

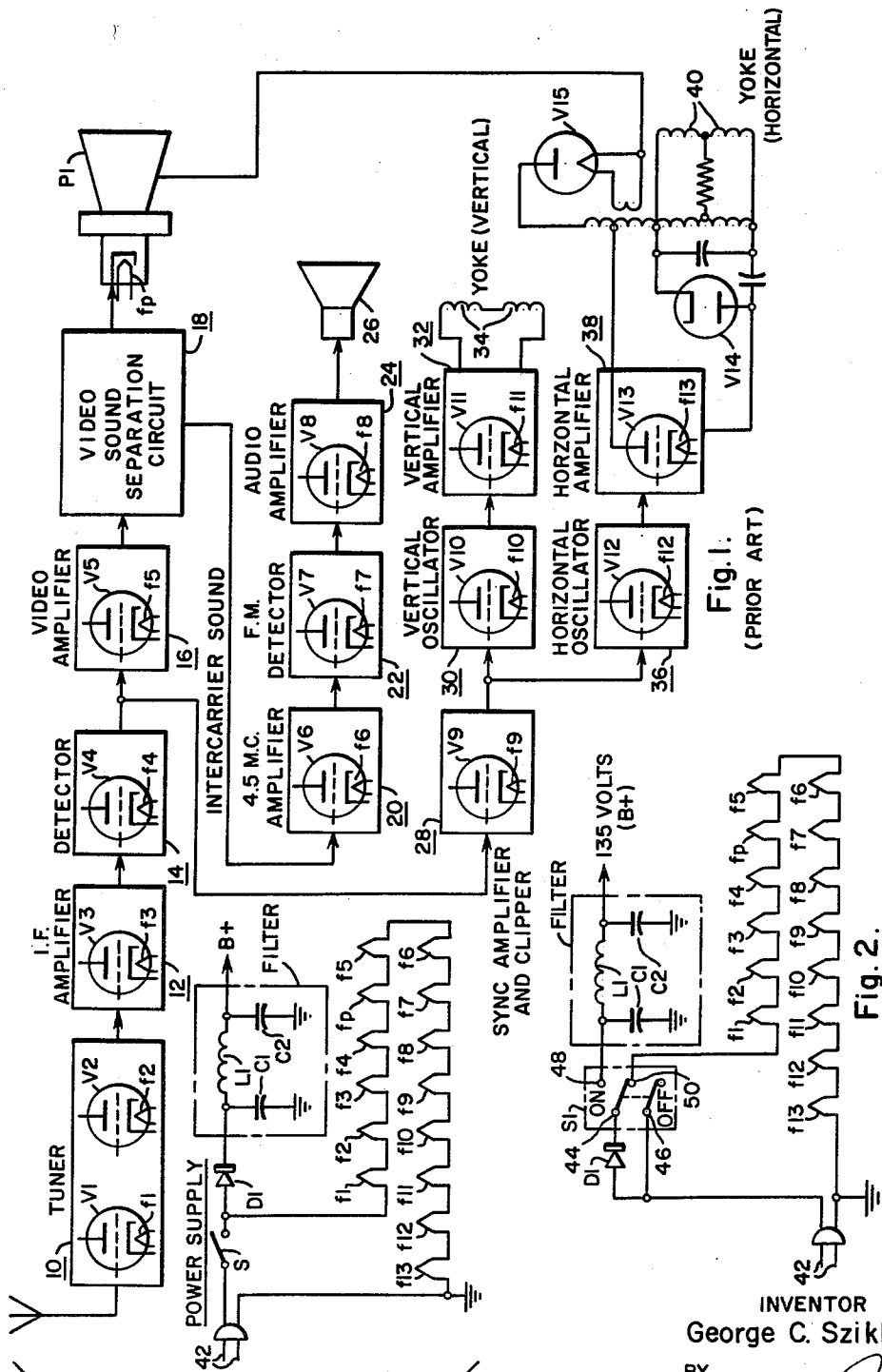
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TELEVISION RECEIVER POWER SUPPLY

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TELEVISION RECEIVER POWER SUPPLY

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4 Claims. (Cl. 328-270)

This invention relates to a television receiver power supply circuit and more particularly to a power supply circuit for a television receiver that applies low level power to the receiver tube heaters when the set is turned off.

It is well known that the initial current surges through the heaters of thermionic or hot cathode type tubes when applied at room temperature is detrimental to the life of the tubes. This is primarily due to the fact that most filaments or heaters are made of tungsten or similar metallic material which have positive temperature coefficients of resistance. Hence, when the initial surge of current through the heaters, at room temperature, is first applied, the initial current is very high since the resistance of the heaters is quite low. In addition, the actual sudden expansion caused by the sudden heating of the heaters to their normal operating temperature, causes crystallization and is detrimental to the life of the tubes. Every time a radio or television receiver is turned off or on this detrimental thermal expansion and contraction occurs so as to effectively shorten the life of the tube each time the set is turned on or off.

In order to lessen or alleviate the detrimental effect of turning a radio or television receiver on and off, means have been employed in the past to continuously operate the heaters at a reduced voltage in a stand by condition when the radio or TV circuit is off. In such circuits, when used with a television receiver, an additional advantage is that the picture from the cathode ray picture tube and the sound will appear only shortly after the set is turned on without the usual 45 to 60 seconds warm up time being necessary. When such circuits are used with an FM radio receiver, there will be considerably less initial frequency drift since the tubes will be warmed up and thus the temperature change will be small after the receiver is turned on. Thus the thermal expansion of the parts of the frequency determining circuits of the receiver, will be substantially minimized so as to minimize the initial frequency drift.

One such circuit known to provide a low power idle heater current for a radio receiver during the off position, employs a rectifier which is always in series with the filaments and the power line, when the B+ supply is removed from the plates. In this type of circuit, the filaments receive a pulsating D.C. during every other 180° of the input alternating current when the set is in the off position. When the set is turned on, the filter for the B+ or plate supply increases the filament current by supplying or feeding current to the filaments when the rectifier is not conducting. As a result in the on position the current through the filament is substantially increased to bring the filaments up to the proper operating temperature.

To convert a conventional power supply to the power supply described above, the components of the conventional power supply must be replaced in order to enable idling or low power on the filaments during the off position. More specifically since the rectifier is supplying current to the filaments during both the on and off condition, it will have approximately twice the current drain as the conventional power supply which is never in the filament circuit. Hence the rectifier in the above known power supply must have twice the current capacities of a

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conventional supply. In addition, the filaments in this heretofore known circuit, are placed in parallel with the filter and filter capacitor so as to substantially reduce, in the on position, the time constant and therefore the filtering efficiency of the filter circuit. Consequently, the value of the capacitors of a conventional filter must be increased to obtain adequate filtering of the hum in the plate voltage.

In the preferred embodiment of the present invention, a power supply is disclosed which will provide low power to the filaments in the off position while in the on position the filaments receive a higher level of current or full A.C. power to raise them up to their proper heating operating temperature while a relatively high D.C. potential is applied to plates of the tubes. These features are all realized by modifying a conventional television power supply without varying or changing the capacity or values of the existing filter capacitors, inductors or rectifiers. This is done by placing a switch in a conventional television or radio power supply that will selectively switch a rectifier in and out of the filament circuit when the set is turned off and on respectively. This results in applying the optimum one half power to the filaments when the set is off. If an additional rectifier is utilized to perform this function it can be a low quality low cost diode since the idler or "off" heater voltages are not critical. A rectifier already in the set can be utilized to perform this function without increasing its current capacity. The current drain of the filaments is usually 100-600 milliamps as is the current of the B+ supply. The rectifier of the present invention is alternately loaded by the filaments or the B+ supply and hence the existing rectifier need not have increased current carrying capacity to provide a low level power to the filaments when the receiver is turned off. In addition, the filaments are not placed across the power supply capacitor when the receiver is on and hence the time constant of the filter source is not affected so that the existing capacitor and inductor or capacitor resistor filter can be employed without modification thereof.

Accordingly, it is an object of the invention to provide an improved power supply for a radio or television receiver, which will effect a relatively low idle power to the filaments during the off position while increasing the power to the proper operating temperature of the filaments during the on position.

Another object of the invention is to provide a power supply for a radio or television receiver which can be constructed by utilizing all the existing elements of an already existing power supply to produce a power supply wherein the heaters of the tube are maintained in a reduced voltage standby condition when the set is turned off so as to minimize thermal expansion during turning on and turning off of the set, and in the on position the voltage across the filaments is substantially increased to bring the heaters or filaments up to their corresponding operating temperature.

A further object of the invention is to provide a power supply for a radio or television receiver which applies a reduced voltage to the filaments in the off position and can utilize all of the components of an already existing power supply of the television or radio receiver.

Other objects and advantages of the invention will become apparent by reading of the following specification and examination of the attached drawing, in which:

FIGURE 1 is a schematic diagram with parts in block form of a television receiver; and

FIG. 2 is a schematic circuit diagram of a power supply circuit embodying the invention to be used with the television receiver illustrated in FIG. 1.

The television receiver illustrated in FIGURE 1 is of

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a conventional type and for this reason will not be described in detail. Generally the receiver includes a tuner 10 having for example, a radio frequency amplifier utilizing a tube V1 having a heater f1 which receives both the sound and picture radio frequency carriers from the antenna and amplifies them. It will be understood that the tubes illustrated in the drawing may comprise one or more tubes but are shown as one tube for purposes of illustration only. The radio frequency amplifier amplifies sound and picture signals and applies them to a mixer utilizing a tube V2 having a heater f2. The oscillator mixer utilizing tube V2, heterodynes the signal from the radio frequency amplifier so that the output thereof includes a picture intermediate frequency carrier and a sound intermediate frequency carrier. In accordance with present day standards these carriers are separated by 4.5 megacycles. The picture and sound intermediate frequencies are applied to a common intermediate frequency amplifier 12 having a tube V3 with a filament or heater f3. It will be understood that generally there is more than one intermediate frequency amplifier. However, for illustrative purposes only one amplifier is shown. After the picture and sound intermediate frequency carriers are amplified by the amplifier 12, they are applied to a second detector 14 to produce a demodulated wave which contains the amplitude modulation of the video wave. In addition, the picture and sound intermediate frequency waves are heterodyned to provide an inter-carrier sound wave. The video and audio waves are then applied to a video sound separation circuit 18 which separates the video and the inter-carrier sound signal. The separated video signals are applied to the cathode or grid of an image producing cathode ray picture tube P1 having a heater f_p.

The inter-carrier sound signal is applied to a 4.5 megacycle amplifier 20 which utilizes a vacuum tube V5, having a heater f6, to amplify the inter-carrier sound wave. The output of the 4.5 megacycle amplifier 20, is applied to a frequency modulation detector 22 utilizing a vacuum tube V7 having a heater f7. The output of the detector 22, an audio signal, is amplified by an audio amplifier 24 which utilizes a vacuum tube V8 having a heater f8. The output of the audio amplifier 24 is applied to a sound reproducing means such as a speaker 26.

The video signal from the detector 14 is fed to the SYNC amplifier and clipper 28 utilizing a vacuum tube V9 having a heater f9 to amplify the video signal and to separate the synchronizing pulses, by limiting action or clipping action of the video signal. The horizontal synchronizing pulses are rather short horizontal pulses having a repetition rate of approximately 15 kilocycles per second. In addition, longer vertical synchronizing pulses are produced having a repetition rate of 60 cycles per second.

The vertical SYNC pulses are applied to the vertical oscillator 30. The oscillator 30 is actuated by these vertical SYNC pulses to produce a sawtooth waveform and includes a vacuum tube V10 having heater filaments f10. The sawtooth waveforms are further amplified by the vertical amplifier 32 having a vacuum tube V11 with heater f11. The amplified sawtooth waveform is applied to vertical yoke coils 34 to provide the vertical deflection on the cathode ray tube.

The output of the SYNC amplifier clipper 28 is also applied to the horizontal oscillator 36 which includes a vacuum tube V12 having heater filaments f12. This oscillator is triggered by the horizontal SYNC pulses to produce a sawtooth voltage waveform during the time between each SYNC pulse which have a repetition rate of 15.75 kc. per second. This sawtooth waveform is further amplified by the horizontal amplifier 38 having a vacuum tube V13 with a heater f13. A portion of this sawtooth waveform is developed across the horizontal deflection coils 40 to provide the horizontal deflection for the cathode ray tube P1. A flyback or damper

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tube V14 is employed to permit class C operation of vacuum tube V13 and improve the deflection efficiency, as described in my U.S. Patent No. 2,428,606. A portion of this sawtooth current waveform is applied to the yoke coils 40 to sweep the cathode ray beam in a horizontal direction. Another portion of this wave increased by use of the transformer windings is providing a large positive pulse rectified by the diode V15 and applied to the accelerator electrode of the cathode ray picture tube P1 thus providing the high voltage for the picture tube.

The television receiver described in FIGURE 1 is a conventional television receiver and forms no part of the present invention. As shown in FIGURE 1 a conventional television receiver power supply has a 117 volt 60 cycle input which is supplied to terminals 42 for receiving this alternating current. In series with these terminals is an on-off switch S. When switch S is closed the filaments f1 through f13 are connected across the line terminals 42. In addition when S is closed or "on" the B+ supply is connected across the line terminals 42 to provide the plate supply for tubes V1-V13. The B+ supply includes a rectifier D1 and a filter including capacitors C1 and C2 and inductor L1. Hence in this conventional transformerless power supply the heaters of the vacuum tubes are connected directly across the A.C. line to provide maximum heater current or power for the filaments in the on position when the switch S is closed. In addition, when the switch S is closed the rectified current passing through rectifier D1 will be filtered by the filter to provide a plate supply for the vacuum tubes. Hence, it will be understood that such a power supply provides no heat to the filaments in the off position and consequently the set must be given 45 to 60 seconds before receiving a picture or any sound and in addition the turning on and turning off of the receiver will result in the detrimental effects to the filaments as discussed above.

A television receiver power supply providing both the filament and plate power which embodies the invention is illustrated in FIGURE 2. This power supply will provide the proper low level power to the heaters when the set is tuored off. This is done without modifying the current carrying capacity or the size of the conventional power supply illustrated in FIGURE 1. As shown in FIGURE 2, the embodiment of the invention includes the power line terminals 42, a diode D1, the filter including the filter capacitors C1 and C2 and an inductor L1. In addition, the heater filaments f1 through f13 of the television receiver are connected in series with one end grounded and the other end connected to contact 50 of a switch S1. Switch S1 is illustrated in FIGURE 2 with the solid lines illustrating the switch in the off position and the dotted lines illustrating the switch in the on position. The switch contains contacts 44, 46, 48 and 50. Contact 44 is connected to the cathode side of diode D1 whereas contact 46 is connected directly to the upper power line terminal 42. Another terminal 48 is connected to the upper terminal of filter capacitor C1 and the fourth terminal 50 is connected to the first lead of the filter heater f1 of tube V1. When the switch S1 is in the on position as illustrated in dotted lines in the drawing, terminal 44 will be connected to contact 48 and terminal 46 will be connected to contact 50. In this position, alternating current will be supplied directly to the heater filaments. Current will also be fed to the filter through diode D1 to provide B+ in the same manner as the conventional power supply shown in FIGURE 1. In the embodiment of the invention illustrated in FIGURE 2, when the switch S1 is in the off position the diode D1 will be disconnected from the filter, and will be inserted in the circuit including the heaters f1 through f13 of tubes V1 through V13. This is caused by the switch S1 connecting terminals 44 and contact 50 and disconnecting the terminals 44 and contact 48 and disconnecting terminal 46 and contact 50. In this position, diode D1 is placed in series with the heaters and the power supplied to the heat-

ers *f1* through *f13* will be approximately half of the power supplied thereto when the receiver is turned on. It has been found that the optimum heating current for reduced power idling is approximately one half the rated heater voltage of the tubes to prevent interface during the normal life of the tube and provide optimum turn on time. Consequently, by inserting the diode *D1* into the filament circuit with the power line terminals 42 and the filaments *f1* through *f13*, the power supplied thereto is approximately the optimum or desirable power to be supplied to the tubes to prevent interface in the tubes and provide an extended lifetime for the tubes by keeping the tubes or the filaments warm sufficiently.

It can be seen from analyzing the circuit diagram of FIGURE 2, that during the on position the diode *D1* only draws current into the filter and *B+* supply. In the off position the diode only draws current through the filaments *f1* through *f13*. The current drawn by the filaments at the reduced effective voltage is approximately equal or lower than the current drawn by such a *B+* supply illustrated in FIGURE 2. Consequently the embodiment of the invention illustrated in FIGURE 2 requires only a current carrying capacity of the diode *D1* which is no greater than the current carrying capacity of the diode *D1* in a conventional power supply illustrated in FIGURE 1. Further the value of the filter capacitor, to obtain optimum filtering, would be the same in the power supply in FIG. 2 as in FIG. 1. Thus the idling power supply of FIG. 2 can be constructed without changing any components in the conventional power supply of FIG. 1 but merely by including a switch *S1* as shown in FIG. 2.

It will be understood that a similar power supply, shown in FIG. 2, can be utilized with an AM or FM radio receiver to minimize the turn on time of the receiver and extend the life of the tubes. The main difference in such a supply would be that fewer tube filaments would be in the filament circuit with the sum of the heater voltages being approximately 117 volts.

Although this invention has been described in connection with a specific embodiment it will be apparent to those skilled in the art that changes and arrangements in parts can be made to suit the requirement without departing from the spirit and scope of the invention.

I claim as my invention:

1. A power supply for an electronic tube system having a plurality of tubes with heaters, cathodes, and anodes, said heaters being connected to form a heater circuit; a pair of power line terminals adapted to be connected to a source of alternating current, a rectifier, and an on-off switch connected to said heater circuit for com-

pleting a bidirectional current path including said terminals and said heater circuit when in the on position and for inserting said rectifier in series with said heater circuit to complete a unidirectional current path therethrough when in the off position.

2. A power supply for a television receiver having a cathode ray picture tube having a heater, a pair of power line terminals adapted to be connected to a source of alternating current, a rectifier, and an on-off switch connected to said heater and being operative to insert said rectifier in series with said heater to provide a unidirectional current thereto when said switch is in its off position and to switch out said rectifier from in series with said heater to provide a bidirectional current thereto when said switch is placed in its on position.

3. A power supply for a television receiver having a plurality of vacuum tubes with heaters, cathodes and anodes, a pair of power line terminals adapted to be connected to a source of alternating current, means connecting said heaters to said power line terminals to provide a bidirectional current path through said heaters when the receiver is turned on, a rectifier, a direct current plate voltage supply connected to the anodes of said tubes connected to said rectifier and forming a unidirectional current path through said power line terminals when the receiver is turned on, and switch means to selectively open said unidirectional current path and insert said rectifier in series with said heater circuit and said power line terminals.

4. A power supply for a television receiver having a plurality of vacuum tubes with heaters, cathodes and anodes comprising a pair of power line terminals adapted to be connected to a source of alternating current, means connecting said heaters to said power line terminals to provide a bidirectional current path therethrough when the receiver is on, a direct current plate voltage supply connected to the anodes of said tubes when the receiver is on, a rectifier and switch means to simultaneously remove the plate voltage from the anodes of said tubes and insert said rectifier in series with said heaters and said power line terminals to provide low level power to said heaters.

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