United States Patent [19]

Switsen

[11] **3,740,477**

[45] **June 19, 1973**

[54] **SIMPLE SPEECH SCRAMBLER**

[76] Inventor: **Henry N. Switsen,** 17236 Bircher Street, Granada Hills, Calif. 91344

[22] Filed: **Sept. 16, 1971**

[21] Appl. No.: **180,966**

[52] **U.S. Cl.** ..... **179/1.5 R,** 179/1.5 E, 323/73

[51] **Int. Cl.** **H04I 9/00**

[58] **Field of Search** ..... 179/1.5 R, 1.5 E; 323/73

[56] **References Cited**

UNITED STATES PATENTS

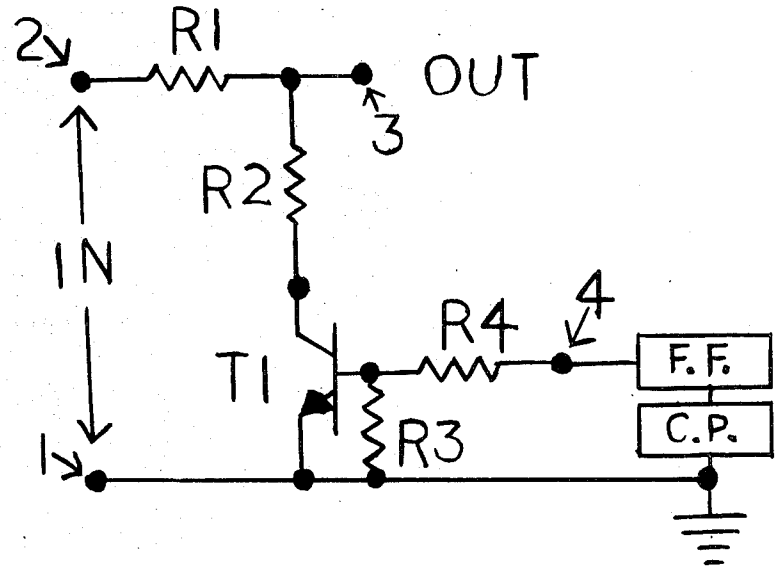
3,098,936 7/1963 Isabeau ..... 179/1.5 R

Primary Examiner—Robert F. Stahl
Assistant Examiner—H. A. Birmiel

[57] **ABSTRACT**

A system to make common speech unintelligible by causing the speech to be first broken up into high and low amplitude sections, and then to be made intelligible again by normalizing the amplitudes of the sections.

9 Claims, 3 Drawing Figures



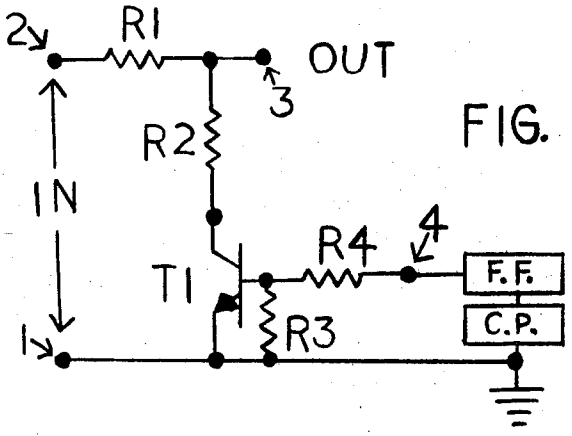


FIG. 1

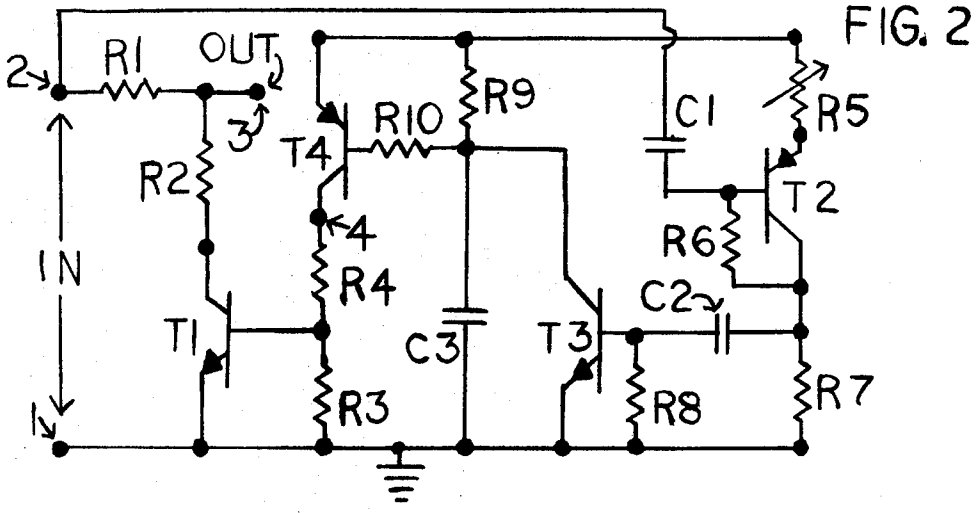


FIG. 2

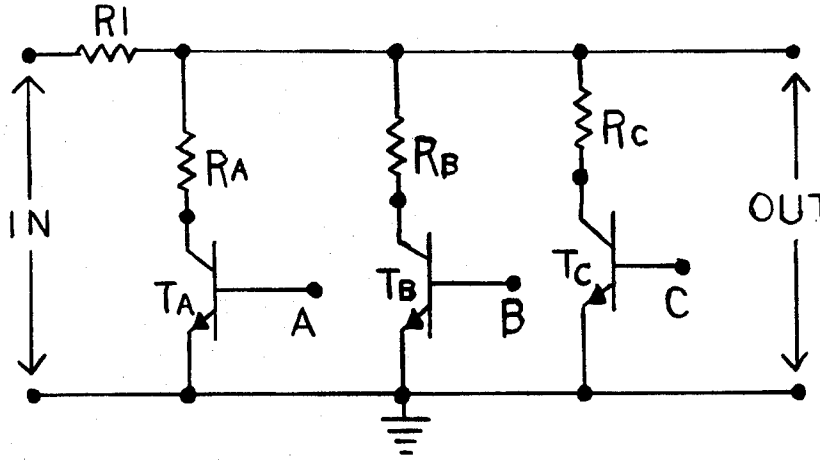


FIG. 3

INVENTOR HENRY N. SWITSEN

SIMPLE SPEECH SCRAMBLER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to apparatus for scrambling common speech so as to allow the transmission of the scrambled speech in privacy from possible eavesdroppers and then unscrambling the speech to allow the intelligence to be extracted.

2. Description of the Prior Art

Speech scramblers are often employed when it is desired to send messages which are subject to eavesdropping, and it is desired to keep the message confidential. After the message is transmitted, whether via radio, or telephone, the speech is unscrambled, or 'de-coded' and can be understood.

The most complex of these systems are used for very top secret communications within the government, and are elaborate and very expensive, and often are nearly impossible to unscramble without knowledge of the scrambling code used, since the speech is converted from actual speech into electronic pulses.

The more simpler forms of speech scramblers do not convert the speech to another medium, but instead mix up the frequencies of the voice so as to be unintelligible.

These methods still however, require comparatively elaborate scrambling (encoding) circuits, with multiple frequency sensing, and inverting, circuit functions. As well, the unscrambling (decoding) circuits must have similar circuit functions and very often, the scramblers and unscramblers must be crystal controlled to insure infrequent field adjustments and fairly accurate reconstructing of the original speech.

SUMMARY OF THE INVENTION

In accordance with one embodiment of the present invention, a very simple circuit is provided to render the speech unitelligible, and also easily reconstructable so as to allow a very cost of manufacture to be realized. This is accomplished by not changing the frequency characteristics of the original speech, but by rapidly changing the amplitude of small sections of speech. Then, if after transmission of the speech, the remaining sections of the speech are also changed in amplitude by the same amount, the result is the original speech at a different amplitude.

This is easily accomplished by merely using the same resistors in both the scrambler and unscrambler, and allows very accurate reconstruction of the original sounds simply, and economically.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagram of the scrambler.

FIG. 2 is a schematic diagram of the unscrambler.

FIG. 3 is a schematic diagram of a scrambler which has a plurality of amplitude levels.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 illustrates the main components of the scrambler, R1, R2, and T1, driven by the Flip-Flop (f.f.) which is driven by the Clock Pulse Generator (c.p.).

The audio is applied between the terminal points 1 and 2. Point 1 is the circuit common or ground. The speech is coupled to the output terminal 3 by resistor R1, and resistor R2 also connects to the point 3 and is coupled back to ground through the transistor switch T1.

When the switch T1 is energized or closed, the resistors R1 and R2 form a voltage divider which is as accurate as the resistors are. The audio can be attenuated whenever the switch is closed, instantaneously, and with no change in the quality of the speech.

The switch can be controlled by any suitable method, depending on precisely what desired output is desired. For explanational purposes a flip-flop and clock pulse generator are illustrated in FIG. 1.

The resistor R3 and R4 are simply coupling elements for the switch T1. When the output of the flip-flop is up, that is point 4 is up, the switch is ON. The audio signal is then attenuated according to the values of R1 and R2. When the point 4 is down, the audio is passed through the resistor R1 unattenuated since the switch T1 is then OFF.

The flip-flop is controlled by the clock pulse generator (c.p.) and is well known. The prefered duty cycle of the flip-flop should be with its output up for the majority of the time, so as to pass 'bursts' of speech to the output.

If the ratio of the resistors R1 and R2 is made large enough, say 25 to 1, and the clock pulse generator is run so as to cause the switch T1 to turn on and off several times per second, then the output will contain the complete audio signal, but the ear will perceive only the high amplitude portions which for speech will contain only partial words or syllables, and which will mask the balance of the low amplitude portions.

The result is audible only as a series of blips and blerps and the audio has been effectively 'scrambled' in so much as it is impossible to extract any intelligence from it.

The resulting audio signal can now be very easily 'unscrambled' if the resistor ratio of the scrambler is known. Note that R1-R2 could also be considered as a gain controlled amplifier with less than unity gain.

FIG. 2 shows the schematic of the unscrambler. It contains the same basic elements as FIG. 1, R1, R2, and T1. Now however the switch T1 is controlled by the audio itself, instead of a flip-flop and clock pulse generator.

The transistors and circuitry shown in FIG. 2 are to illustrate one possible method of "hardware" to accomplish the following:

The audio is at this time composed of high and low amplitude portions. The ratio of the high amplitude portions to the low amplitude portions is fairly high, so as to cause the masking of the low amplitude portion to the ear. If the switch is now made to turn on at the same point in time as the high amplitude portions of the audio arrive at the point 2 and are passed through R1 to point 3, then they will now be attenuated by the same amounts as the low amplitude portions were in the scrambler, if the ratio of R1 and R2 is still the same. It is the job of the associated circuitry to turn the switch T1 on during these times.

The audio signal is coupled to T2 through C1 and T2 is a class A audio amplifier which is gain controlled by R5. R6 biases T2 through load resistor R7, and the signal is coupled through C2 to T3 which is biased to class C operation by R8. The gain control R5 is adjusted so that T3 conducts only during the high amplitude portion of the audio signal. When T3 conducts, C3 is suddenly discharged and when T3 turns off again, C3 be-

gins charging through R9, R10 and the base junction of transistor T4. The time constant of C3 is long enough to prevent the voltage on C3 from rising significantly as T3 turns on and off at the audio rate, but is short enough to allow C3 to rise far enough to turn off T4 shortly after the last impulse from the large amplitude audio signal. T4 then, turns on and off only at the rate of change from high amplitude audio to low amplitude audio, but switches exactly in step with the amplitude changes of the incoming audio. The output of T4 is directly coupled to T1 through R4, and so T1 turns on at the precise point in time that the first impulse of the high amplitude audio arrives at point 2, and turns off when the low amplitude audio arrives at the point 2. If the same ratio for R1 and R2 exists in the unscrambler and scrambler, then the audio signal will reappear at point 3 of FIG. 2 reconstructed and once again unintelligible. There will only be an amplitude change in the signal appearing at point 3 as compared to the original signal input at the input terminals of FIG. 1. The output signal of FIG. 2 can then be simply amplified if desired.

Thus I have described an extremely simple system to scramble and then unscramble speech or any audio signal.

It is recognized that modifications and variations may readily occur to those skilled in the art and, consequently, it is intended that the claims be interpreted to cover such modifications and equivalents.

One such modification and variation is illustrated in FIG. 3. This shows a section of a scrambler similar to the one in FIG. 1, but now however, a plurality of transistors are employed to enable the speech to be further scrambled by containing more than one level of attenuation, and allowing also for the control of these various levels by different electronic (or other) signals. An example of one possible system might be to control transistor Ta from a flip-flop as before, but to control Tb from the frequency content of the input. Then transistor Tc might possibly be turned on for say 1 second, but only 1 second after both Ta and Tb were on together. The possibilities are limitless.

The unscrambler would simply do the opposite, and by the same amount.

What is claimed is:

1. An audio scrambler system in which portions of the original audio information signal are changed in amplitude so as to render the resulting audio signal effectively void of intelligence to the ear, comprising:

an audio source input, accepting original audio;

impedance divider means to reduce the amplitude of said original audio when said impedance divider means is in use to a level in excess of zero, so as to preserve the intelligence contained in the reduced amplitude audio which results when said impedance divider is in use;

controlled switch means to cause said impedance divider means to alternately be in and out of use, whereas the resulting output will contain all the intelligence contained in the original audio signal, but in a manner unintelligible to the ear.

2. The circuit described in claim 1 wherein:

said impedance divider means include two resistors.

3. The circuit described in claim 1 wherein:

said controlled switch means includes a transistor.

4. The circuit described in claim 3 wherein:

said transistor is controlled by a flip-flop.

5. An audio unscrambler system in which only portions of the original audio information, which is now scrambled audio information, are changed only in amplitude so as to render the resulting audio signal clearly intelligible to the listener, comprising:

an audio source input, accepting original audio; said original audio having been previously scrambled in such a way that it contains both high amplitude portions, and low amplitude portions, in a predetermined amplitude ratio;

impedance divider means to reduce the amplitude of the said original audio when in use; said reduction to be such that the amplitude ratio of the unreduced said original audio to the reduced said original audio shall be similar to the said predetermined amplitude ratio;

controlled switch means to cause said impedance divider means to alternately be in and out of use, so as to cause only said high amplitude portions of said original audio to reduced in amplitude, and thereby render said original audio clearly intelligible to the listener.

6. The circuit described in claim 5 wherein:

said impedance divider means includes two resistors.

7. The circuit described in claim 5 wherein:

said controlled switch means includes a transistor.

8. The circuit described in claim 1 wherein:

said impedance divider means includes a plurality of attenuators which can be in use separately.

9. The circuit described in claim 5 wherein:

said impedance divider means includes a plurality of attenuators which can be in use separately.

* * * * *