PATENT SPECIFICATION

Application Date: Aug. 18, 1939. No. 23869/39. **532,160**

Complete Specification Left: May 20, 1940.

Complete Specification Accepted: Jan. 17, 1941.

PROVISIONAL SPECIFICATION

Improvements in Circuits for Operating H.P.M.V. Lamps

We, THE GENERAL ELECTRIC COMPANY LIMITED, of Magnet House, Kingsway, London, W.C.2, a British company, and VICTOR JAMES FRANCIS, of British nationality, and KARL GUSTAV SCHNETZLER, of German nationality, both of Research Laboratories of The General Electric Company Limited, Wembley, Middlesex, do hereby declare the nature of this invention to be as follows:—

This invention relates to combinations of a HPMV device with circuit elements, having terminals adapted to be connected to alternating current mains of assigned RMS voltage V_M and frequency $p/2\pi$ and adapted, when the terminals are so connected, to cause an assigned wattage W to be dissipated in the HPMV device.

The terms V_T, and Δ bear the meanings assigned to them in Patent Specification No. 486,586.

In the said specification it is proposed that the said circuit elements should be a condenser in parallel with the HPMV device and a choke in series with the combination of the HPMV device and the condenser. The advantage accruing from this arrangement, explained in the said specification, is that Δ (which must always be positive) is greater than it could be for any arrangement in which the HPMV device, V_M, p, W, V_T are the same and the condenser is absent or that V_T is greater than it could be in any arrangement in which the HPMV device, V_M, p, W, Δ are the same and the condenser is absent. It was said that, if this advantage is to be obtained, LCp^2 (where L is the inductance of the choke and C the capacity of the condenser) must be very different from 1 and therefore that there must be no approach to resonance.

We have now found that the said advantage may also be obtained if the position of the choke and the condenser are interchanged, that is to say if the choke is in parallel with the HPMV device and the condenser in series with the combination of the HPMV device and the choke. Indeed it is possible in such an arrangement to make V_T/V_M greater than unity, Δ having a value suitable for regular operation in commercial conditions. In order that this result should be obtained, LCp^2 need not be very different from 1, so that there may be resonance.

We are aware that is has been proposed, for example in Patent Specification No. 357,492, to arrange a gas-filled discharge device, a condenser and a choke in this manner, there being resonance between the condenser and choke at the supply frequency. But no reference was made in the said specification (on which no patent was granted) to HPMV devices, and therefore no suggestion made that V_T/V_M might exceed unity with Δ positive.

According to the invention in its simplest aspect in a combination of the kind specified the said circuit elements comprise a choke of inductance L in parallel with the HPMV device and a condenser of capacity C in series with the said combination of HPMV device and choke, and the values of L and C are so adjusted relative to the nature of the HPMV device and to V_M, p, W, that both Δ is positive and V_T/V_M is substantially greater than unity.

In order to avoid surges it may be desirable to introduce subsidiary impedance elements Z as explained in the said specification No. 486,586. But of course the precise values of these impedances will have to be determined anew in accordance with modifications of the principle there set forth which will be clear to those skilled in the art.

According to a second aspect of the invention a combination according to the simplest aspect is modified by the introduction of such impedances Z.

The following particulars of one embodiment of the invention will suffice to indicate to those skilled in the art (once they are informed that the result is possible) how to adjust L and C so as to obtain the result characteristic of the invention with customary HPMV devices, V_M's and p's. The example has been chosen to show how large V_T/V_M may be; for this purpose a value of Δ on the limit of what is practicable has been selected. For commercial operation it would prob-

ably be necessary to readjust L and (or) C slightly so as to give a higher Δ and a lower V_T.

$V_M = 100$ volts.
$W = 400$ watts.
$L = 0.115$ henry.
$C = 114\ \mu F$.
Z (a choke in series with the HPMV device, this combination being in parallel with the main choke).
$= 0.014$ henry.
$V_T = 149$ volts.
$\Delta = 4$ volt.

Dated the 18th day of August, 1939.

NORMAN R. CAMPBELL,

For the Applicants.

COMPLETE SPECIFICATION

Improvements in Circuits for Operating H.P.M.V. Lamps

We, THE GENERAL ELECTRIC COMPANY LIMITED, of Magnet House, Kingsway, London, W.C.2, a British company, and VICTOR JAMES FRANCIS, of British nationality, and KARL GUSTAV SCHNETZLER, of German nationality, both of Research Laboratories of The General Electric Company Limited, Wembley, Middlesex, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to combinations of a HPMV device with circuit elements of the type having terminals adapted to be connected to alternating current mains of assigned RMS voltage V_M and frequency $p/2\pi$ and adapted, when the terminals are so connected, to cause an assigned wattage W to be dissipated in the HPMV device.

The terms V_T and Δ bear the meanings assigned to them in Patent Specification No. 486,586.

In the said specification it is proposed that the said circuit elements should be a condenser in parallel with the HPMV device and a choke in series with the combination of the HPMV device and the condenser. The advantage accruing from this arrangement, explained in the said specification, is that Δ (which must always be positive) is greater than it could be for any arrangement in which the HPMV device, V_M, p, W, V_T are the same and the condenser is absent or that V_T is greater than it could be in any arrangement in which the HPMV device, V_M, p, W, Δ are the same and the condenser is absent. It was said that, if this advantage is to be obtained, LCp^2 (where L is the inductance of the choke and C the capacity of the condenser) must be very different from 1 and therefore that there must be no approach to resonance.

We have now found that the said advantage may also be obtained if the position of the choke and the condenser are interchanged, that is to say if (as shown in the accompanying drawing) the choke L is in parallel with the HPMV device H and the condenser C in series with the supply S and the combination of the HPMV device and the choke. Indeed it is possible in such an arrangement to make V_T/V_M greater than unity, Δ having a value suitable for regular operation in commercial conditions. In order that this result should be obtained, LCp^2 need not be very different from 1, so that there may be resonance.

We are aware that it has been proposed, for example in Patent Specification No. 357,492 (on which no patent was granted and whose date of application, is before what are now known as HPMV devices were known), to arrange a gas-filled discharge device, a condenser and a choke in this manner, there being resonance between the condenser and choke at the supply frequency; and that the said specification contains the following passage:—"It is furthermore immaterial whether the alternating current arc burns in mercury or other metal vapour, in rare gas or other gases and mixtures, whether the tube is evacuated or not, whether it works at a pressure above atmospheric or in a vacuum."

It will be observed that, as might be expected, no distinction is made in the said specification between HPMV devices (which alone are characterised by a Δ) and other devices; and that no suggestion is made that V_T/V_M might exceed unity with Δ positive.

According to the invention in its simplest aspect in a combination of the type specified the said circuit elements comprise a choke of inductance L in parallel with the HPMV device and a condenser of capacity C in series with the supply and the said combination of

HPMV device and choke, and the values of L and C are so adjusted, relative to the nature of the HPMV device and to V_M, p, W, that both $\triangle$ is positive and V_T/V_M is substantially greater than unity.

In order that the lamp may run stably it is usually necessary to insert a small impedance Z (as shown in the said drawing) in series with the condenser C. In order to mitigate surges, as explained in the said specification No. 486,586, it may be desirable to make the impedance Z in series with the condenser larger than would be necessary merely in order to produce stable running. It is also permissible to introduce subsidiary impedance elements for this purpose in other positions, as explained in the said specification. The precise values of these subsidiary impedances, and the modifications that their presence renders necessary in the main impedances L and C, will have to be determined in accordance with modifications of the principle set forth in the said specification, which will be clear to those skilled in the art. The subsidiary impedances are preferably chokes or resistances or both.

According to a second aspect of the invention a combination according to the simplest aspect is modified by the introduction of subsidiary impedances as aforesaid.

The following particulars of two embodiments of the invention, described by way of example, will suffice to indicate to those skilled in the art (once they are informed that the result is possible) how to adjust L and C so as to obtain the result characteristic of the invention with customary HPMV devices. V_M's, and p's. In both examples $p=314$ sec^{-1}. The examples have been chosen to show how large V_T/V_M may be. In the first example LCp^2 is about 1.3 and there is a wide departure from resonance; then, in order that V_T/V_M shall be large, a value of $\triangle$ has to be chosen on the limit of what is practicable. For commercial operation it would probably be necessary in the example to readjust L and (or) C slightly so as to give a higher $\triangle$ and a lower V_T. In the second example LCp^2 is about 1.1 and there is a closer approach to resonance. $\triangle$ can then be larger. Z has also to be larger to secure stability and freedom from surges.

EXAMPLE 1.

$V_M=100$ volts.
W $=400$ watts.
L $=0.115$ henry.
C $=114$ μF.
Z (a choke in the position shown in the said drawing).
$=0.014$ henry.
$V_T=149$ volts.
$\triangle=4$ volt.

EXAMPLE 2.

$V_M=100$ volts.
W $=400$ watts.
L $=0.145$ henry.
C $=77$ μF.
Z (a choke in the position shown in the said drawing).
$=0.25$ henry.
$V_T=200$ volts.
$\triangle=26$ volts.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A combination of a HPMV device with circuit ~~elments~~ elements of the type specified wherein the said circuit elements comprise a choke of inductance L in parallel with the HPMV device and a condenser of capacity C in series with the supply and the said combination of HPMV device and choke, and the values of L and C are so adjusted, relative to the nature of the HPMV device and to V_M, p, W, that both $\triangle$ is positive and V_T/V_M is substantially greater than unity.

2. A combination according to Claim 1 comprising also one or more subsidiary impedance elements (preferably chokes or resistances or both) whose presence causes the HPMV device to run more stably and mitigates surges.

3. A combination according to Claim 2 wherein there is one said subsidiary impedance which is in the position Z shown in the accompanying drawing.

4. A combination of a HPMV device with circuit elements of the type specified substantially as hereinbefore described by way of example.

Dated the 20th day of May, 1940.

NORMAN R. CAMPBELL,
For the Applicants.

Reference has been directed in pursuance of Section 7, Sub-section (4) of the Patents and Designs Acts, 1907 to 1939, to Specification No. 357,492.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1941.

HPMV device and choke, and the values of L and C are so adjusted, relative to the nature of the HPMV device and to V_M, p, W, that both Δ is positive and V_T/V_M is substantially greater than unity.

In order that the lamp may run stably it is usually necessary to insert a small impedance Z (as shown in the said drawing) in series with the condenser C. In order to mitigate surges, as explained in the said specification No. 486,586, it may be desirable to make the impedance Z in series with the condenser larger than would be necessary merely in order to produce stable running. It is also permissible to introduce subsidiary impedance elements for this purpose in other positions, as explained in the said specification. The precise values of these subsidiary impedances, and the modifications that their presence renders necessary in the main impedances L and C, will have to be determined in accordance with modifications of the principle set forth in the said specification, which will be clear to those skilled in the art. The subsidiary impedances are preferably chokes or resistances or both.

According to a second aspect of the invention a combination according to the simplest aspect is modified by the introduction of subsidiary impedances as aforesaid.

The following particulars of two embodiments of the invention, described by way of example, will suffice to indicate to those skilled in the art (once they are informed that the result is possible) how to adjust L and C so as to obtain the result characteristic of the invention with customary HPMV devices, V_M's, and p's. In both examples $p = 314$ sec^{-1}. The examples have been chosen to show how large V_T/V_M may be. In the first example LCp^2 is about 1.3 and there is a wide departure from resonance; then, in order that V_T/V_M shall be large, a value of Δ has to be chosen on the limit of what is practicable. For commercial operation it would probably be necessary in the example to readjust L and (or) C slightly so as to give a higher Δ and a lower V_T. In the second example LCp^2 is about 1.1 and there is a closer approach to resonance. Δ can then be larger. Z has also to be larger to secure stability and freedom from surges.

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L = 0.115 henry.
C = 114 μF.
Z (a choke in the position shown in the said drawing).
= 0.014 henry.
$V_T = 149$ volts.
$\Delta = 4$ volt.

EXAMPLE 2.

$V_M = 100$ volts.
W = 400 watts.
L = 0.145 henry.
C = 77 μF.
Z (a choke in the position shown in the said drawing).
= 0.25 henry.
$V_T = 200$ volts.
$\Delta = 26$ volts.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A combination of a HPMV device with circuit ~~elements~~ elements of the type specified wherein the said circuit elements comprise a choke of inductance L in parallel with the HPMV device and a condenser of capacity C in series with the supply and the said combination of HPMV device and choke, and the values of L and C are so adjusted, relative to the nature of the HPMV device and to V_M, p, W, that both Δ is positive and V_T/V_M is substantially greater than unity.

2. A combination according to Claim 1 comprising also one or more subsidiary impedance elements (preferably chokes or resistances or both) whose presence causes the HPMV device to run more stably and mitigates surges.

3. A combination according to Claim 2 wherein there is one said subsidiary impedance which is in the position Z shown in the accompanying drawing.

4. A combination of a HPMV device with circuit elements of the type specified substantially as hereinbefore described by way of example.

Dated the 20th day of May, 1940.

NORMAN R. CAMPBELL,
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