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J. D. COBINE ET AL

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GAS DISCHARGE TUBE

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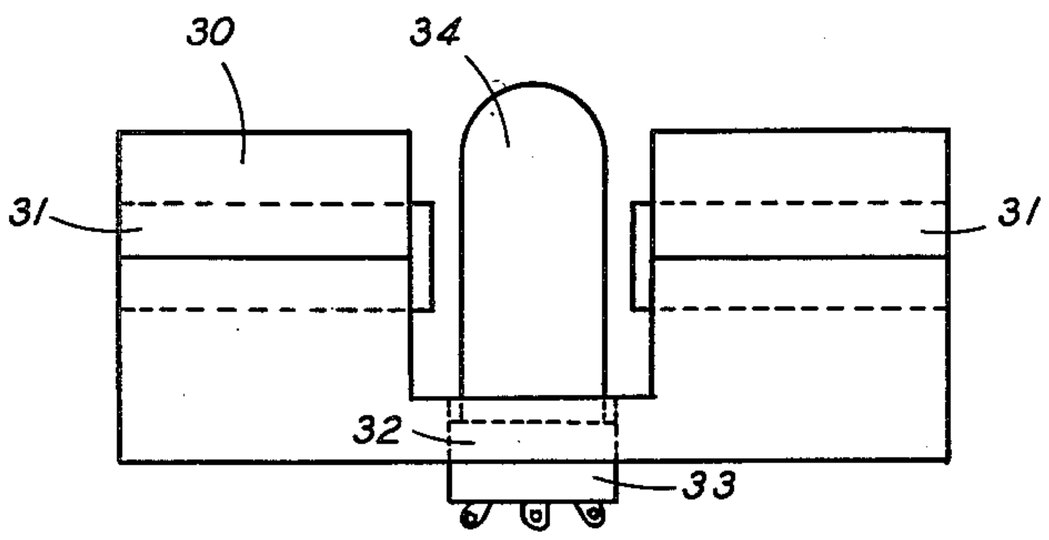

FIG. 4

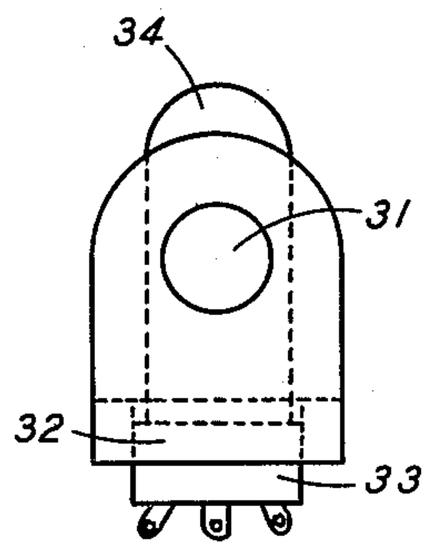

FIG. 5

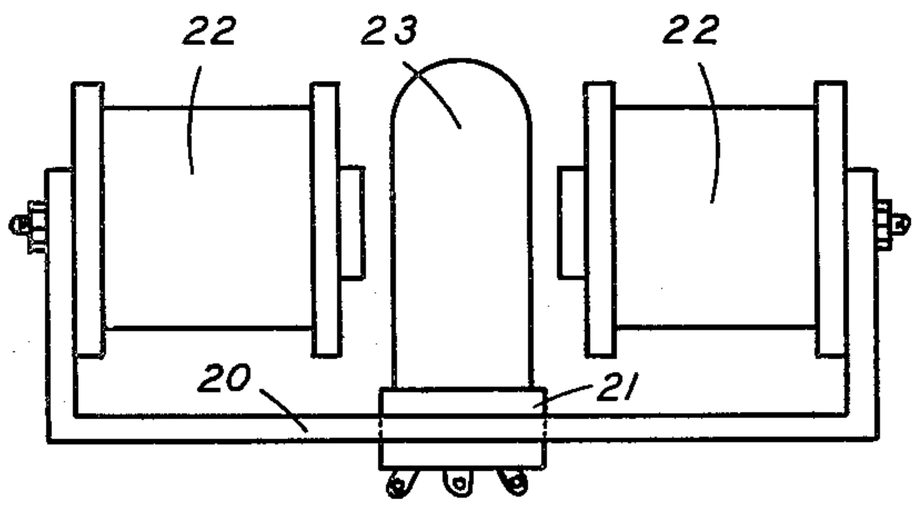

FIG. 2

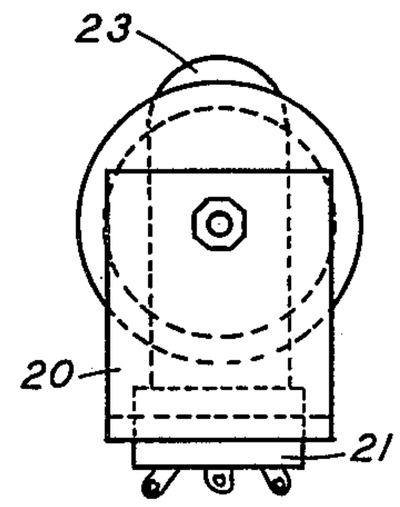

FIG. 3

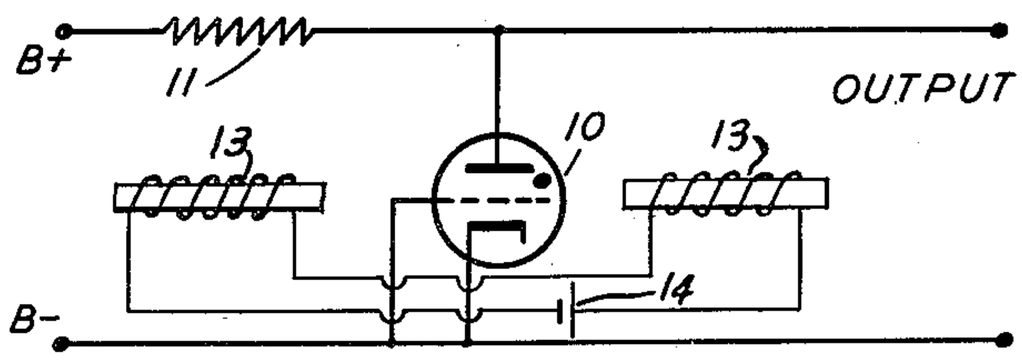

FIG. 1

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GAS DISCHARGE TUBE

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4 Claims. (Cl. 315—344)

1

This invention relates generally to electrical apparatus and more particularly to gas discharge tubes.

A voltage having components distributed continuously over a band of frequencies is defined as a noise. A random noise exists when the energy distribution of this voltage with respect to frequency is substantially constant over a wide range of frequencies. A source providing random noise is useful in making receiver noise measurements, in determining the frequency response of an apparatus, in jamming transmitters, and as a universal frequency source.

While it is generally appreciated that gas discharge tubes may be used as a random noise generator, such applications of gas discharge tubes have been limited due to the co-existence of prominent pulses in the low frequency portion of the frequency spectrum of such a tube. These low frequency pulses usually take the form of non-sinusoidal oscillations and are generally undesirable. It has been found that the characteristics of voltage fluctuations in a gas discharge tube are greatly altered when the discharge is placed in a transverse magnetic field. It has also been found that a certain flux density of a magnetic field about a gas discharge tube will cause a substantial reduction in the random noise generated in a gas discharge tube and also that a certain flux density will cause a reduction in the low frequency oscillations and simultaneously increase the high frequency noise components present in a gas discharge tube; thus, increasing the random noise.

It is an object of this invention to control the magnitude of the noise inherent in a gas discharge tube.

It is also an object to attenuate the noise components in a certain portion of the frequency spectrum of a gas discharge tube and to simultaneously accentuate other portions of the same frequency spectrum.

Other objects, features, and advantages of this invention will suggest themselves to those skilled in the art and will become apparent from the following description of the invention taken in connection with the accompanying drawings in which:

Fig. 1 is a schematic diagram of a typical circuit including a gas discharge tube;

Fig. 2 is an elevation of an assembly including a gas discharge tube and two electromagnets;

Fig. 3 is an end view of Fig. 2;

Fig. 4 is an elevation of an assembly including a gas discharge tube and a permanent magnet; and

Fig. 5 is an end view of Fig. 4.

2

Referring now to Fig. 1, a gas discharge tube 10 is connected across a direct-current potential source through a load resistor 11. Tube 10 is placed in a magnetic field, which may be generated by electromagnet 13, 13, for example, energized by direct current source 14. Obviously, however, a permanent magnet could be substituted for electromagnet 13, 13.

Fig. 2 shows a base plate 20, holding a tube socket 21 and two electromagnets 22, 22. Interposed between the electromagnets 22, 22, is a gas discharge tube 23 held by tube socket 21.

Figs. 4 and 5 show a similar arrangement utilizing a permanent magnet. A non-ferrous metal casting 30 with a transverse segment cut out of the center, is drilled to receive and hold two permanent magnets 31, 31. The remainder of the casting at the cut-out portion shown at 32 has a hole bored to receive and hold a tube socket 33. Inserted between the pole faces of magnets 31, 31 and held by tube socket 33, is a gas discharge tube 34.

In operation, a gas discharge tube, such as a type 6D4, in a circuit similar to that shown in Fig. 1, is placed in a magnetic field similar to the arrangement shown in Figs. 2 and 4. When it is desired that this arrangement be used as a noise generator, the application of a magnetic field having a critical flux density, 300 gauss in the case of the type 6D4 tube, will suppress the low frequency oscillations normally inherent in such a tube and at the same time will increase the high frequency components of noise to a high level, resulting in output voltage fluctuations having a substantially flat energy distribution with respect to frequency, over a range of frequencies from a few cycles per second to several megacycles.

A comparison of the noise level with and without the presence of a magnetic field shows an increase of 10 db where the magnetic field is used, also the noise spectrum of the tube is extended well into the region of megacycles. The magnetic field strength required for maximum high frequency noise depends on the geometry of the tube and the magnitude of the tube current and this critical value of flux density may vary from a few hundred to a few thousand gauss, depending on the particular type of gas discharge tube used. The voltage required to maintain ionization in a gas discharge tube depends on the strength, 260 gauss in the case of the type 6D4 tube, of the magnetic field. The higher the field strength, the higher the voltage required to maintain ionization. Thus, the B+ voltage must be high enough

to maintain ionization at the highest field strength used.

There also exists a second critical value of magnetic field strength, 260 gauss in the case of the type 6D4 tube, which will cause a substantial reduction in the random noise voltages inherent in a gas discharge tube. Consequently, such an application of a magnetic field may be used when the proximity of a gas discharge tube and other tubes or circuits, introduces by stray coupling unwanted noise from the gas discharge tubes under the influence of a magnetic field, makes possible the choice of a field strength which will result in either the suppression or the accentuation of the desired frequency components in the spectrum of a gas discharge tube. Upon the application of a weak magnetic field, the low frequency oscillations first increase in amplitude then decrease to zero and never reappear as the field strength is increased. Conversely, the high frequency noise components first decrease and then increase as the magnetic field strength is increased from zero.

While there has been here described what is at present considered to be the preferred embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the scope of the invention.

What is claimed is:

1. An apparatus for generating a noise output from a gas discharge tube having an anode and a cathode, including means for applying a magnetic field of adjustable magnitude transverse to the longitudinal axis of said tube, and means for applying operating potentials to said tube to initiate and maintain ionization of said gas between the anode and cathode of said gas discharge tube at the maximum magnitude of said magnetic field, such that the strength of said magnetic field determines the frequency distribution in the noise output from said tube.

2. An apparatus for generating a noise output from a gas discharge tube having an anode and a cathode, including means for applying a magnetic field of relatively high intensity transverse to the longitudinal axis of said tube, and means for applying operating potentials to said tube to initiate and maintain ionization of said gas between the anode and cathode of said gas discharge tube at said intensity of the magnetic field, such that the level of the high frequency noise components of the frequency spectrum of said tube is substantially increased and simultaneously the low frequency pulses inherent in said tube are substantially suppressed.

3. An apparatus for generating a noise output from a gas discharge tube having an anode and a cathode, including means for applying a magnetic field of relatively low intensity transverse to the longitudinal axis of said tube, and means for applying operating potentials to said tube to initiate and maintain ionization of said gas between the anode and cathode of said discharge tube at said intensity of the magnetic field, such that the level of the high frequency noise components of the frequency spectrum of said tube is substantially reduced and simultaneously the low frequency pulses inherent in said tube are substantially increased.

4. Apparatus for controlling the character of noise obtainable from a gaseous electron discharge device, comprising the combination of a gaseous electron discharge device having a cathode and anode, means for applying operating potentials to said device so as to initiate and to maintain an ionized electron path between said cathode and anode and means for setting up a magnetic field substantially transversely with respect to said path, said operating potentials being of sufficient magnitude to maintain operation of said device in the presence of a maximum value magnetic field and said magnetic field having an intensity so as to favor the generation of noise in a given frequency region.

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