Snivets

The term "snivet" is used to describe a visible phenomenon in the raster of television receivers caused by rf radiation from the horizontal-output-deflection circuit. The phenomenon usually appears as one or more dark vertical bands near the right edge of the raster. These bands vary in width and number depending on the operating conditions of the horizontal-output circuit and the design of the horizontal-output tube. Snivets can occur on any vhf or uhf channel. The severity of the interference varies inversely with signal strength as a result of the reduction of receiver gain by the automatic-gain-control system. It is possible, however, for snivets to appear even in the presence of strong local signals.

This Note describes an inexpensive and effective method of snivet suppression based on the use of a separate external grid-No. 3 (beam-plate) connection in RCA beam power tubes designed for this purpose.

Theories About Snivets

Early theories regarding the cause of snivets recognized that the interfering rf radiation was caused in part by discontinuities around the "knee" region of the plate-characteristic curves of the beam power pentode used as the horizontal-output tube. However, the exact mechanism was not clearly understood, and efforts to control or measure the radiation met with only random success.

It was also recognized that a second component of radiation was caused by Barkausen oscillations occurring between the screen grid (grid No. 2) and the plate at plate-voltage values below the "knee" of the plate-current curve. These oscillations are most severe when the plate is negative with respect to the screen grid, and occur when the decelerating field of the negative plate returns electrons back to the screen grid. Accelerated by the positive potential of the screen grid, some of these electrons pass through the screen grid and are then decelerated by the negative cathode. The oscillation of "bunches" of electrons back and forth through the potential field of the screen grid generates rf energy which is radiated out of the horizontal-output tube to the sensitive input circuit of the tuner. The resulting snivet appears on the right side of the television raster because this portion is scanned at the time that the decreasing plate potential passes over the "knee" portion of the tube characteristic.

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Recent Investigations

More recent work on the snivet problem has resulted in a better understanding of the mechanism by which this interference is generated. If the plate voltage of a typical beam power pentode such as the RCA-6JB6 is swept with sufficient magnitude to include the low-voltage portion of the plate-characteristic curve, a properly synchronized search receiver or wide-band panoramic display device will indicate the nature, amplitude, and frequency of rf oscillation. Such a test seems to indicate two distinct sources of rf radiation.

Barkausen oscillation occurs below the "knee" of the characteristic curve and falls principally in the higher-frequency areas of the uhf band. Screen-grid current is at a maximum when this type of oscillation occurs. The frequency and amplitude of oscillation can be affected by an external magnetic or rf field. The interference appears as a broad vertical band of "hash" near the right edge of the raster.

Radiation which results from "knee" discontinuities displays slightly different characteristics from the Barkausen oscillations. This type of interference appears only as the plate voltage traverses the "knee" region, rather than at screen-grid current peaks. The oscillation seems to be affected more by the shape of the "knee" and the direction of plate-voltage change than by the conditions which enhance Barkausen. This type of radiation may appear almost anywhere on the right half of the television raster on most vhf channels as one or more narrow vertical bands.

Barkausen oscillations may also be detected and observed by monitoring of the grid-No.1 current on a curve-tracing type of oscilloscope. The presence of grid-No.1 current with the tube operating in the curve tracer* indicates both the presence and the relative magnitude of rf oscillation. Fig.1 shows how positive grid-No.1 current can be completely eliminated by the use of a 50-volt positive potential on the grid No.3 (beam plate).

This grid-No.1-current method is not an indication, however, of radiation interference produced by "knee" discontinuities. The suppression of this type of snivets by a positive grid-No.3 voltage can be attributed more to a shift in "knee" shape and voltage which reduces the high rate of change of plate current as this portion of the plate characteristic is traversed during scan. In some cases, therefore, it is possible to observe "knee"-type snivets after Barkausen oscillations have been suppressed.

Cure of Snivets

Suppression of snivets has proved to be a challenge in the past. Early methods that were reasonably successful were also expensive because of extra components and shielding required. Bypassing of the horizontal-output-tube circuit has no appreciable effect on snivet interference. Operation above the "knee" region eliminates snivets, but is inefficient to the point of being economically unacceptable.

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* Care must be taken to adjust the oscilloscope sweep so that the grid No.1 is not driven into the positive region.

A relatively simple, low-cost solution to the problem is the application of a small positive voltage to the grid No.3 of the horizontal-output tube. The positive grid No.3 in the suppression area draws a small current and represents an impedance in the electron stream low enough to load down the "high-Q tuned circuit" (formed by the elements in the tube) that supports Barkausen oscillations. This loading, coupled with the attendant distortion of the electrostatic field in the suppression area, is sufficient to eliminate Barkausen oscillations in most cases. The effectiveness of this method of suppression is illustrated in the curves of Fig.1.

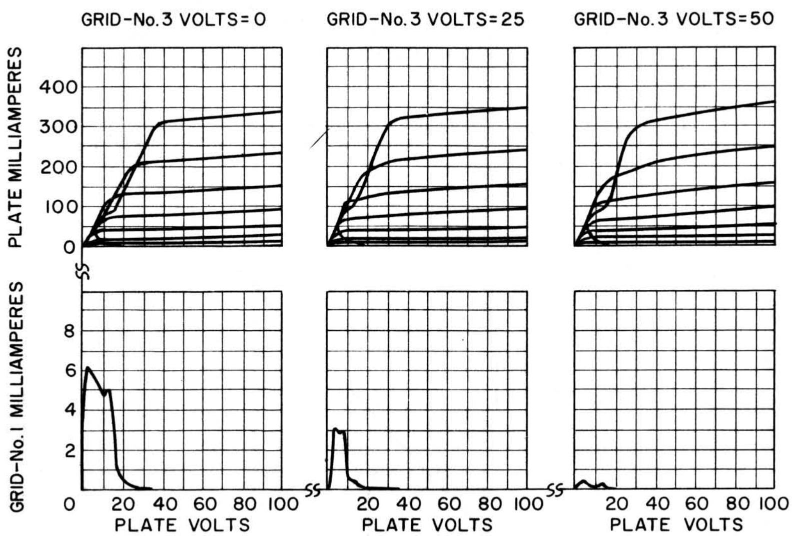

Fig.1 - Effect of grid-No.3 voltage on typical plate and grid-No.1 curves for the 6JB6 horizontal-output pentode.

The plate-family curves in Fig.1 also show that very little distortion of the "knee" results until a voltage greater than +50 volts is applied to grid No.3. The RCA family of horizontal-output tubes are especially designed for this type of operation, and provide minimum deterioration of performance as a result of shifts in the suppression characteristic of the tube. It has been found that even the moderate distortion of the knee at a grid-No.3 voltage of +50 volts has very little effect on the output of the horizontal-deflection system. If it is desired to operate these horizontal-output tubes without the grid-No.3 voltage, full output under normal operating conditions can be obtained without circuit modification.

Fig.2 shows the actual output of a black-and-white horizontal-output system for various grid-No.3 voltages. Fig.3 shows similar curves for a color-television system.

Typical Circuit

The application of the snivet-suppression method described using the RCA-6JB6, 22JG6, or 6JE6 beam power tube requires only the addition of a 2-watt dropping resistor and a bypass capacitor, as shown in Fig.4(a). The bypass capacitor prevents horizontal pulse voltage from appearing at the grid No.3, and also reduces the dc voltage required on grid No.3 for complete elimination of snivets. In a typical receiver displaying snivets in both the vhf and uhf bands, a positive grid-No.3 voltage of 30 volts

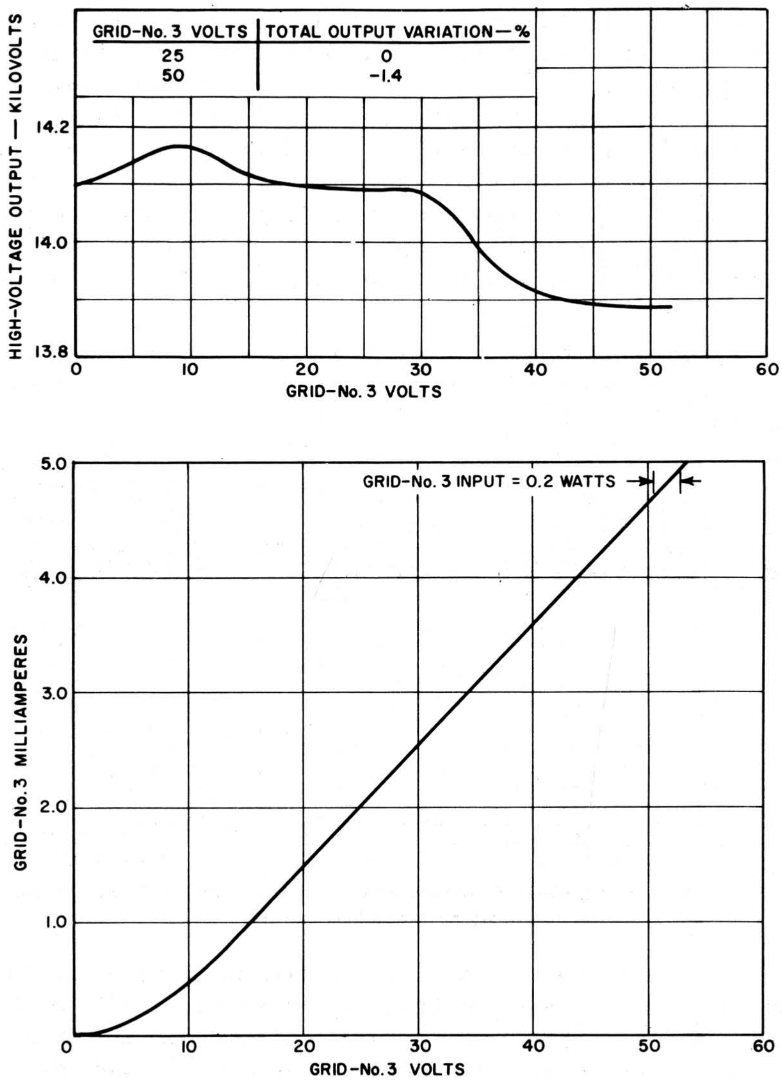

Fig.2 - High-voltage output and grid-No.3 current of the 22JG6 as a function of grid-No.3 voltage.

will eliminate interference. The curves in Fig.1 represent a "worst" case requiring a grid-No.3 voltage of +50 volts to eliminate the snivet. Average tubes are less active for Barkausen oscillation than this example and will usually clear up with a positive grid-No.3 voltage of 25 to 35 volts.

All present RCA horizontal-output tubes having separate grid-No.3 connections have a maximum grid-No.3 rating of +70 volts. However, a value of +30 to +50 volts has been found effective and is recommended for complete suppression of snivets.

In a typical horizontal-output circuit, the grid No.3 draws a current of 1 to 3 milliamperes. This current varies 50 to 80 per cent between low-brightness and high-brightness levels as a result of loading in the picture-tube high-voltage supply. The resulting variation in grid-No.3 voltage caused by the series dropping resistor may be reduced by use of a resistance divider network, as shown in Fig.4(b). If a lower source voltage (60 to 100 volts) is available, it may be used to provide some savings in component costs and better voltage regulation on grid No.3.

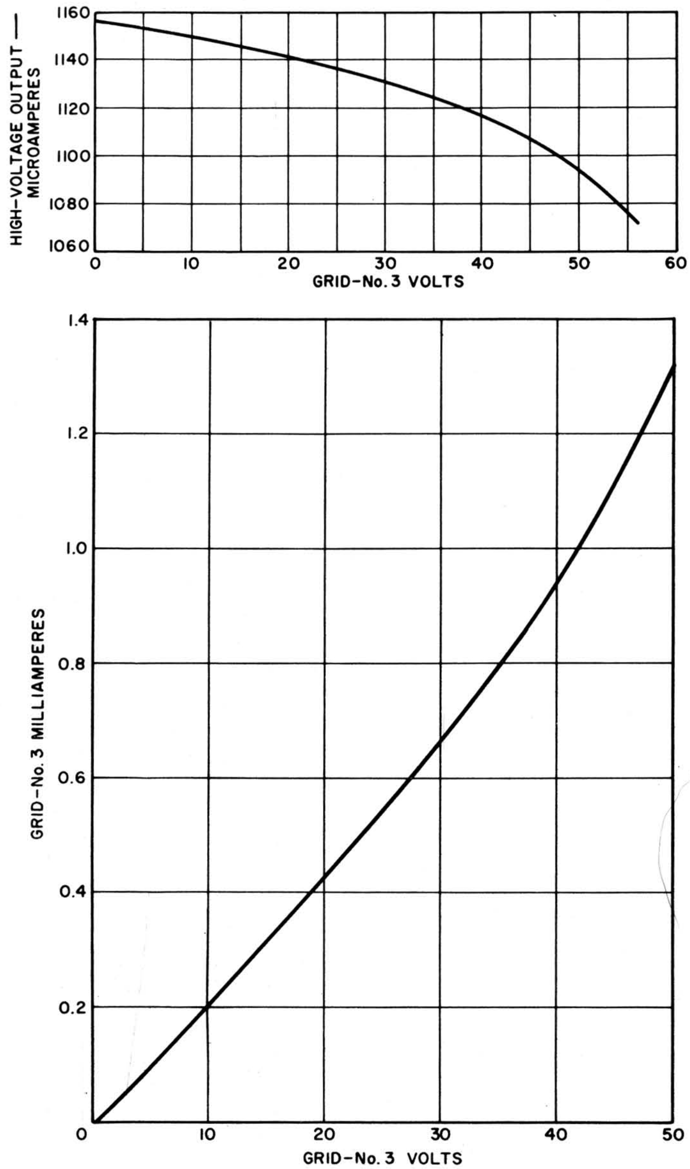

Fig.3 - High-voltage output and grid-No.3 current of the 6JE6 as a function of grid-No.3 voltage.

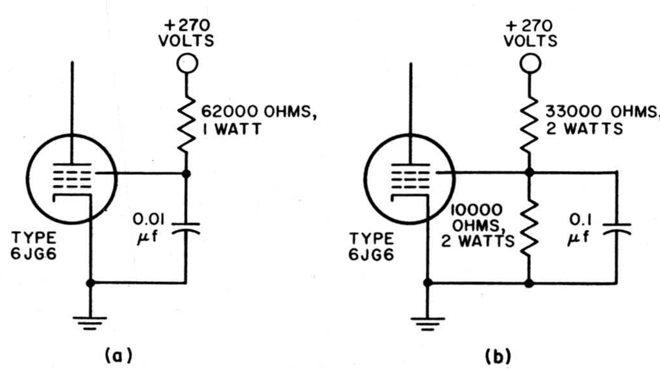

Fig.4 - Typical circuits for supplying positive voltage to grid No.3.

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