MEANS FOR BRIGHTENING PICTURE TUBES

Norman A. Ackerman, Chicago, Ill., assignor to Perma-Power Company, Chicago, Ill., a corporation of Illinois

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This invention relates to an improved means for brightening or reactivating picture tubes for television receivers and the like.

It has been observed that the brightness of a picture tube diminishes over a one or two year period of time, to the extent where replacement is desirable. It has been proposed to remedy this situation by applying a substantially higher voltage to the picture tube filament over a period of from one to thirty minutes. This process is known as "boiling out" the filament. This results in a substantial increase in brightness for a considerable short period of from two to three months after which the boiling out process is again necessary. I have found that by increasing the voltage on the picture tube filament to a much lesser extent, and by maintaining such increased voltage on the filament continuously, whenever the tube is used, that the brightness of the tube will be maintained for a much longer period of time than when the brightness is increased by the boiling out method.

Furthermore, this boiling out is a service operation which requires special equipment; hence, it is a rather costly solution to the problem as it requires from four to six service calls a year in order to maintain the tube at the desired brightness.

It is an object of this invention to provide means for increasing the brightness of a tube, or for reactivating the same, which avoids the aforesaid difficulties of the prior art boiling out method.

A further object is to provide such a device which is in the form of an attachment which, when incorporated into a television receiver, will prolong the life of the picture tube for as much as a year.

In connection with the application of the aforementioned principle to the commercial television receivers now on the market, applicant has found that it is not commercially practical to re-wire the receiver for the purpose of providing a separate power source for the picture tube filament.

The various tubes of the present day commercial television receiver are powered from a common source; a separate transformer is not provided for the picture tube. Therefore, in applying a higher voltage to the picture tube filament, it is not merely a question of substituting a different transformer for the picture tube filament; an additional transformer must be provided.

It is a further object of my invention to provide, in a commercial television receiver, a separate transformer for the picture tube filament, together with control means therefor which do not require a re-wiring of the receiver.

The foregoing object is obtained by connecting the separate power source to the two filament prongs of the picture tube base. Then a relay is provided which is connected into the chassis filament circuit in such a manner that the latter serves as a control circuit for the independent picture tube filament circuit. Thus, it is not necessary to run separate leads from the separate power source to the off-on switch of the television receiver.

A further object is to provide a device of this type, which can be referred to as a reactivator, in the form of a separate unit which can be readily interposed into a standard filament circuit by means of the detachable connection provided by the picture tube base and its socket.

A still further object is to provide an independent power source for the picture tube filament of a commercial television set which is insulated from the cathode circuit, whereby a short circuit between the filament and cathode due to a sagging filament or the like can be remedied.

A still further object is to provide a reactivator which can be mounted on the television receiver, in an accessible location, and which is provided with means for successively increasing the voltage applied to the picture tube filament, so that the operator may apply a greater voltage to the picture tube filament from time to time, as conditions require, without the necessity of calling a serviceman.

A further object is to provide a reactivator suitable for both series connected and parallel connected filament circuits.

Other objects, features and advantages will become apparent as the description proceeds.

With reference now to the drawings in which like reference numerals designate like parts:

Fig. 1 is a view showing a preferred embodiment of my invention in conjunction with a standard picture tube and a standard base therefor;

Fig. 2 is a circuit diagram of the parts shown in Fig. 1;

Fig. 3 is a further circuit diagram showing the relationship of the reactivator to a series connected filament circuit of a standard television receiver;

Fig. 4 is a circuit diagram similar to Fig. 3, but showing the reactivator in connection with a parallel connected filament circuit;

Fig. 5 is a circuit diagram illustrating a modified form of my invention;

Fig. 6 is a detailed sectional view showing the manner in which the tap switch is mounted in the transformer cover so that the same is readily accessible, and

Fig. 7 is a graph illustrating the nature and operation of my invention.

In Fig. 1, the reference numeral 10 designates a picture tube of the type which is used in commercial television receiving sets, the picture tube having a standard type of base 11. The usual commercial set is also provided with a socket 12 for the base 11, the socket being connected by a flexible cable 13 to a chassis 14.

The present invention provides a reactivator 15 which comprises three separate components: a socket 16 for the base 11, a base 17 for the socket 12 and a separate component referred to herein as unit 18. The latter includes a transformer 19 and a relay 20 as shown in Fig. 2, and these elements are enclosed by a cover 21 and a base 22. A cable 23 connects socket 16 with the unit 18; a cable 24 connects base 17 with the unit 18, and a cable 25 connects the socket 16 with the base 17. It is understood that the bases 11 and 17 are provided with the usual prongs 26 and the sockets 12 and 16 are provided with apertures 27, the prongs being received within the apertures and engaged by the resilient contacts which are not shown.

Another cable 28 extends from the unit 18 and is provided with a wall socket connector plug 29 so that the transformer 19 may be independently powered. Thus, the reactivator comprises, essentially, a separate unit 18 together with suitable means, such as the socket 16,
base 17 and connecting cables, for interposing the unit between the chassis filament circuit, and the picture tube filament circuit. Of course, if desired, the socket and base 16 and 17 may be combined into an integral unit, with the consequent elimination of cable 25; this also would permit forming the conductors 23 and 24 into a single cable. However, the present arrangement is preferred for the purpose of illustration 65. Fig. 3 is a circuit diagram in which the picture tube filament 30 is conventionally represented as having a filament 30, a cathode 31 and the usual grid elements 32. The filament 30 is suitably connected to filament prongs 33 and 34. These, in turn, are adapted for electrical connection with the conductors 35 and 36 which connect with the secondary 37 of the transformer 19. The conductors 35 and 36 comprise the cable 23. Conductor 36 is connected directly to the secondary winding 37, whereas conductor 35 is connected to a movable contact 38, the latter being designed to make contact with one of a plurality of taps 39 which are provided on the secondary.

The primary 40 is connected by suitable conductors to the cable 28 so that it may be independently energized from the usual house lighting circuit. Interposed in the primary circuit is a relay switch 41 which includes a secondary contact 42, and a movable contact 43 which is carried on a bimetallic strip 44. The heater is connected by conductors 46 and 47, which comprise the cable 24, to prongs 48 and 49 of the base 17. These prongs, in turn, are adapted to be connected to conductors 50 and 51, respectively, which form a part of the chassis filament circuit.

The remaining prongs 52 of base 11 are connected to the remaining prongs 53 of base 17 by three separate conductors which comprise the cable 25. The prongs 53 are connected into the chassis 14 by suitable conductors 54 which are contained in cable 15.

In Fig. 2, the various elements of the reactivator are boxed in and designated generally by the reference numeral 15; the elements outside of the box being standard elements found in any commercial television receiver.

Fig. 3 shows diagrammatically the relationship of the reactivator to a series connected chassis filament circuit.

In this diagram, the reference numeral 60 designates the filament of the various tubes of a receiver, other than the picture tube filament, which is designated by the reference numeral 30. These filaments 60 are connected in a series circuit with each other and with a wall socket connector plug 61 by means of suitable conductors 62. The usual off-on switch 64 is interposed between the filament circuit and the source of power represented by the plug 61.

The reactivator 15, which includes the heater 45, is connected into this circuit as shown diagrammatically, the heater 45 serving to avoid such a break in the series circuit 60, 62 as would necessitate a re-wiring of the set. Preferably, the heater 45 is made so that it has the same resistance as the filament 30, so as to avoid any change in the voltage applied to the filaments 60.

Fig. 3 also illustrates the manner in which the closing of the off-on switch 66 serves as a signal to energize the heater 45, whereby the reactivator 15 and the picture tube filament 30 are controlled by the single off-on switch 66.

Fig. 4 shows diagrammatically the relationship of the reactivator to a parallel connected chassis filament circuit. Here, the parallel circuit includes the conductors 65 and the secondary of a power transformer 66. The filaments 60 are connected in parallel with each other across the conductors 65. The reactivator 15, including the heater 45, is also interconnected across the conductors 65 so that it too is in parallel with the filaments 60. Thus, in this parallel circuit, a power transformer is interposed between the filament circuit and the source of power represented by the plug 61, the power transformer being designed to deliver a uniform voltage of 6.3 volts to all of the filaments. Since the heater 45 has the same resistance as the filament 30, an additional load is imposed upon the power transformer 66.

Fig. 5 shows a modified form of the invention which is adapted for use only with a parallel connected chassis filament circuit. In this embodiment of the invention, the reactivator 15 includes a transformer 19 having a primary 67 and a secondary 68. The primary is connected to the conductors 65, and thus forms a part of the filament circuit. The secondary 68 is connected to the picture tube filament 30, and may of course, include the tap switch 38-39, if desired, so as to provide for a series of successive voltage increments, just as shown in connection with Fig. 2. Thus, in this embodiment of the invention, the picture tube filament 30 is connected directly from the filament circuit, the increase in voltage being provided by a step-up transformer 19.

Thus, there is no relay in this embodiment of the invention, since the picture tube filament is not energized by an independent source of power.

The secondary embodiment of the invention represents perhaps the simplest and least costly embodiment, but since it is adapted for use only on a parallel filament circuit type of television receiver, it is not as acceptable from a commercial viewpoint as is the principal embodiment shown in Figs. 2-4, which is of universal application.

As indicated previously, television receivers are of two types, those having the parallel connected filament circuit, and those having a series connected circuit. The advantage of the latter is that the power transformer 66 can be eliminated; therefore, a substantial proportion of receivers now on the market are of the latter type. It is, of course, possible to adapt the Fig. 5 embodiment of the invention to a series connected filament circuit type of receiver by including in the filament circuit a suitable resistance network without departing from the scope of my invention.

The Fig. 5 embodiment, in appearance, and when the tap switch is included, will be identical to the arrangement shown in Fig. 1, including the three separate components, socket 16, the base 17, and the unit 18.

One feature of the present invention is the fact that the voltage on the picture tube filament may be successively increased over successive intervals to bring the tube back to its original brightness. These intervals may be as long as six months or a year, depending upon the extent to which the tube is used. This feature results from the provision of the taps 39 which are designed to provide a series of increments in the tube voltage, each increment representing about a 7% increase. As shown in Fig. 2, four such taps are provided, representing voltages of 6.3, 6.8, 7.25 and 7.8, thus providing three successive increments.

A related feature is the fact that a rotary type of tap switch is used, in which the rotary contact 38 is mounted on a stem 70 which projects through the cover 21 as shown in Figs. 1 and 5. The stem may be provided with a slot 73 for a screw driver. The cover 21 and base 22 are provided with foot portions 71 which are slotted as indicated by the reference numeral 72, or are otherwise apertured, so that the unit 18 may be secured to the receiver in an accessible location. For instance, it can be screwed to the inside wall of the cabinet, or mounted externally at the back. Thus, for example, at six month intervals, as the tube grows dim, the owner of the set needs to do is to rotate the stem another notch so as to apply an increased voltage to the picture tube filament. Once the reactivator is installed, the tube may be maintained at a satisfactory degree of brightness for a period of more than a year since the application of successive voltage increments does not require a service call.

Fig. 6 shows the manner in which the tap switch may be mounted on the cover. For instance, a type of tap
of this somewhat higher heat, there is believed to be some reformation of the molecular thorium layer, but not nearly so much as in the boiling out process. The over-all result of the method of this invention is a much more gradual falling off of tube brightness than that which obtains in the boiling out process, as illustrated in Fig. 7.

Furthermore, in the boiling out process, it has been found that tube failure occurs in a substantial portion of the tubes so treated, due to the greatly increased voltages involved, whereas no such tube failure has occurred in the practice of the present invention. Also, this boiling out process, increased brightness does not always occur, with the result that the boiling out must be repeated, whereas the method of the present invention is not characterized by such lack of certainty.

As indicated above, the taps of the transformer 19 provide for successive voltage increments of about 7% or 8% each. I have found that there can be substantial variation one way or the other; in any event the increase is of an entirely different order than the 100% voltage increase provided by the prior art boiling out process.

For instance, I have found that good results may be obtained with a voltage increase as low as 2½% and as high as 40%, the substantially 7% increase referred to herein being selected as representative of an increase which is large enough to produce satisfactory results, and which is small enough to permit the use of the same as one of several successive increments.

In some instances, however, when the tube is quite dim, the tap switch is initially moved to the 7.25 volt tap. Then, after a substantial period of use, if it again becomes dim, the next voltage increment is added. Similarly, it may be found desirable, at times, to move the tap switch directly from the 6.8 volt tap to the 7.8 volt tap, thus representing the second voltage increase applied to the filament. Thus, it will be seen that it is not necessary to limit the successively applied increments to a 7% voltage increase; under some circumstances a substantially 14% increment is desirable. However, I have found that when the reactuator is initially installed, it has never been found necessary to apply initially the highest obtainable voltage, namely, the 7.8 volt tap, to the filament, since equally satisfactory results have been obtained by the use of a lower voltage tap. Thus, the embodiments illustrated have been found to be useful in obtaining at least two successive voltage increments in any situation, and in the majority of situations it provides three voltage increments. Of course, it will be understood that additional voltage taps can be provided if desired so that four or five or more successive voltage increments may be obtained.

It is obvious that an electromagnet relay may be substituted for the thermal relay herein shown and described, the thermal relay being preferred from a cost standpoint.

Although only preferred embodiments of my invention have been shown and described herein, it is obvious that various modifications and changes may be made therein without departing from the spirit of the invention as pointed out in the appended claims.

I claim:

1. The combination of a television receiver, which includes a picture tube having an indirectly heated cathode and a heater filament therefor, a filament circuit including power supply means for applying a normal voltage to said heater filament, and reactuator means, including a transformer, interposed between said filament circuit and said heater filament for applying an increased voltage to said heater filament, said transformer providing a voltage of from 2½% to 40% greater than the voltage supplied by said filament circuit.

2. The combination claimed in claim 1 in which the primary of said transformer is energized by said filament circuit.
3. A reactivator for the picture tube of a television receiver having an indirectly heated cathode, a heater filament therefor, and a filament circuit for applying a normal voltage to said heater filament, said reactivator comprising a transformer having an output circuit designed to provide a voltage from two and one-half per cent to forty per cent greater than said normal voltage, and means for detachably connecting said output circuit to said heater filament.

4. A reactivator as claimed in claim 3 including a base, a cover cooperating therewith, said transformer being disposed within said base and cover, and having a plurality of taps, and a tap switch disposed within said base and cover and having a rotatable stem, said stem projecting through said cover so as to be accessible from the outside of said separate unit.

5. A reactivator for the picture tube of a television receiver having a filament circuit and cathode and grid circuits for said picture tube, said picture tube having an indirectly heated cathode and a heater filament therefor, said reactivator comprising a replaceable unit including a transformer having an output circuit designed to provide a voltage from two and one-half to forty per cent greater than the voltage normally provided by said filament circuit, means for detachably connecting said output circuit to the heater filament of said picture tube, conductor means extending from said replaceable unit, second connecting means for detachably connecting said conductor means to said filament circuit whereby the operation of said replaceable unit may be controlled by said filament circuit, and additional conductor means extending from said first to said second connecting means to accommodate said cathode and grid circuits.

6. In a television receiver, the combination of a power source, a plurality of tube filaments and a relay connected thereto, a relay switch actuated by said relay, a picture tube having an indirectly heated cathode and a heater filament therefor, and a transformer having a primary and secondary windings, the filament of said picture tube being energized from the secondary of said transformer, and said relay switch being connected in series circuit with the primary of said transformer whereby energization of said power source will cause the primary circuit of said transformer to be energized, thereby energizing the heater filament of said picture tube.

7. In a television receiver, the combination of a power source, a plurality of tube filaments and a heater connected thereto, a bimetallic switch actuated by said heater, a picture tube having an indirectly heated cathode and a heater filament therefor, and a transformer having a primary and secondary windings, the heater filament of said picture tube being energized from the secondary of said transformer, and said bimetallic switch being connected in series circuit with the primary of said transformer whereby energization of said power source will cause the primary circuit of said transformer to be energized, thereby energizing the heater filament of said picture tube.

8. A picture tube reactivator comprising a reactivator socket having first contact means for the filament prongs of a picture tube and having second contact means for the cathode and grid prongs of a picture tube, said picture tube having an indirectly heated cathode and a heater filament therefor, a reactivator base having filament circuit prongs and having cathode and grid circuit prongs, said base being adapted for cooperation with the usual picture tube socket so that the prongs of said reactivator base may be connected into the chassis circuits of a television receiver, a transformer having primary and secondary windings, a pair of conductors extending from said first contact means to said second contact means, a plug connector, conductor means extending between said plug connector and the primary winding of said transformer to form a primary circuit which may be energized from a house lighting circuit, independently of the usual power supply means of the television receiver, a relay including circuit closing means in said primary circuit, actuating means for said circuit closing means, and a control circuit including said actuating means and the said filament circuit prongs of said base whereby said actuating means may be energized by the filament circuit of said television receiver, and conductor means extending between said reactivator socket and said base and connecting said second contact means with the cathode and grid circuit prongs of said base whereby the cathode and grid of said picture tube may be energized by the cathode and grid circuits of the television receiver when said reactivator socket is applied to said picture tube, and when said base is connected with said usual picture tube socket of a television receiver.

9. A picture tube reactivator comprising a reactivator socket having first contact means for the filament prongs of a picture tube and having second contact means for the cathode and grid prongs of a picture tube, said tube having an indirectly heated cathode and a heater filament therefor, a base having filament circuit prongs and having cathode and grid circuit prongs, said base being adapted for cooperation with the usual picture tube socket so that the prongs of said base may be connected into the chassis circuits of a television receiver, a transformer having primary and secondary windings, a pair of conductors extending from said first contact means to said second contact means, whereby when said socket is applied to a picture tube, the secondary circuit of said transformer will include the heater filament of said picture tube, a plug connector, conductor means extending between said plug connector and the primary winding of said transformer to form a primary circuit which may be energized from a house lighting circuit, independently of the usual power supply means of the television receiver, a relay including circuit closing means in said primary circuit, actuating means for said circuit closing means, and a control circuit including said actuating means and the said filament circuit prongs of said base whereby said actuating means may be energized by the filament circuit of said television receiver, and conductor means extending between said reactivator socket and said base and connecting said second contact means with the cathode and grid circuit prongs of said base whereby the cathode and grid of said picture tube may be energized by the cathode and grid circuits of the television receiver when said reactivator socket is applied to said picture tube, and when said base is connected with said usual picture tube socket of a television receiver.

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