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ELECTRONIC HORN

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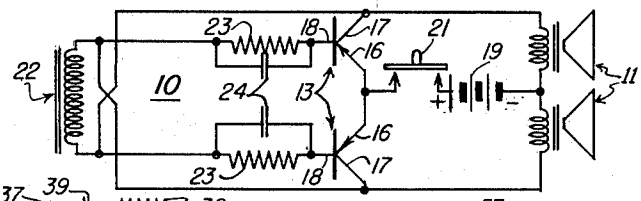


Fig. 1

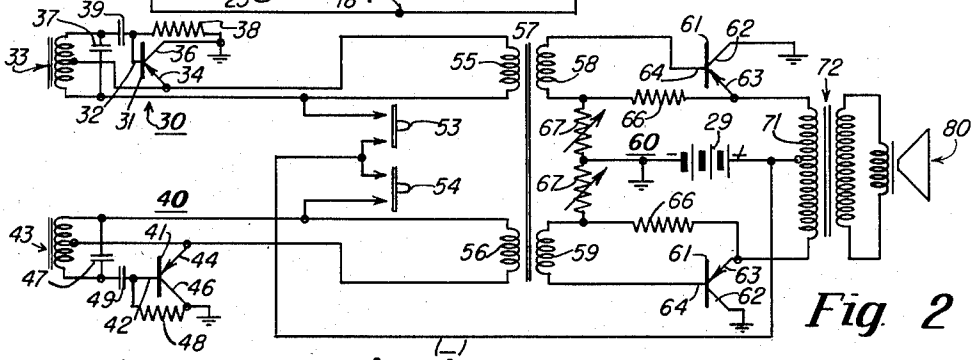


Fig. 2

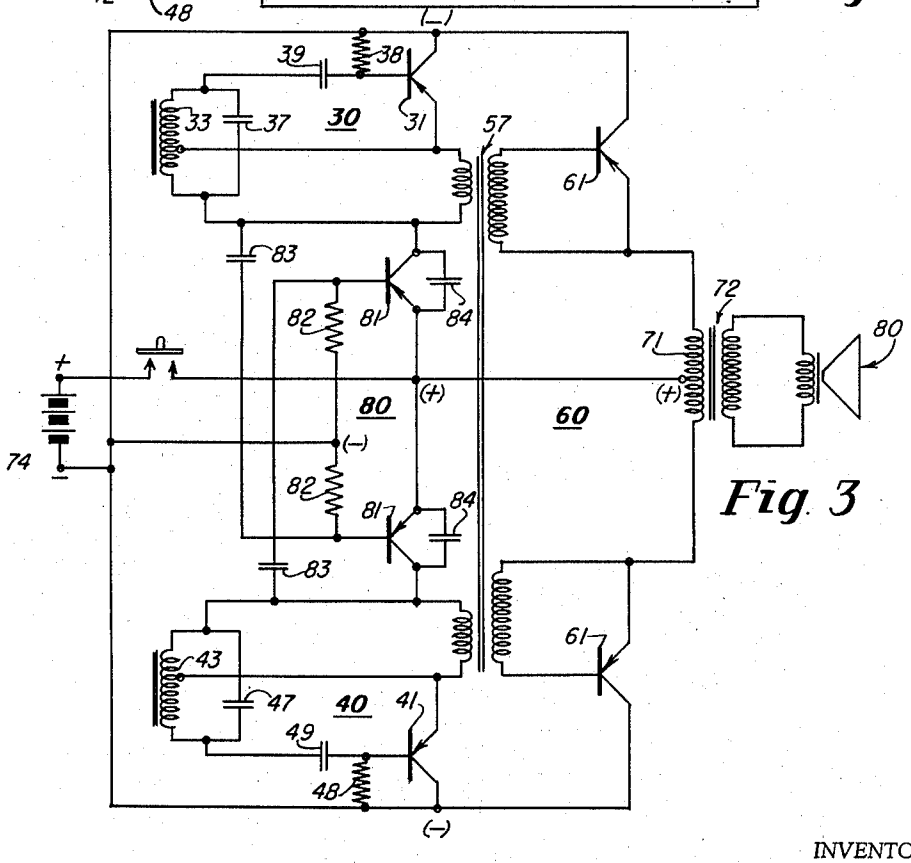


Fig. 3

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ELECTRONIC HORN

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3 Claims. (Cl. 340—384)

This invention relates generally to electronic sound producing devices and more particularly to a transistor operated electronic horn suitable for use with automobiles, trucks, and other vehicles.

The horns commonly used on automotive vehicles often require very high current during operation. This causes a substantial drain from the battery of the vehicle and may also cause the horn to burn out with sustained use. Furthermore, many of the presently used horns produce a harsh sound which is quite aggravating to motorists. A more pleasant sound is produced by using multiple tones in combination, but a separate trumpet must be provided for each tone in horns of conventional construction and this makes such horns quite expensive.

It is an object of the present invention to provide an electronic horn for automotive vehicles which develops sufficient power to produce a loud sound without drawing large amounts of current.

Another object of the invention is to provide an electronic horn which produces a pleasant sound.

Still another object of the invention is to provide an electronic horn of simple and inexpensive construction.

A feature of the invention is the provision of an electronic horn including a transistor powered oscillator which is capable of providing the required power with relatively low current drain.

A further feature of the invention is the provision of an electronic horn including an oscillator circuit producing a plurality of different tones and which may be coupled to a single loudspeaker to give a multi-tone sound effect.

A still further feature of the invention is the provision of an electronic horn having a plurality of oscillators providing different tones and apparatus for shifting between the different frequencies giving a warbling effect to the sound produced by the horn.

The invention is illustrated in the drawings in which:

Fig. 1 shows the circuit of an electronic horn in accordance with the invention;

Fig. 2 shows the circuit of another embodiment of the invention for producing multiple tones; and

Fig. 3 shows the circuit of still another embodiment of the invention which provides a warbling effect.

The electronic horn of the invention includes transistor devices connected in an oscillator circuit to produce electric signals of audible frequency. The level of the signals is relatively high, so the oscillator may be coupled directly to a loudspeaker which converts the electric signals to sound energy which is easily heard. A plurality of transistor powered oscillators may be connected in parallel to produce electric signals of different frequencies. These signals may be applied to a transistorized amplifier stage which increases the level of the signals, and the output of the amplifier stage is applied to a loudspeaker which converts the electric signals to sound energy. In this form of the invention, the sound is composed of a plurality of tones which has a more pleasing effect, and the sound is somewhat louder as a result of the amplification. A

plurality of oscillators may be alternately disabled by a multivibrator circuit with the different tones produced thereby being alternately applied to the loudspeaker so that the resulting sound has a warbling effect.

The circuit of an electronic horn for producing single tones is shown in Fig. 1. This embodiment of the invention includes an oscillator, designated generally as **10**, and a pair of loudspeakers **11**. The loudspeakers **11** may be of any well-known construction and, therefore, they will not be described in detail. Five-inch weather-proof speakers of the type commonly used with railroad equipment have been used with satisfactory results. A pair of loudspeakers is used to utilize the output of the push-pull circuit without requiring a transformer. A single loudspeaker with a tapped winding, or a tapped transformer and a single loudspeaker may also be used in this circuit.

The oscillator **10** includes a pair of transistors devices **13** of the PNP junction type, each having an emitter **16**, a collector **17**, and a base **18**. The transistor devices are coupled in a push-pull circuit with the emitters **16** being coupled together and the loudspeakers **11** being coupled across the collectors. A direct current voltage source **19**, which may be provided by the electrical system of the vehicle, is coupled between the common junction of the emitter electrodes **16** and the common junction of the loudspeakers **11**. A switch **21** of the pushbutton type is series connected with the voltage source **19**. A coil **22** is coupled across the base electrodes **18** and is cross-coupled across the collector electrodes **17**, to provide feedback for producing a substantially sinusoidal output waveform. It will be understood that the coil **22** has sufficient distributed capacitance to cause the coil to operate as a tuned circuit providing energy storage for the oscillator. The coil **22** may be provided with a core made of highly permeable ferro-magnetic material such as ferrite, and such a core saturates on a portion of positive and negative voltage swings producing a substantially square output waveform. The resistors **23** are series connected in the base circuits to alternately bias the base electrodes **18** negatively with respect to the emitter electrodes **16**. The capacitors **24** are coupled across the resistors **23** to bypass the alternating current components of the current in the base circuits.

The following circuit values may be used for the circuits shown in Fig. 1, but these values are not intended to limit the scope of the invention in any way.

Transistors devices **13**	PNP junction.
Coil **22**	300 millihenries.
Resistors **23**	270 ohms.
Capacitors **24**	4 microfarads.
Voltage source	6 volt D.C. battery.

Another embodiment of the invention which produces the effect of combined tones is illustrated in Fig. 2. This circuit consists generally of a pair of oscillators **30** and **40** for generating electric signals of different frequencies which are used to drive an amplifier **60**. The output of the amplifier is converted to sound energy by the transducer **80** which may be a small weather-proof speaker as previously explained.

The oscillator **30** is basically of the Hartley type employing a transistor device **31** with the base electrode **32** being connected to one end of a coil **33** whose other end is connected to a source of direct current voltage **29**. The collector electrode **36** is grounded with respect to the source of voltage, and the emitter electrode **34** is tapped into the coil **33** at a point between the ends thereof. A capacitor **37** is connected across the ends of the coil **33** so that these elements form a tuned circuit providing the energy storage required for an oscillating circuit. A bias resistor **38** is connected between the base electrode **32** and the collector electrode **36**, and a blocking capacitor

39 is series connected to the junction of the base 32 and resistor 38. The direct current in the base electrode, therefore, returns to ground through the bias resistor 38, and in doing so the IR drop across the resistance biases the base positively with respect to the collector 36. The emitter is biased still more positively with respect to the collector 36 since it is connected to the plus terminal of the voltage source 29. An output coil 55 forming one primary winding of a transformer 57 is coupled between the lower end of the coil 33 and the emitter 34.

The other oscillator 40 is connected in the same manner as is the oscillator 30, so these connections will not be explained again in detail. The output coil 56 for the oscillator 40 forms another primary winding for the transformer 57, and it is apparent that the output of both oscillators may be applied simultaneously to the amplifier stage 60. A pair of switches 53 and 54 are coupled respectively between the oscillators 30 and 40 and the source of direct current voltage 29 so that the output of the oscillators may be selectively applied to the amplifier stage 60 if desired.

The amplifier 60 is a push-pull power amplifier. A pair of transistor devices 61 is employed with the collector electrodes 62 being grounded. The emitter electrodes 63 are each connected to one end of a pair of series connected resistors 66 and 67 which are grounded at the other end. The secondary windings 58 and 59 of the transformer 57 are each connected between a base electrode 64 and the common junction of one of the pairs of resistors 66 and 67. The output voltage appearing across the resistors 66 and 67 is applied to the primary winding 71 of the transformer 72, and the portion of the output voltage which appears across the resistors 66 is fed back to the input.

The circuit values of the oscillators 30 and 40 are chosen so that the horn will have an output waveform composed of two different frequencies. Frequencies of about 410 cycles and 1535 cycles, which produce an unusual effect in combination, have been obtained using the following circuit values, but again the circuit values are only representative and are not intended to limit the scope of the invention in any way.

Transistor devices 31, 41, and 61	PNP junction.
Coils 33 and 43	2.4 henries, 20% tap.
Capacitor 37	2.75 microfarads.
Capacitor 47	.25 microfarad.
Capacitor 39	.5 microfarad.
Capacitor 49	.05 microfarad.
Resistor 38	1,500 ohms.
Resistor 48	2,200 ohms.
Resistors 66	10 ohms.
Resistor 67	1,000 ohms.
Voltage source 29	6 volt D.C. battery.

The embodiment of Fig. 2 may be modified as shown in Fig. 3 to provide a "warbling" electronic horn in which the output shifts between two frequencies at a low frequency rate. This is accomplished by interposing a multivibrator between the two oscillators 30 and 40 which operates to disable the oscillators alternately so that the different signals produced thereby are alternately applied to the amplifier 60. The multivibrator 80 consists of a pair of transistor devices 81, resistors 82, and capacitors 83 and 84 connected in a well-known manner. The multivibrator cuts off the supply voltage for one and then the other of the oscillators, and therefore the oscillators are alternately energized. The amplifier 60 is similar to that shown in Fig. 2 but does not have feedback.

The circuit values for the circuit shown in Fig. 3 are preferably selected so as to provide two tones with a 10 to 20 percent frequency difference, and with a shifting frequency of about 8 cycles per second. The tuned circuits of the oscillators 30 and 40 may be adjusted to resonate respectively at about 560 and 610 cycles per second, and the values of the bias resistors 38 and 48 are adjusted to provide the proper bias. The following circuit values are given by way of illustration:

Transistor devices 31, 41, 61, and 81	PNP junction.
Coils 33 and 43	.3 henry tapped at 7%.
Capacitor 37	.35 microfarad.
Capacitor 47	.25 microfarad.
Capacitors 39 and 49	.25 microfarad.
Capacitors 83	70 microfarads.
Capacitors 84	250 microfarads.
Resistors 82	1,200 ohms.
Transformer 57	24 ohms split primary to 18 ohm split secondary.
Transformer 72	5 ohm center tap primary to 16 ohm secondary.
Voltage source 74	6 volt D.C. battery.

The invention provides an electronic horn which develops sufficient power to produce a loud and effective sound which is considerably more pleasant to the ear than the sound produced by the horns commonly used on automotive vehicles. All of the various embodiments and modifications of the invention described above are capable of operating more efficiently than such conventional horns and, therefore, the current drain from the battery is greatly reduced. As an example, the current drain is of the order of 1 to 2.5 amperes as compared to a current drain of the order of 10 to 40 amperes for conventional horns.

We claim:

1. An electronic automotive horn for use with an automobile vehicle having an electrical system providing low direct current voltage, said horn including in combination, oscillator means for producing oscillatory electric signals, said oscillator means including first transistor means having input and output circuit portions and regenerative feedback circuit means coupled between said output and input circuit portions of said first transistor means for sustaining the oscillation thereof, power amplifying circuit means coupled to said oscillator means for increasing the power value of the oscillatory electric signals produced by said oscillator means, said amplifying circuit means including second transistor means having input and output circuit portions, means coupled between said output circuit portion of said first transistor means and said input circuit portion of said second transistor means for appyling the oscillatory electric signals to said second transistor means with maximum transfer of power, said second transistor means serving to amplify the signals applied thereto and produce oscillatory electric signals at said output circuit portion thereof at an increased power level, a loudspeaker coupled to said power amplifying circuit means for converting the amplified oscillatory electric signals to sound energy of an intensity to warn of the approach of the vehicle at substantial distances, and a voltage supplying circuit for supplying energizing voltage to said first and second transistor means at a level no higher than the voltage of the electrical system, said voltage supplying circuit being coupled to said oscillator means and said amplifying circuit means and adapted to be connected to the electrical system of the vehicle, said voltage supplying circuit including a switch normally opening said voltage supply-circuit to keep said first and second transistor means normally deenergized, with said transistor means responding instantaneously upon actuation of said switch to produce the oscillatory electric signals and apply the same to said loudspeaker thereby providing an immediate horn warning with a minimum drain of energy from the electrical system of the vehicle.

2. An electronic automotive horn for use with an automotive vehicle having an electrical system for providing low direct current voltage, said horn including in combination, oscillator means for producing oscillatory electric signals, said oscillator means including first and

second transistor means having input and output circuit portions, regenerative feedback circuit means coupled between said output and input circuit portions of said transistor means for sustaining the oscillations thereof, with said feedback circuit means being adjusted such that said first and second transistor means oscillate at different predetermined frequencies, power amplifying circuit means coupled to said oscillator means for increasing the power of the oscillatory electric signals produced by said oscillator means, said amplifying circuit means including third and fourth transistor means connected for push-pull operation, means coupled between said oscillator means and said power amplifying circuit means for applying the oscillatory electric signals to said third and fourth transistor means with maximum transfer of power, said third and fourth transistor means serving to amplify the signals applied thereto and produce oscillatory electric signals at an increased power level, a loudspeaker coupled to said power amplifying circuit means for converting the amplified oscillatory signals to sound energy of an intensity to warn of the approach of a vehicle at substantial distances, dual condition electronic switching means coupled to said oscillator circuit means for controlling the activation thereof, said electronic switching means being coupled to said first and second transistor means to alternately operatively connect said first and second transistor devices so that the sound energy output of said loudspeaker has a warbling effect, and a voltage supplying circuit for supplying energizing voltage to all of said transistor means at a level no higher than the voltage of the electrical system, said voltage supplying circuit being coupled to said oscillator means and said amplifying circuit means and adapted to be connected to the electrical system, said voltage supplying circuit further including a switch normally opening said voltage supplying circuit to keep all of said transistor means normally deenergized, with said transistor means responding instantaneously upon actuation of said switch to produce the oscillatory electric signals and apply the same to said loudspeaker, thereby providing immediate warning with a minimum drain of energy from the electrical system of the vehicle.

3. In an automotive vehicle an electronic horn system including in combination, a vehicle electrical system having a battery providing low direct current voltage, oscillator means for producing oscillatory electric signals, said oscillator means including first transistor

means having input and output circuit portions and regenerative feedback circuit means coupled between said output and input circuit portions of said first transistor means for sustaining the oscillation thereof, power amplifying circuit means coupled to said oscillator means for increasing the power value of the oscillatory electric signals produced by said oscillator means, said amplifying circuit means including a second and third push-pull connected transistor means having input and output circuit portions, means coupled between said output circuit portion of said first transistor means and said input circuit portions of said second and third transistor means for applying the oscillatory electric signals to said second and third transistor means with maximum transfer of power, said second and third transistor means serving to amplify the signals applied thereto and produce oscillatory electric signals at said output circuit portion thereof at an increased power level, a loudspeaker coupled to said power amplifying circuit means for converting the amplified oscillatory electric signals to sound energy of an intensity to warn of the approach of the vehicle at substantial distances, a normally open horn switch, and a voltage supplying circuit coupled to said oscillator means and said amplifying circuit means and series coupled with said switch to said battery in said electrical system of the vehicle for supplying energizing voltage to said first and second transistor means at a level no higher than the voltage of the electrical system, said switch normally opening said voltage supplying circuit to keep said first, second and third transistor means normally deenergized, with said transistor means responding instantaneously upon actuation of said switch to produce the oscillatory electric signals and apply the same to said loudspeaker thereby providing an immediate horn warning with a minimum drain of energy from said vehicle electrical system.

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