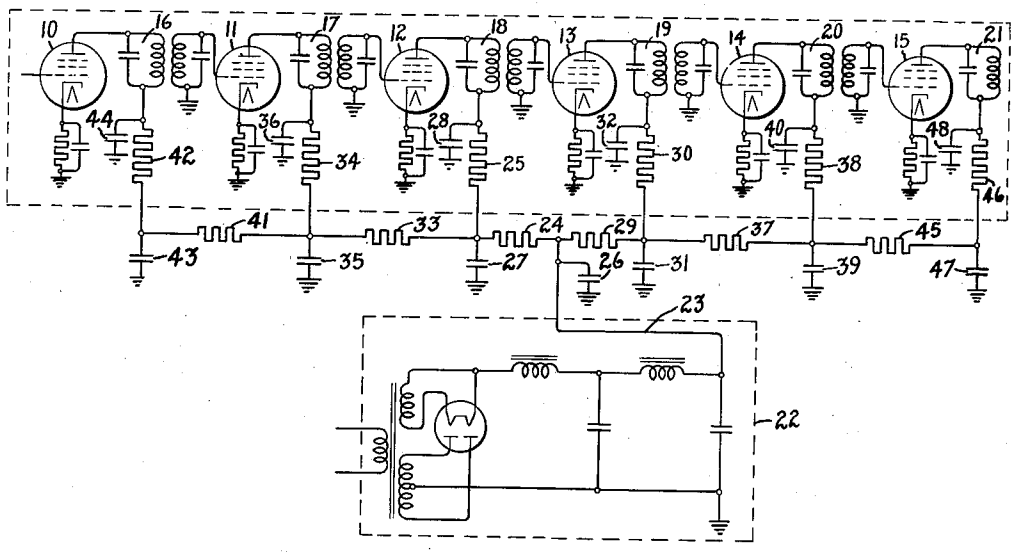
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AMPLIFIER POWER SUPPLY

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AMPLIFIER POWER SUPPLY

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This invention relates to amplifiers and more particularly to high gain multi-stage amplifiers having a common source of operating power.

In providing multi-stage amplifiers with operating power from a common source it is necessary to provide signal current filters between the source and each amplifier stage to prevent intercoupling between the stages which might result in undesirable effects, such as oscillation and distortion. It is an object of my invention to provide a simpler and cheaper filter system between a multi-stage amplifier and a common source of operating power therefor, which filter at the same time minimizes intercoupling between stages of the amplifier.

It is a further object of my invention to provide filters connected between a multi-stage amplifier and a common source of power therefor, such that the filtering action between the first and last stage of such an amplifier is substantially as effective as between adjacent stages, no matter how many stages the amplifier may contain.

The features of my invention which I believe to be novel are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof may best be understood by reference to the following description taken in connection with the accompanying drawing in which the single figure of the drawing represents a preferred embodiment of my invention.

In the figure a six-stage amplifier is illustrated, which has respectively six electron discharge devices 10, 11, 12, 13, 14 and 15, one in each stage. These stages are suitably coupled, as illustrated, by inductively coupled circuits provided between the output of each of these devices and the input of the succeeding device. Tuned output circuits for the devices 10 through 15 are respectively circuits 16, 17, 18, 19, 20 and 21.

A common source 22 of operating power is provided for the multi-stage amplifier comprising devices 10 through 15 inclusive. This power source is illustrated as of a conventional type of power supply and need not be described in detail. It is energized from a source of alternating current mains power, and produces a continuous potential between ground and a conductor 23.

The electron discharge devices 10 through 15 are supplied respectively with operating power from the source 22 through their tuned outputs 16 through 21. A power circuit for the device 12 extends from the source 22 through the connection 23, resistors 24 and 25, tuned output circuit 18, device 12 to ground and thus back to the source 22. A by-pass condenser 26 is connected between the conductor 23 and the resistor 24 to ground, and a second by-pass condenser 27 is connected from a point between resistors 24 and 25 to ground. A third by-pass condenser 28 is connected from a point between resistor 25 and tuned output circuit 18 to ground. The resistors 24, 25 and the condensers 26, 27 and 28 constitute two cascade-connected filters between the source 22 and the output circuit 18.

A similar circuit supplies power for device 13 and extends from conductor 23 through a resistor 29, resistor 30, tuned output circuit 19, device 13, ground, and thus back to the source 22. A by-pass condenser 31 is connected from a point between resistors 29 and 30 to ground and a second by-pass condenser 32 is connected from a point between the resistor 30 and the output circuit 19 to ground. The resistors 29 and 30 with their associated condensers 26, 31 and 32 therefore form two cascaded filters between the source 22 and the output circuit 19.

A power circuit for the device 11 extends from the source 22 through conductors 23, resistors 24, 33 and 34, circuit 17, device 11 to ground, and thus back to the source 22. A by-pass condenser 35 is connected from a point between resistors 33 and 34 to ground. A second by-pass condenser 36 is connected from a point between resistor 34 and output circuit 17 to ground.

A similar power circuit for the device 14 extends from the source 22 through the conductor 23, resistors 29, 37 and 38, output circuit 20, device 14 to ground, and back to the source 22. A by-pass condenser 39 is connected from a point between resistors 37 and 38 to ground and a second condenser 40 is connected from a point between resistance 38 and output circuit 20 to ground. Therefore between each of the devices 11 and 14 there are three cascaded filters between the source 22 and the output circuit associated with the respective discharge device.

The various filters are illustrated as being connected in cascade rather than as being individually connected from the output circuit for each discharge device to the source 22, as is the usual case. Such cascade connection provides that much higher attenuation exists for signal current passing between two remote discharge devices through the power supply circuit than for signal current passing between two adjacent devices in which the signal levels are more nearly equal. For example the signal level is nearly equal in the devices 13 and 14, which have three filters connected in cascade therebetween in their power supply circuit. On the other hand, the signal levels in the devices 11 and 14 are widely different. The level in the device 14 is much higher than the signal level in the device 11. There are six cascaded filters in the power circuit between these two remote devices, and these six filter sections provide a high degree of at-

tenuation for signal current passing through the power circuit between devices 11 and 14.

A power circuit for the device 10 extends from the source 22 through the conductor 23, through resistors 24, 33, 41 and 42, to the output circuit 16, and thence through the device 10 to ground and back to the source 22. A by-pass condenser 43 is connected from a point between the resistors 41 and 42 to ground, and a second by-pass condenser 44 is connected from a point between resistor 42 and output circuit 16 to ground.

A power circuit for the device 15 passes from the source 22 through the conductor 23 and through resistors 29 and 37, through a pair of resistors 45 and 46 in series, through the output circuit 21 and through the device 15 to ground and back to the source 22. A condenser 47 is connected from a point between resistors 45 and 46 to ground and a second condenser 48 is connected from a point between resistor 46 and output circuit 21 to ground. The devices 10 and 15 therefore each have four filter sections between their corresponding output circuits and the source 22 with correspondingly high attenuation of signal currents.

Care must be exercised in connecting power supply circuits of this nature that the source 22 be connected to approximately the central point of the cascaded resistors 42, 41, 33, 24, 29, 37, 45 and 46, which are connected serially from the first discharge device 10 to the last discharge device 15.

In case the multi-stage amplifier includes an even number of discharge devices, as illustrated, it is preferred to provide, as shown, a pair of resistors between the central pair of discharge devices and to connect the source of power between these two resistors. In the circuit illustrated, two such resistors 24 and 29 have been provided, between which the conductor 23 from the source 22 is connected. If the multi-stage amplifier should have an odd number of discharge devices, the source of power may be connected to a point of the cascaded filters nearest to the central discharge device in the amplifier.

When the source 22 is centrally connected to the cascaded power supply filters, along which the discharge devices are connected, any coupling which may exist between the output of discharge devices transmitting relatively powerful signals and the input of devices carrying weak signals produces substantially no undesirable reaction. If the source 22 were connected to one end of the cascade-connected power supply filters nearest the discharge device 15, the high level signal at the device 15 would be radiated from circuits of the source 22 in spite of attenuation in filters between the source 22 and the output circuit 21. This radiation from the relatively large surfaces of the source 22 is proportionately strong in relation to signal current in signal circuits associated with the device 10, which would therefore pick up the radiation and tend to produce oscillation or distortion through the amplifier.

If, on the other hand, the source 22 were connected to that end of the cascaded power supply filters near the device 10, the large surfaces of the source 22 would pick up radiation of high level signals in the circuits associated with the device 15. This radiation, picked up by the large surfaces of the source 22, would be transmitted through filters between the source 22 and the output circuit 16 in sufficient strength to affect the relatively weak signals passing through the device 10 and produce distortion or even oscillation. By providing for connection of the source 22 near the center of the cascade-connected power supply filters, the effect of such radiation is minimized and simpler and cheaper filters may be used.

While I have shown a particular embodiment of my invention, it will, of course, be understood that I do not wish to be limited thereto, since different modifications may be made both in the circuit arrangement and instrumentalities employed, and I aim by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A multi-stage amplifier having at least three cascade-connected electron discharge devices and a common source of power therefor, a power supply filter connected between each pair of adjacent discharge devices, said filters being connected in cascade with each other, and a connection from said source of power to an intermediate point along said cascade-connected filters to supply power to said devices.

2. An amplifier having more than two cascade-connected electron discharge devices, a plurality of corresponding cascade-connected power supply filters and a common source of power for said devices connected to an intermediate point on said filters, and means connected between each pair of adjacent cascade-connected filters to supply power to the respective cascade-connected electron discharge device.

3. In combination with at least three cascaded signal amplifying stages, a power supply filter connected between each pair of adjacent stages to provide signal attenuation therethrough between said stages, said filters being connected in cascade with each other to provide progressively greater signal attenuation through said filters between remote signal amplifying stages, a source of operating power for said stages, and means connecting said source to the central point of said cascaded filters to produce a minimum of signal coupling between said stages.

4. An amplifier having more than two cascade-connected electron discharge devices, a plurality of cascade-connected filters and a common source of operating potential for said devices connected to an intermediate point on said filters, and means connected between each pair of adjacent cascade-connected filters to supply operating potential to the respective cascade-connected electron discharge device.

5. An amplifier having at least three cascade-connected electron discharge devices, a circuit associated with each of said devices requiring operating potential, a plurality of cascade-connected resistances, one of said resistances being connected between each pair of adjacent circuits, a by-passing condenser connected from the junction of each pair of adjacent resistances to ground, said resistances and condensers forming cascaded filters, and a source of operating potential for said devices having one terminal connected to ground and another terminal connected to an intermediate point of the resistances in said cascaded filters.

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