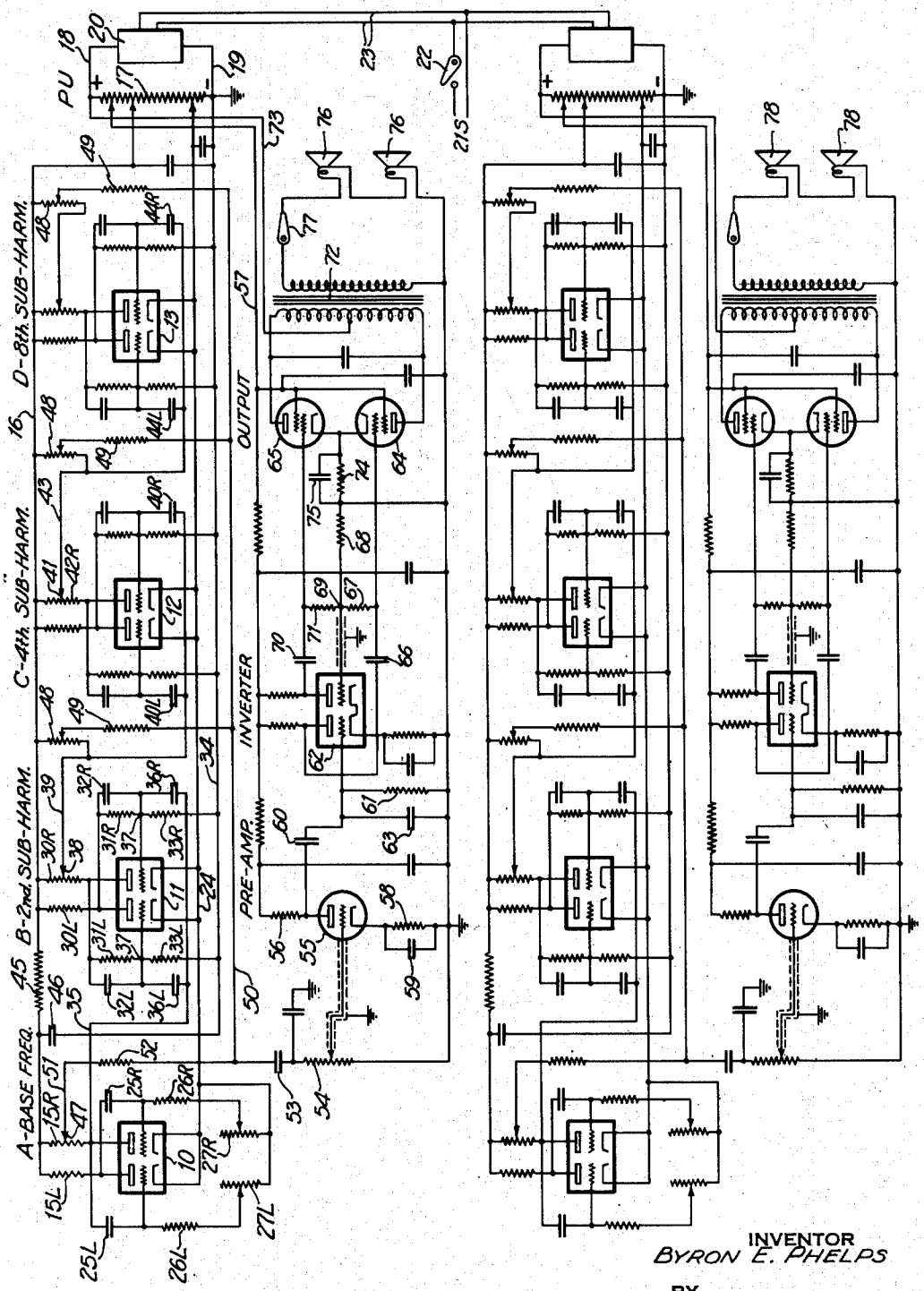
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OSCILLATION GENERATOR FOR NOISE MAKING DEVICES

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OSCILLATION GENERATOR FOR NOISEMAKING DEVICES

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1 Claim. (Cl. 250—36)

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This invention relates to a device for making a noise simulating the noise of the engines of an airplane, its principal use at the present time being in association with military training apparatus, wherein the actual environment of aerial operations is to be reproduced as closely as possible.

It is an object of the invention to provide a device of the kind described whereby the noise can be varied in volume and also in pitch, to correspond with the variations of engine noises in flight.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

The single figure of the drawing is a circuit diagram of the apparatus.

It has been found desirable to provide a plurality of complete sound producing units, so that the full audio effects can be realized, including the beat frequencies of a plurality of engines running at slightly different speeds. The drawing shows two complete sound producing units, one above the other. Since these are identical, only the upper one will be described in detail.

The sound producing unit comprises an audio-frequency wave generator composed of a power unit PU and a series of trigger circuits A, B, C, D in cascade connection, to produce a base frequency and second, fourth, and eighth sub-harmonic frequencies. The base frequency is generated in the trigger circuit A, which is a conventional multi-vibrator utilizing a twin triode 10, such as a 6SN7. The plates of this tube are fed through plate resistors 15R and 15L, a wire 16 leading to an intermediate point, for instance 240 volts, on the bleeder resistance 17 of the power unit. The bleeder resistance is connected across the output leads 18, 19 of a conventional transformer, rectifier, and filter combination, represented by the box 20. The transformer receives alternating current through wire 23 from a source 21, when switch 22 is closed. The cathodes of tube 10 are fed through a wire 24 from a lower point, for instance 90 volts, on the bleeder resistance 17. The left plate of the tube 10 is coupled through a condenser 25R to the right grid of the tube, while the right plate is coupled through a condenser 25L to the left grid. The grids are also connected through fixed grid resistors 26R and 26L and rheostats 27R and 27L to the cathode lead 24. When the power is turned on by closing switch 22 and a voltage is set up across the bleeder resistance 17, one side of the tube 10, say the right side, will start to conduct. This will drive the left grid below the cut-off point, until the charge on the related coupling condenser 25L flows off through the grid resistor 26L and rheostat 27L. When the voltage

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of the left grid rises to about −2 volts, the left side of the tube will begin to conduct and the right side will be cut off by a negative impulse applied through the condenser 25R to the right grid. When the charge on the condenser 25R drains off to the point where the right grid reaches a potential of −2 volts, the right side of the tube will start to conduct. The process will continue, with the two tubes becoming conductive alternately, in accordance with the well-known multi-vibrator principle. The frequency of the alternations depends upon the circuit constants. Using a 6SN7 tube, with condensers 25R and 25L of .1 mfd., resistances 15R and 15L of .04 megohm, resistances 26R and 26L of .005 megohm, and rheostats 27R and 27L of 0–.1 megohm, the frequency can be varied from 20 to 300 cycles/second.

The second stage B, wherein the second sub-harmonic is generated is a trigger circuit, which is stable in either of two conditions and which reverses in response to negative impulses. The plates of the tube 11 of this stage, which may also be a 6SN7, are connected through resistors 30R and 30L to the B+ wire 16; the cathodes are connected to the B— wire 24. The two plates are cross connected to the two grids by resistances 31R, 31L, and condensers 32R, 32L. Grid resistances 33R, 33L connect the grid to a bias wire 34 leading to the grounded negative end of the bleeder resistance 17. Also, a coupling is provided from the right plate of tube 10, through wire 35, and impulsing condensers 36R, 36L to the grids of tube 11.

It will be observed that the right grid of tube 11 is connected to a point 37 of a voltage divider consisting of the resistances 30L, 31R, and 33R, which may have values .02, .2, and .2 megohm, respectively. The left grid is connected to a point 37 on a voltage divider 30R, 31L, and 33L. With a total drop across these voltage dividers of 240 volts, the grids seek a potential of 114 volts, compared to 90 volts on the cathodes. When the power is turned on, one side of the tube, say the right side, will become conductive, its plate potential will drop, and the left grid will be biased below the cut-off potential. The circuit is stable in this condition. When the right side of the first tube 10 becomes conductive, a negative impulse is transmitted through the impulsing condensers 36R and 36L to the grids of the tube 11, reducing the potential on both grids and cutting off the right side. The resulting rise of the right plate potential causes the potential of the left grid to rise more steeply than the potential of the right grid, as the condensers 36R and 36L discharge, with the result that the left side becomes conductive and biases off the right side. The impulsing condensers 36R and 36L should have somewhat less than half the capacity of the coupling condensers 32R and 32L; for instance, the former may be .001 and the latter .00045 mfd.

The following positive impulse transmitted through the impulsing condensers when the right side of the tube 10 becomes non-conductive has no effect upon the second stage, since at this time the right grid of tube 11 is biased too far below cut-off to be raised above the cut-off point by this impulse; furthermore, the potential of the left grid is raised at the same time, dropping the potential of the left plate, which counteracts the effect of the positive impulse on the right grid. However, when the next negative impulse is transmitted through the impulsing condensers, the second stage will be reversed in the same manner as previously described. Thus, the second stage will reverse at one-half the rate of the first stage.

The third and fourth stages C and D, producing the fourth and eighth sub-harmonics, respectively, are identical to the second stage B. The grids of the tube 12 of the third stage are coupled from a point 38 on the plate resistor 30R through a wire 39 and impulsing condensers 40R and 40L. The grids of the tube 13 of the fourth stage are similarly coupled to a point 41 on the plate resistor 42R of the right hand section of the third stage, through a wire 43 and impulsing condensers 44R and 44L. The third stage reverses at half the rate of the second stage and the fourth stage reverses half the rate of the third stage, thus producing, respectively, fourth and eighth sub-harmonics. A resistance 45 and condenser 46 are inserted between the first and second stages A and B for decoupling them.

The output of all four stages is fed into a conventional audio-frequency amplifier, shown below the audio-frequency wave generator. From a center tap 47 of the plate resistor 15R the output of the first stage is led through a wire 51, resistance 52, condenser 53, and volume control 54, to the grid of a pre-amplifier tube 55, which may be half of a 6SN7. The output from each of the other stages is taken from a volume control 48 through a resistance 49 and wire 50 to condenser 53. The resistance of the volume controls 48 may be .5 megohm and that of the resistances 49 and 52 may be 1.0 megohm, while the condenser 53 may be .10 mfd. The plate supply of the tube 55 comes through a plate resistor 56 and a wire 57 from a tap on the bleeder resistance 17, say 330 volts. The cathode is connected through a grid bias resistance 58 and bypass condenser 59 to ground.

The plate of tube 55 is coupled by a condenser 60 and grid resistor 61 to the left grid of the inverter tube 62. A tone control condenser 63 is connected between the left grid and ground. The left plate of tube 62 is coupled to the control grid of the lower output tube 64 by a condenser 66 and grid resistance 67, 68. The right grid of tube 62 is connected to point 69 and its voltage is therefore proportional to the voltage at the grid of tube 64. The right plate of tube 62 is coupled by condenser 70 and grid resistance 71, 68 to the control grid of the upper output tube 65. The resistances 71, 67 and 68 may be .4, .3, and .1 megohm, respectively. This circuit, known as the "floating paraphase" causes the control grid voltages of the tubes 64 and 65 to vary in exact inverse ratio. The plates of the output tubes are connected to opposite ends of the primary coil of an output transformer 72, the center tap of which is connected by a wire 73 to the positive end of the bleeder resistance, having a potential of 400 volts. The cathodes are connected through a biasing resistor 74 and bypass condenser 75 to ground. The transformer 72 serves to couple the amplifier to a receiving device, such as to loud speakers 76. The voice coils of these loud speakers are connected in series, through a switch 77, to the secondary winding of the transformer 72.

The steep front waves generated by the four stages of the audio-frequency wave generator cause the loud speakers to produce a sound resembling the noise of an airplane engine. The noise can be simulated more and more closely by proper proportioning of the amplitude of the sub-harmonics by means of the volume controls 48. Its total volume can be varied by means of the volume control 54 and its pitch by means of the rheostats 27L and 27R, for reproducing the sound of an engine in diving and climbing. The second sound generator shown below operates loud speakers 78, the combined output of the four loud speakers yielding beat frequencies similar to those generated by two airplane engines.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention therefore to be limited only as indicated by the scope of the following claims.

What is claimed is:

In a device of the class described, an electronic circuit comprising an oscillator circuit and a plurality of trigger circuits, each having two conditions of stability, said oscillator circuit including means to vary the frequency thereof through a wide range, means connecting said oscillator and trigger circuits in cascade arrangement whereby said oscillator circuit drives an adjacent trigger circuit alternately to its two different conditions of stability, so that it reverses at half the frequency of the oscillator, and whereby each trigger circuit, except the last in the cascade, drives a succeeding trigger circuit alternately to its two different conditions of stability, so that each succeeding trigger reverses at half the frequency of its driving trigger, a utilization circuit comprising a single input conductor, and means coupling said conductor to output points in each of said oscillator and trigger circuits so that the outputs of said latter circuits are combined to form a complex wave in said utilization circuits.

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