Knocking treatment to cathode ray tubes.

Proprietor: SONY CORPORATION 7-35 Kitashinagawa 6-chome Shinagawa-ku Tokyo 141 (JP)

Inventor: Hata, Katsuhiko c/o Sony Corporation Patents Division 7-35 Kitashinagawa 6-chome Shinagawa-ku Tokyo (JP)
Inventor: Ohashi, Hisao c/o Sony Corporation Patents Division 7-35 Kitashinagawa 6-chome Shinagawa-ku Tokyo (JP)
Inventor: Honda, Keiji c/o Sony Corporation Patents Division 7-35 Kitashinagawa 6-chome Shinagawa-ku Tokyo (JP)
Inventor: Yamakami, Takahiko c/o Sony Corporation Patents Division 7-35 Kitashinagawa 6-chome Shinagawa-ku Tokyo (JP)

Representative: Cotter, Ivan John et al D. YOUNG & CO. 10 Staple Inn London WC1V 7RD (GB)

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European patent convention).

Description

This invention relates to methods of performing knocking treatment to cathode ray tubes. In the manufacture of cathode ray tubes, such as television picture tubes, metal electrodes which form an electron gun within a body of the cathode ray tube, after being assembled in the cathode ray tube, have projections such as flash or flashing which is produced during press forming. Uneven surfaces, and dust which adheres to the tube elements during various processes, cause unstable charges to be generated when the cathode ray tube is operating. So as to eliminate such disadvantages, it is known to condition or treat the tube elements by applying a high voltage between a high voltage electrode and a low voltage electrode so as to generate discharges, by formation of a strong electric field, so as to remove unstable structures such as dust and flashing. This operation is called "knocking". As illustrated in Figure 1 of the accompanying drawings, which shows a cathode ray tube 1, the knocking treatment is performed by applying a high voltage from a source 5 between an anode button 2 and a terminal pin 4 which is at a low potential. The anode button 2 is connected to high voltage electrodes within the cathode ray tube 1 and the terminal pin 4 is connected to low voltage elements mounted within a neck portion of the cathode ray tube 1, for example within an electron gun 3.

The electron gun 3 may be formed in various manners and may, for example, comprise a unipotential type electron gun, illustrated in Figure 2, which has a first grid G1, a second grid G2, a third grid which is a first anode G3, a fourth grid G4 and a fifth grid which is a second anode G5. Each of the grids may be a metal electrode of cup or cylindrical shape. The third grid G3 and the fifth grid G5 are high voltage electrodes and are electrically connected together and to the anode button 2. The other grids G1, G2 and G4 are electrically connected together and to the terminal pin 4, which extends from a stem of the neck portion of the tube 1.

So as to perform a knocking treatment as described with reference to Figure 1 to the electron gun 3 in such arrangements, the knocking voltage source 5 is connected to the button 2, which is connected to the third grid G3 and the fifth grid G5 of the electron gun 3, and to the low voltage electrodes G1, G2 and G4. The knocking voltage source 5 may supply either a d c voltage or a half-wave rectified a c voltage. Usually, the knocking treatment is performed by applying alternately a d c voltage and an a c voltage. However, the method of alternately applying an a c voltage and a d c voltage does not provide a sufficient knocking effect. When a d c voltage is used in the knocking treatment, a constant high voltage HV is supplied continuously between the high voltage electrodes and the low voltage electrodes as shown in the waveform illustrated in Figure 3, which is a graph of applied voltage V plotted against time T. Alternatively, the d c voltage may be applied repeatedly at regular intervals. In a knocking treatment using a half-wave rectified a c voltage, such as is illustrated in Figure 4, half-wave rectified pulses are applied between the high and low voltage electrodes, for example at a frequency of 60 Hz.

When a d c voltage is used for the knocking treatment, the discharge energy is high because the impedance is low and the effective voltage is high. However, discharges will be generated only at portions having a large amount of flash or portions where a large electrical field intensity exists, as, for example, between the third grid G3 and the fourth grid G4, or between the fourth grid G4 and the fifth grid G5, or between the second grid G2 and the third grid G3. Also, when using a d c voltage, the number of discharges is small: in other words, the so-called discharge inducing power is small and the overall conditioning of the tube is insufficient.

So as to obtain a sufficient conditioning effect using d c knocking treatment, the d c voltage may be increased or the time of applying the voltage may be lengthened. For these conditions, however, sputtering of metal materials from the electrode is produced, whereby secondary faults may occur due to adhesion of the sputtered metal to the inner walls of the neck portion of the cathode ray tube body, damage may occur to various elements mounted close to the electron gun 3 within the neck, and, also, short circuit faults may occur. For example, in cathode ray tubes of the Trinitron (registered trade mark) type, a convergence means is mounted in the rear portion of the electron gun 3. The convergence means is usually supplied with a high voltage from the anode button 2 with the voltage being divided by a bleeder resistor. The bleeder resistor is mounted within the narrow neck portion between the electron gun 3 and the inner wall of the tube. If sputtering is produced as described above, the impedance of the bleeder resistor may be decreased or the resistor may be destroyed.

On the other hand, if the knocking treatment uses a half-wave rectified a c voltage, the discharge energy is low because the impedance is high and the effective voltage is low. Since the impedance is high and the high frequency component is large, the discharge inducing power is high and discharges will be generated between the electrodes. However, since the discharge energy is low, a sufficient conditioning effect of the various electrodes does not occur.

Thus, even if d c knocking and a c knocking methods are performed alternately, sufficient conditioning does not result and the knocking treatment is not successful. Thus, when completed cathode ray tubes are assembled and operated in a television receiver, for example, unstable discharges may occur during the working state.

US Patents Nos: US—A—3 323 854 and US—A—4 052 776 describe cathode ray tube knocking treatments in which a superimposed
voltage comprising a d c voltage and an alternating voltage is applied between high and low voltage electrodes of the cathode ray tube. In the former document, the alternating voltage is provided by a peak random generator, and in the latter document, rf bursts are added to a fluctuating voltage.

According to the invention there is provided a method of performing a knocking treatment to a cathode ray tube having low and high voltage electrodes, the method comprising the step of applying a superimposed voltage comprising a high d c voltage and an alternating voltage at the low and high voltage electrodes with the positive potential of the superimposed voltage being connected to the high voltage electrodes, characterised in that the alternating voltage is a half-wave rectified voltage, the superimposed voltage is in the range of 50 to 70 kilovolts, and the ratio of the alternating voltage to the d c voltage is in the range of 4:1 to 0.5:1.

The voltage ratio of the a c component to the d c component of the superimposed voltage may preferably be selected to be in the range of 2:1 to 1:1.

A method embodying the invention and described hereinbelow enables a knocking treatment to be performed effectively at relatively low applied voltages.

The invention will now be further described, by way of illustrative and non-limiting example, with reference to the accompanying drawings, in which:

Figure 1 is a view illustrating a known method of manufacturing a cathode ray tube;
Figure 2 is a block diagram of an electron gun of a cathode ray tube;
Figure 3 is a graph illustrating an applied d c voltage that can be used in the method of Figure 1;
Figure 4 is a graph illustrating a half-wave rectified voltage that can be used in the method of Figure 1;
Figure 5 is a view illustrating an example of a method embodying the invention for manufacturing a cathode ray tube;
Figure 6 is a graph illustrating an applied d c voltage and a superimposed half-wave rectified a c voltage, with the a c voltage added to the d c voltage, as usable in the method of Figure 5;
Figure 7 is a graph illustrating a d c voltage and a superimposed half-wave rectified a c voltage, with the a c voltage subtracted from the d c voltage, as usable in the method of Figure 6; and
Figure 8 is a graph illustrating an applied superimposed d c voltage and a superimposed full wave a c voltage, as usable in the method of Figure 5.

Figure 5 illustrates an embodiment of the invention and those elements thereof designated by references common to Figure 1 comprise the same elements as illustrated in Figure 1. For example, the cathode ray tube 1 has an electron gun 3 which has grids G1, G2, G3, G4 and G5 as illustrated in Figure 2. A d c high voltage source 7 and an a c power source 8 are connected between the anode button 2, which is connected to the first and second anodes G3 and G5, and the terminal pin 4, which is connected to the low voltage electrodes G1, G2 and G4. The a c source 8 may, in one possible variant, produce half-wave rectified a c power. The voltage sources 7 and 8 are, for example, connected in series. The potential applied to the anode button 2 and therefore to the high voltage electrodes G3 and G5 is the high potential or positive polarity, the low potential of the combined voltage from the sources 7 and 8 being applied to the pin 4. The polarity of the a c voltage source 8 with respect to the d c source 7, and the order of the series connection between the sources 7 and 8, can be selected arbitrarily. The superimposed voltages from the sources 7 and 8 can be supplied to the cathode ray tube in different manners, for example as illustrated in Figure 6 or in Figure 7.

Thus, in Figure 6, the applied voltage is a d c voltage of a first level, indicated by the generally horizontal solid line, and the a c half-wave rectified voltage is indicated by positive peaks which are superimposed upon the d c voltage. It should however be appreciated that, although a half-wave rectified a c voltage is illustrated in Figure 6, a full wave a c voltage may instead be superimposed on the d c voltage, which would give the waveform illustrated in Figure 8. The waveform of Figure 6 is for a case in which the positive half cycles or positive-going peaks of the rectified a c voltage are applied to the d c voltage (i.e. the a c voltage is added to the d c voltage), whereas that of Figure 7 is for a case in which the negative half cycles or negative-going peaks of the a c voltage are superimposed on the d c voltage, i.e. the a c voltage is subtracted from the d c voltage.

The applied voltage comprising the superimposed a c and d c voltages is selected to be in the range of 50 to 70 kV, and the voltage ratio of the a c component to the d c component is selected to fall within the range of 4:1 to 0.5:1, more preferably within the range of 2:1 to 1:1.

Thus, according to the methods described above with reference to Figures 5 to 7, which apply a combination of a c and d c voltages between the button 2 and the terminal 4, sufficient discharge will be generated between the electrodes of the electron gun 3 and projections such as flash or dust so that the projections will effectively be removed, thereby conditioning the tube so that it will perform well. Also, conditioning at the inner wall of the neck of the tube 1 will be performed well, which cannot be accomplished in the known methods. Also, the conditioning can be performed well even on parts 6 mounted within the neck, for example a bleed resistor formed by an insulative substrate having a resistive layer coated thereon. Thus, according to the methods of Figures 5 and 8, when the knocking voltage is applied between the anode button 2 and the terminal pin 4, surface creepage appears to be produced at the inner wall of the neck of the tube 1 and on the surface of the
bleeder resistor so as to result in a conditioning effect.

In the above-described examples, the knocking voltage is produced by the superposition of a d.c. voltage and an a.c. voltage. In some cases, however, the knocking treatment using a superimposed knocking voltage, which will hereafter be referred to as the first type of knocking treatment, may be combined with a knocking treatment, hereinafter referred to as the second type of knocking treatment using only an a.c. voltage. Furthermore, the superimposed knocking voltage may be combined with a knocking treatment using a d.c. voltage, which will be referred to hereinafter as the third type of knocking treatment. For example, one method comprises the steps of the second type of knocking treatment for a first period—the third type of knocking treatment for a second period—the first type of knocking treatment for a third period—the third type of knocking treatment for a fourth period—and the second type of knocking treatment for a fifth period. That is, there are two second type knocking treatments, two third type knocking treatments and one first type knocking treatment, which are performed in each of five periods. The high voltage for the third type of knocking treatment is selected to be 50 kV.

A prior art method comprises the steps of the second type of knocking treatment for a first period—the third type of knocking treatment for a second period—the second type of knocking treatment for a third period—the third type of knocking treatment for a fourth period—and the second type of knocking treatment for a fifth period. That is, there are three second type knocking treatments and two third type knocking treatments which are performed in each of five periods. The total of the five periods is longer than that in the above-mentioned method embodying the invention, and, even if a sufficient d.c. voltage such as 55 kV is selected, the conditioning will be insufficient.

The invention is not limited to treatment or manufacture of a tube in which the electron gun is of the unipotential type, as illustrated in Figure 2, but can be applied also to tubes having electron guns of various other configurations, such as, for example, bipotential type guns comprising first to fourth grids G1 to G4.

The supply arrangement of the knocking voltage is not limited to embodiments where the d.c. component and the a.c. component are obtained from respective sources 7 and 8. Instead, use may be made of a single power source which provides voltages of any of the waveforms illustrated in Figures 6, 7, and 8.

In the above-described methods embodying the present invention, treatment is performed with a knocking voltage comprising superposed d.c. and a.c. voltages. With this arrangement, sufficiently high discharge can be generated between electrodes of the electron gun and conditioning will be performed very well on the electrodes. Since the conditioning is performed well, the d.c. voltage need not be increased by a large amount and sputtering of the electrode, as occurs with very high d.c. voltages as used in the prior art, will not be produced. Thus, faults caused by metal adhering to the inner wall of the neck portion of the cathode ray tube due to sputtering will not occur. Furthermore, damage of inside parts such as bleeder resistors and the generation of cracks in the neck portion of the tube will be avoided. The effective conditioning makes it possible to reduce the knocking time as a whole and to improve the rate of production of tubes. Since the conditioning can be performed on the inner wall of the neck portion of the cathode ray tube, the dark current will be increased and the ability to withstand higher voltages will be improved.

Claims

1. A method of performing a knocking treatment to a cathode ray tube (1) having low and high voltage electrodes, the method comprising the step of applying a superimposed voltage comprising a high d.c. voltage and an alternating voltage to the low and high voltage electrodes with the positive potential of the superimposed voltage being connected (2) to the high voltage electrodes, characterised in that the alternating voltage is a half-wave rectified voltage, the superimposed voltage is in the range of 50 to 70 kilovolts, and the ratio of the alternating voltage to the d.c. voltage is in the range of 4:1 to 5:1.

2. A method according to claim 1, wherein positive-going peaks of the alternating voltage are superimposed on the d.c. voltage.

3. A method according to claim 1, wherein negative-going peaks of the alternating voltage are superimposed on the d.c. voltage.

4. A method according to claim 1, claim 2 or claim 3, wherein the ratio of the alternating voltage to the d.c. voltage is in the range of 2:1 to 1:1.

5. A method according to any one of claims 1 to 4, including the step of applying an alternating voltage to the low and high voltage electrodes before the step of applying the superimposed voltage thereto.

6. A method according to any one of claims 1 to 4, including the first step of applying an alternating voltage and the second step of applying a d.c. voltage to the low and high voltage electrodes before the step of applying the superimposed voltage thereto.

Patentansprüche

1. Verfahren zur Hochspannungsfestigkeitsbehandlung einer Kathodenstrahlöhre (1) mit Niederspannungs- und Hochspannungselektroden, bei dem in einem Verfahrensschritt eine aus einer hohen Gleichspannung und einer alternierenden Spannung bestehende überlagerte Spannung an die Niederspannungs- und die Hochspannungselektroden angelegt wird, wobei das positive Potential der überlagerten Spannung mit den
Hochspannungselektroden (2) verbunden ist, dadurch gekennzeichnet, daß die alternierende Spannung eine halbwellig-gleichgerichtete Spannung ist, daß die überlagerte Spannung im Bereich von 50 bis 70 Kilovolt liegt und daß das Verhältnis der alternierenden Spannung zu der hohen Gleichspannung im Bereich von 4:1 bis 0,5:1 liegt.

2. Verfahren nach Anspruch 1, bei dem der Gleichspannung positive Spitzen der alternierenden Spannung überlagert werden.


4. Verfahren nach Anspruch 1, 2 oder 3, bei dem das Verhältnis der alternierenden Spannung zu der Gleichspannung im Bereich von 2:1 bis 1:1 liegt.

5. Verfahren nach einem der Ansprüche 1 bis 4 mit dem weiteren Verfahrensschritt, daß an die Niederspannungs- und die Hochspannungselektroden eine alternierende Spannung angelegt wird, bevor die überlagerte Spannung an sie angelegt wird.

6. Verfahren nach einem der Ansprüche 1 bis 4, bei dem in einem ersten Verfahrensschritt eine alternierende Spannung und in einem zweiten Verfahrensschritt eine Gleichspannung an die Niederspannungs- und die Hochspannungselektroden angelegt wird, bevor die überlagerte Spannung an sie angelegt wird.

Revenidications

1. Procédé d’application d’un traitement de brûlage à un tube à rayons cathodiques (1) possédant des électrodes de haute et de basse tension, le procédé comprenant l’opération consistant à appliquer une tension superposée constituée d’une tension continue élevée et d’une tension alternative aux électrodes de haute et de basse tension, le potentiel positif de la tension superposée étant appliqué (2) aux électrodes de haute tension, caractérisé en ce que la tension alternative est une tension redressée sur une alternance, la tension superposée est comprise dans l’intervalle de 50 à 70 kV, et le rapport de la tension alternative à la tension continue est compris dans l’intervalle de 4:1 à 0,5:1.

2. Procédé selon la revendication 1, où des crêtes positivement orientées de la tension alternative se superposent à la tension continue.

3. Procédé selon la revendication 1, où des crêtes négativement orientées de la tension alternative se superposent à la tension continue.

4. Procédé selon la revendication 1, 2 ou 3, où le rapport de la tension alternative à la tension continue est compris dans l’intervalle de 2:1 à 1:1.

5. Procédé selon l’une quelconque des revendications 1 à 4, comportant l’opération qui consiste à appliquer une tension alternative aux électrodes de basse et de haute tension avant l’opération d’application à celles-ci de la tension superposée.

6. Procédé selon l’une quelconque des revendications 1 à 4, comportant la première opération qui consiste à appliquer une tension alternative et la deuxième opération qui consiste à appliquer une tension continue aux électrodes de basse et de haute tension avant l’opération d’application à celles-ci de la tension superposée.