Fig. 4.

400-1: Output wiring length

400-2: FET voltage V(C)

400-3: Starting pulse voltage V(A)

500: Fig. 5.

500-1: Output wiring length - FET voltage V(C), Starting

pulse voltage V(A)

500-2: ◇ FET voltage V(C)

□ Output voltage V(A)

500-3: FET voltage V(C) (Vp)

500-4: Output wiring length (m)

500-5: Starting pulse voltage V(A)

600: Fig. 6.

C1, C2: Capacitors

FET: Field-effect transistor (an example of the switching element)

N1: Primary winding

N2: Secondary winding

N3: Feed-back voltage detection winding

T1: Transformer

7: Starting pulse generation circuit.

600-1: Starting pulse voltage V(A)

600-2: FET voltage V(c)

700: Fig. 7.

800: Fig. 8.

9: Control circuit

800-1: Starting pulse voltage V(A)

800-2: FET voltage V(C)

900: Fig. 9.

7: Starting pulse generation circuit

Fig. 1

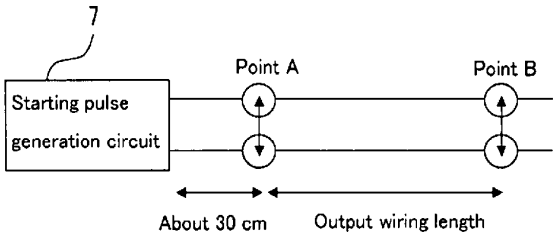


Fig. 2

Starting pulse voltage (Unit: kVp)

Output wiring length (m)	V (A)	V (B)
0	4.23	4.24
0.5	4.11	4.13
1	4.04	4.06
2	3.71	3.75
4	3.40	3.41
6	3.09	3.09
8	2.76	2.76
10	2.51	2.48

Fig. 3

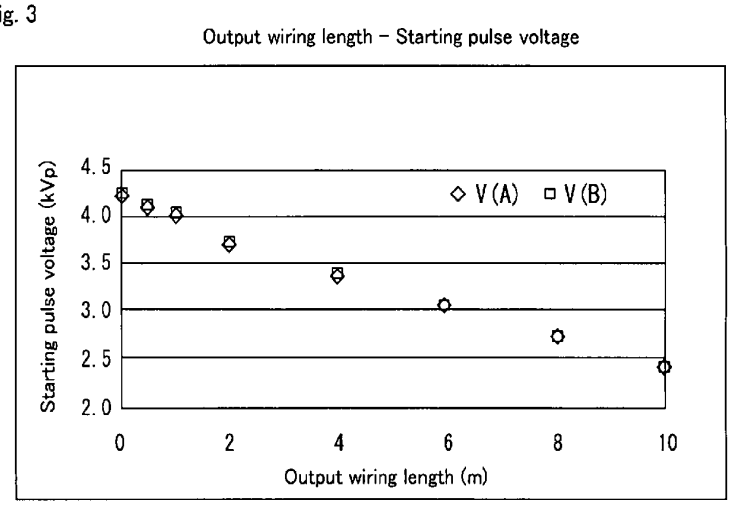


Fig. 4

Output wiring length (m)	FET voltage V(C) (Vp)	Starting pulse voltage V(A) (kVp)
0	302	4.404
0.5	304.8	4.384
1	294	4.208
2	286	4.028
3	262.8	3.688
6	226	3.184
9	189.6	2.72

Fig. 5

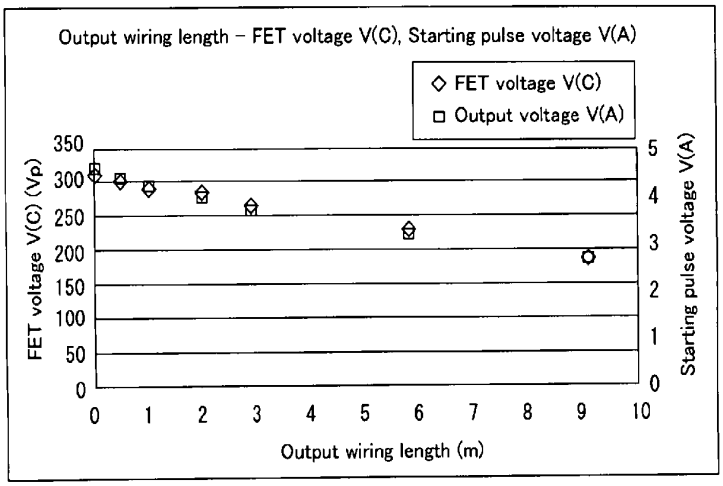
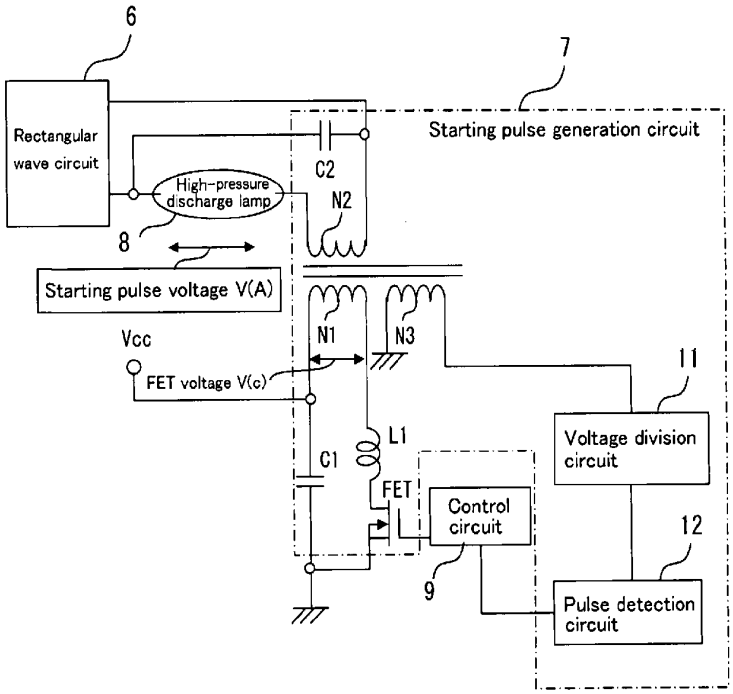

Output wiring length – FET voltage V(C), Starting pulse voltage V(A)
◇ FET voltage V(C)
□ Output voltage V(A)
FET voltage V(C) (Vp)
Starting pulse voltage V(A)
Output wiring length (m)
350
300
250
200
150
100
50
0
5
4
3
2
1
0
0 1 2 3 4 5 6 7 8 9 10

Fig. 6



C1, C2: Capacitors

FET: Field-effect transistor (an example of the switching element)

L1: Inductance

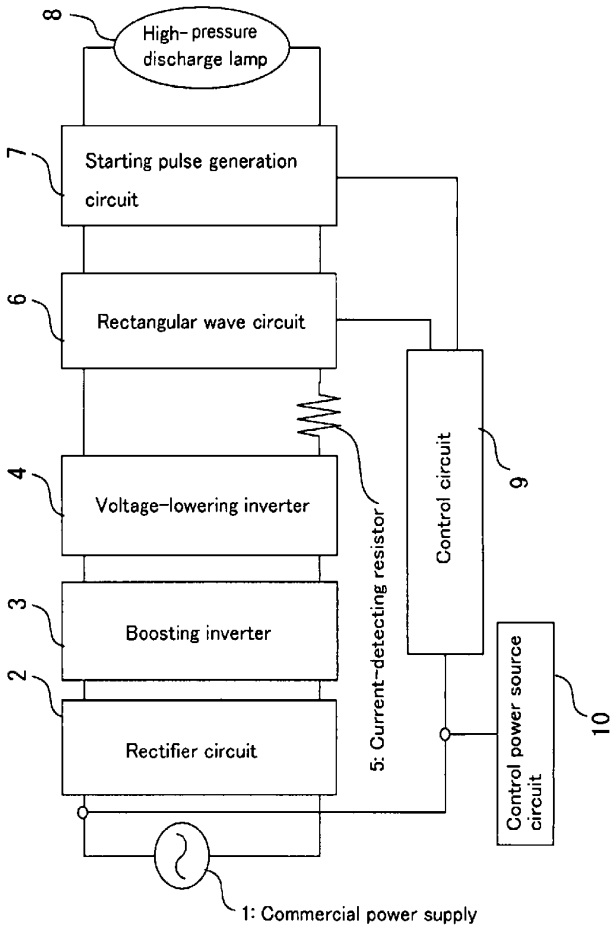
N1: Primary winding

N2: Secondary winding

N3: Feed-back voltage detection winding

T1: Transformer

Fig. 7


8
High-pressure discharge lamp
7
Starting pulse generation circuit
6
Rectangular wave circuit
4
Voltage-lowering inverter
3
Boosting inverter
2
Rectifier circuit
5: Current-detecting resistor
Control circuit
9
Control power source circuit
10
1: Commercial power supply

5

Fig. 8

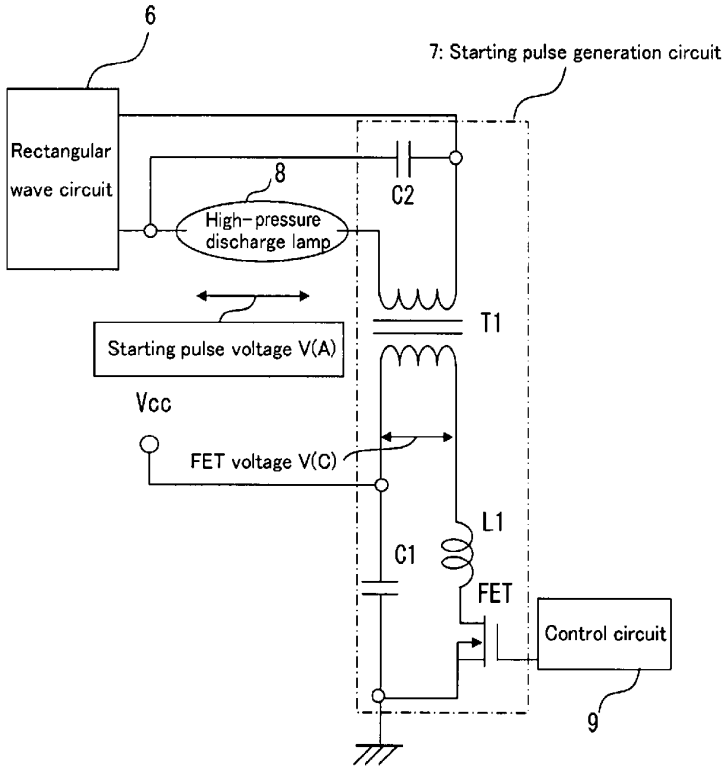
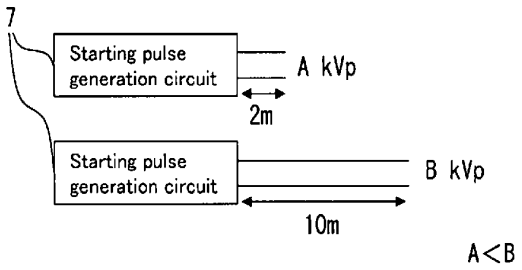

6
7: Starting pulse generation circuit
Rectangular wave circuit
8
High-pressure discharge lamp
C2
T1
Starting pulse voltage V(A)
Vcc
FET voltage V(C)
L1
C1
FET
Control circuit
9

Fig. 9


7
Starting pulse generation circuit
A kVp
2m
Starting pulse generation circuit
B kVp
10m
A<B

7