United States Patent

Fathauer

[15] **3,686,571**

[45] **Aug. 22, 1972**

[54] **SPEECH SCRAMBLER**

[72] Inventor: **George H. Fathauer,** Decatur, Ill.

[73] Assignee: **Zaring Industries, Inc.,** Carmel, Ind.

[22] Filed: **Aug. 1, 1969**

[21] Appl. No.: **846,831**

[52] **U.S. Cl.**.....**325/32,** 179/1.5 R, 179/1.5 FS

[51] **Int. Cl.**.....**H04k 1/00**

[58] **Field of Search** 325/32, 122; 179/1.5

[56] **References Cited**

UNITED STATES PATENTS

2,206,590	7/1940	Webb, Jr.	179/1.5
2,953,643	9/1960	Koenig, Jr.	325/32
2,301,455	11/1942	Roberts	179/1.5

Primary Examiner—Benjamin A. Borchelt

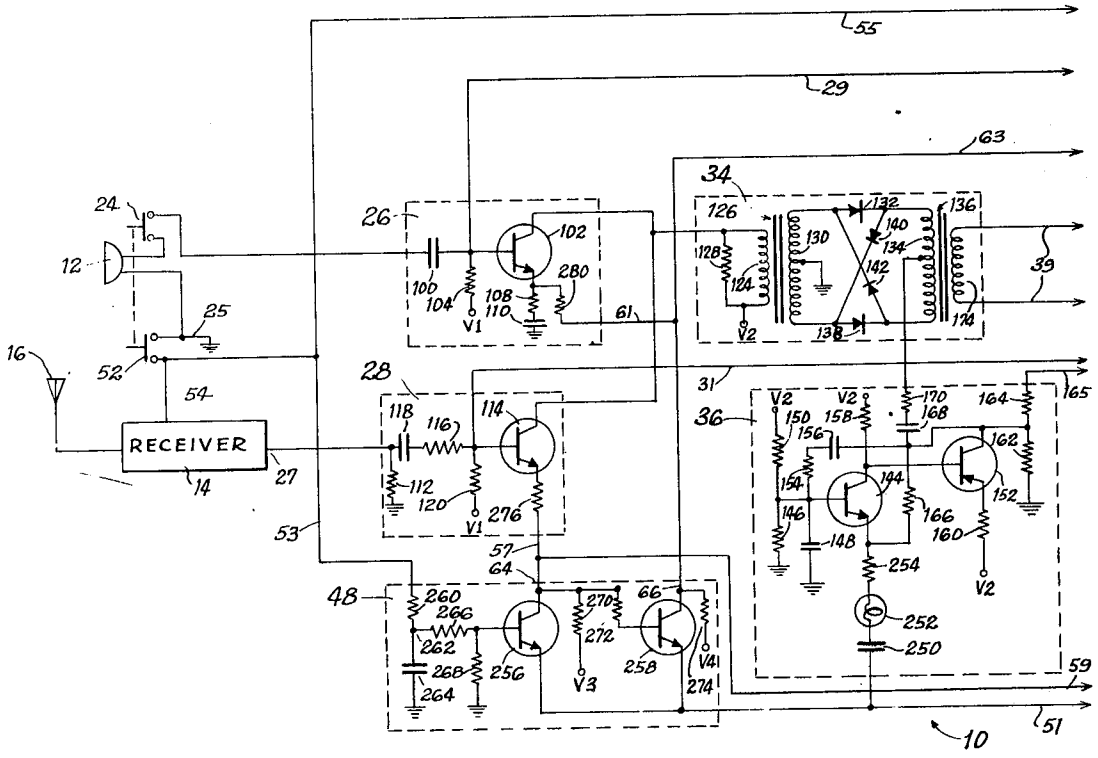
Assistant Examiner—H. A. Birmiel

Attorney—Pendleton, Neuman, Williams & Anderson

[57] **ABSTRACT**

A speech scrambler for use with conventional mobile communications systems is described including signal gating circuitry so that it may be operated by a simple push button transmitter switch and in the scramble or clear modes without modification of the equipment with which it is used.

10 Claims, 2 Drawing Figures

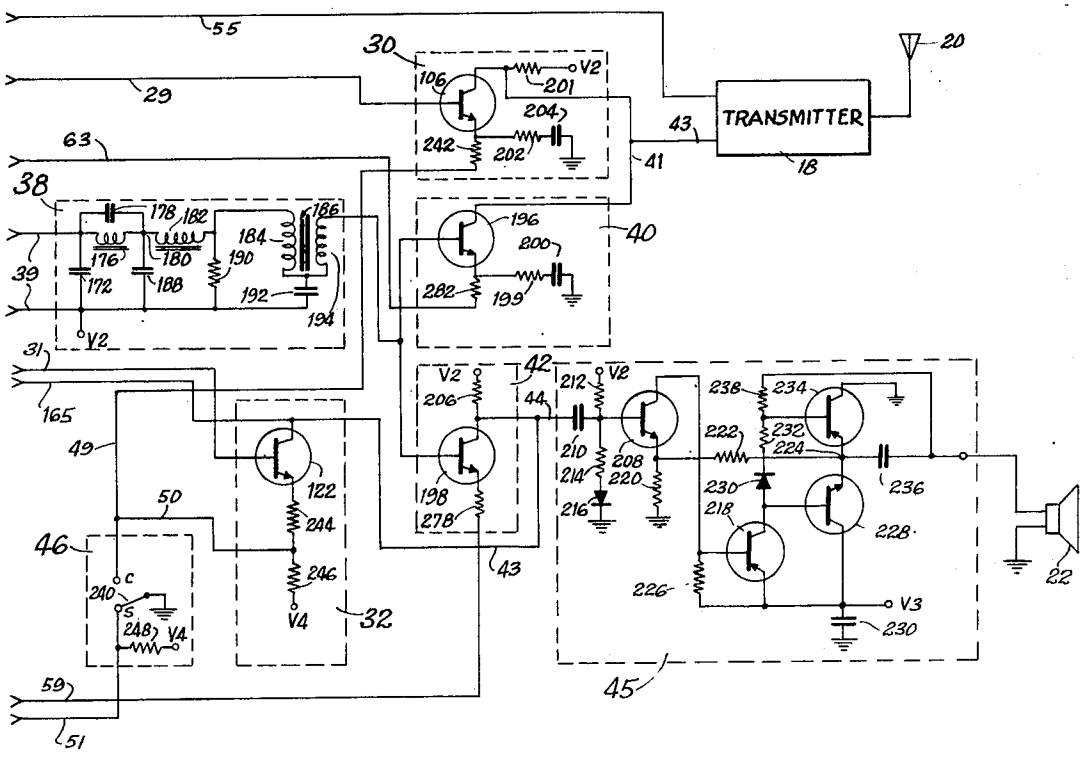


United States Patent

Fathauer

[15] **3,686,571**

[45] **Aug. 22, 1972**



Patented Aug. 22, 1972 3,686,571

2 Sheets-Sheet 1

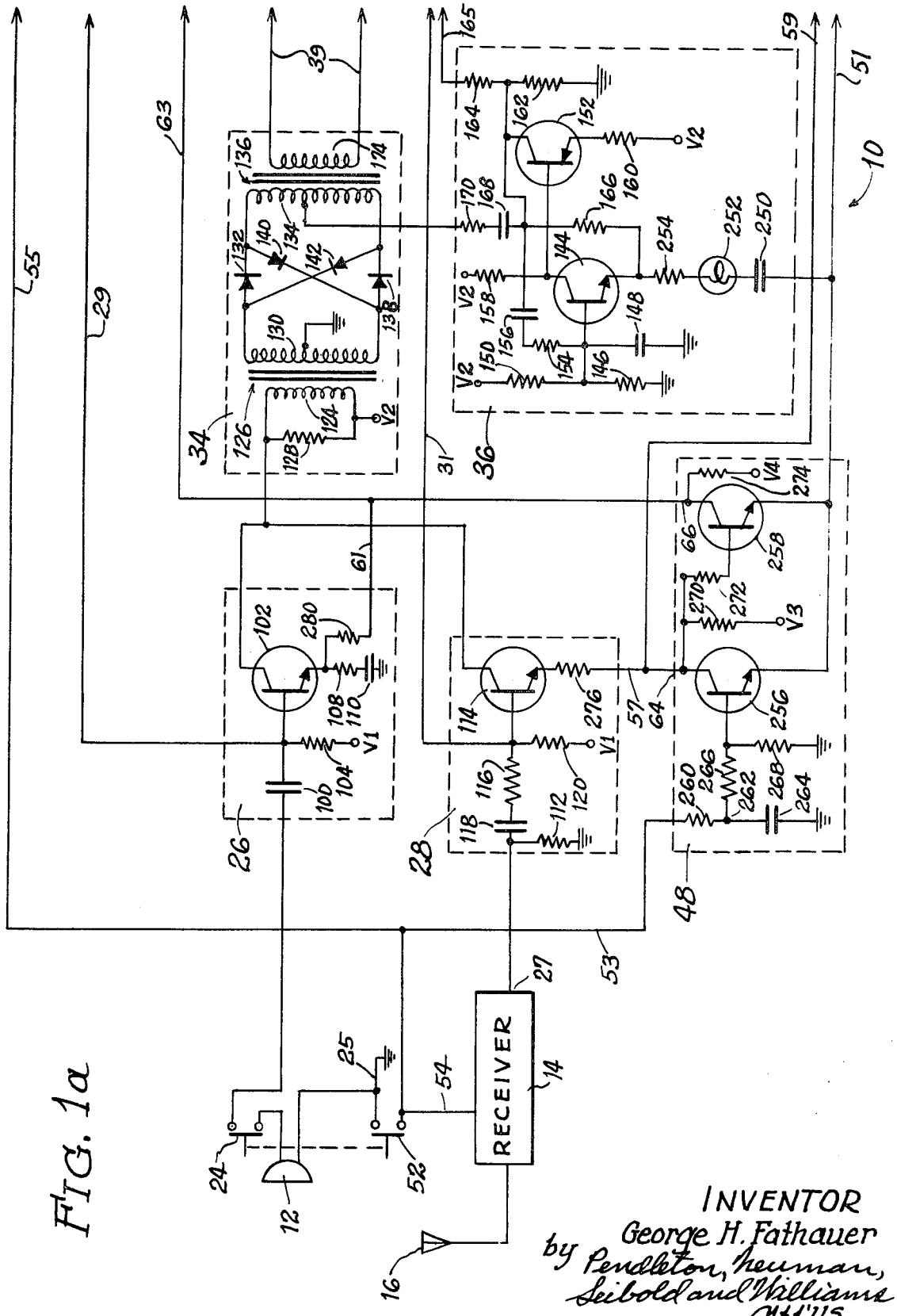


FIG. 1a

INVENTOR
George H. Fathauer
by Pendleton, Neuman, Seibold and Williams
Att'ys

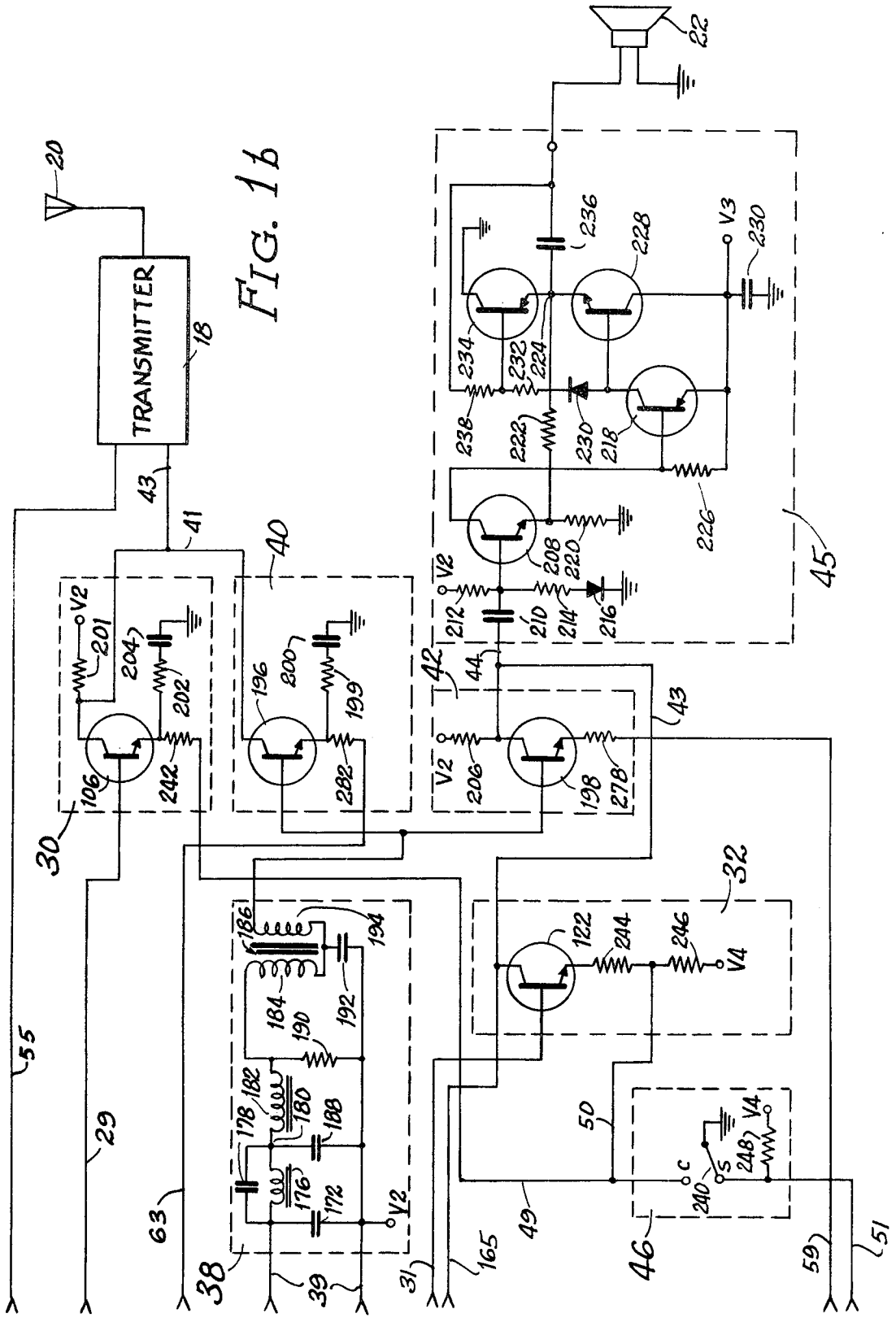

TRANSMITTER
18
20
22
30
32
38
40
42
43
45
46
49
50
51
55
59
63
165
V2
V3
V4
106
122
178
180
182
184
186
188
190
192
194
196
198
199
200
201
202
204
206
208
210
212
214
216
218
220
222
224
226
228
230
232
234
236
238
240
242
244
246
248
278
282

FIG. 1b

SPEECH SCRAMBLER

BACKGROUND OF THE INVENTION

This invention relates to speech scramblers and more particularly to the provision in speech scramblers of gating circuitry enabling them to operate with a push button transmitter switch and in the scramble or clear modes with conventional mobile communications equipment without modification of that equipment.

Various speech scramblers providing security and privacy in mobile communications systems, such as those used by police and fire departments and taxi cab companies, have been proposed in the past. They have, however, had many disadvantages. Often they were incorporated into complete communications systems and were not easily adapted for use in existing systems. If they could be used with existing systems, they usually required that electrical and/or physical modifications be made on the existing equipment. Further, prior scramblers often did not provide for easy switching between the scramble and nonscramble or clear modes or for push-to-talk operation in both modes. Many prior scramblers used separate circuitry for the scrambling and unscrambling operations in the receive and transmit modes resulting in equipment of unnecessary complexity. Finally, scramblers found in the prior art have generally been unnecessarily large and bulky without the small size and light weight desirable for use in mobile systems.

SUMMARY OF THE INVENTION

This invention provides a speech scrambler having gating circuitry selectively enabling use in the scramble or clear modes with simple push-to-talk switching for use with existing mobile communications systems without modifying those systems. More specifically, this invention provides two similar sets of gate/amplifier chains, one operated to transmit and one operated to receive but both using a common scrambler circuit, and appropriate switching circuitry to selectively activate either one of the chains and the scrambler circuit depending on the desired mode of operation.

It is, accordingly, an object of this invention to provide a speech scrambler having gating circuitry allowing it to be operated in both the scramble and clear modes and with push-to-talk switching.

It is an object of this invention to provide circuitry for use with a speech scrambler allowing selective operation in the scramble and clear modes and with push-to-talk switching.

It is an object of this invention to provide a speech scrambler adapted for use with existing mobile communication systems without modification of those systems.

It is an object of this invention to provide a speech scrambler for use in mobile communications systems in which the same circuitry is used for both scrambling in the transmit mode and unscrambling in the receive mode.

It is an object of this invention to provide a speech scrambler which may be physically contained in a unit of compact size and lightweight construction.

It is an object of this invention to provide a speech scrambler which is characterized by simplicity of design and economy of construction.

Further and additional objects will appear from the description, accompanying drawing, and appended claims.

DESCRIPTION OF THE DRAWING

FIGS. **1***a* **1***b* comprise a diagram, partly in block form and partly in schematic form, of a speech scrambler incorporating one embodiment of this invention and showing how it may be used with components of a mobile communications system. For ease in understanding, the two figures should be placed end-to-end so that the similarly numbered conductors are aligned.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A speech scrambler **10** including a preferred embodiment of this invention is disclosed in the drawing. Its general operation and relationship to the other components of a conventional mobile communications system with which it may be used will be described first followed by the circuit details.

The system includes a conventional microphone **12** and receiver **14** with receiving antenna **16** at the left side of FIG. **1***a*, a conventional transmitter **18** with transmitter antenna **20** and a speaker **22** at the right side of FIG. **1***b*, and the special circuitry of this invention therebetween.

The microphone **12** is coupled through a normally open first push-to-talk switch **24** between a common ground connection **25** and an audio input of a transmit preamplifier **26**. The communications receiver **14** has a radio frequency input connected to the antenna **16** and an audio frequency output **27**, adapted normally to drive a low impedance speaker, but connected to an audio input of a receive preamplifier **28**. The audio signal from microphone **12** is also coupled from transmit preamplifier **26** through conductor **29** to a transmit clear gate **30** (FIG. **1***b*) while the audio signal from receiver **14** is coupled from receive preamplifier **28** through conductor **31** to a receive clear gate **32**. Transmit preamplifier **26**, receive preamplifier **28**, transmit clear gate **30**, and receive clear gate **32** all have, in addition to the respective signal inputs, a control input and they supply, at an appropriate output, an audio signal proportional to the input signal when an enabling signal is presented to the respective control input. Transmit preamplifier **26** and receive preamplifier **28** also amplify their respective applied audio signals and perform an impedance matching function.

The outputs of transmit preamplifier **26** and receive preamplifier **28** are applied together to a first input of a balanced modulator **34**. An output from a subcarrier signal oscillator **36**, in this case operating at approximately 3 KHertz, is applied to a second input of balanced modulator **34**. The balanced modulator output is supplied to a low pass filter **38** through conductors **39**. The balanced modulator and filter combination frequency shifts and inverts the applied audio signal.

During transmission, the speech signal from transmit preamplifier **26** is modulated onto a 3 KHertz carrier by the balanced modulator **34** producing a double sideband, suppressed carrier signal centered about 3 KHertz. The low pass filter **38** limits the modulator output to an upper frequency of approximately 3 KHertz and thus supplies at its output only the lower sideband. That lower sideband is in the frequency range of 0 to 3 KHertz and is frequency inverted from the original speech signal, i.e. frequencies at the lower end of its

range correspond to high frequencies in the speech signal and frequencies at the upper end of its range correspond to low frequencies in the speech signal. If speech in this form is intercepted, it has been found to be unintelligible. If a signal from a transmitter utilizing a similar scrambler is applied through receiver **14** and receive preamplifier **28** to balanced modulator **34**, it will be modulated onto the 3 KHertz subcarrier producing another double sideband, suppressed carrier signal centered about 3 KHertz, the lower sideband appearing in the original frequency range of 0 to 3 KHertz and containing the reinverted speech signal and the upper sideband appearing in the frequency range of 3 to 6 KHertz. That upper sideband is suppressed by low pass filter **38**. In actual operation of this circuit, scrambling is achieved up to about 2.7 KHertz.

The output of the low pass filter **38** is connected to an audio input of a transmit driver **40** and an audio input of a receive driver **42**; each driver delivers at its output an amplified audio signal when an enabling signal is presented to a respective control input. The outputs of transmit clear gate **30** and transmit driver **40** are connected together through conductor **41** and connected through conductor **43** to an audio input of the conventional, mobil communications transmitter **18** which modulates the audio signal onto a radio frequency carrier and supplies the resultant signal to the antenna **20**. Antennas **16** and **20** may, of course, be the same antenna used both to transmit and receive and some of the transmitter or receive circuitry may serve dual purposes. The outputs of receive clear gate **32** and receive driver **42** are connected together through conductor **43** and connected through conductor **44** to an input of a receive audio power amplifier **45** which drives speaker **22** connected to its output.

A scramble/clear switch **46** (FIG. **1***b*) and a transmit/receive switch circuit **48** (FIG. **1***a*) control the scrambler operation. The scramble/clear switch **46** is a manual switch for selecting whether the scrambler is to be operated in the scramble mode or the nonscramble, clear mode such that the speech signals are not processed by the modulator and filter. The transmit/receive switch circuit functions to correlate the mode of the scrambler with the transmit/receive mode of the associated equipment but is effective only when switch **46** is first placed in the "scramble" position. Switch **46** has an output coupled to the control inputs of transmit clear gate **30** through conductor **49** and receive clear gate **32** through conductor **50** and an output coupled to a control input of oscillator **36** and a first input of transmit/receive switch **48** both through conductor **51**. The control input of oscillator **36** enables or disables the oscillator depending on the signal applied. A second normally open push-to-talk switch **52** at microphone **12** is coupled between ground and a second input of transmit/receive switch **48** through conductor **53**, a control input of receiver **14** through conductor **54**, and a control input of transmitter **18** through conductor **55**. The control inputs to receiver **14** and transmitter **18** determine whether either is in an active or standby condition. The common junction of those inputs is normally maintained at a predetermined d.c. voltage by a power source within receiver **14** in conventional mobile communications receivers for operation of their own push-to-talk circuits. Coupling that source to ground by actuating switch **52** changes the voltage at the control inputs to receiver **14** and transmitter **18** placing receiver **14** on standby and activating transmitter **18**. Switches **48** and **52** are actuated by a common manual push button. A first output from transmit/receive switch **48** is connected to the control input of receive preamplifier **28** through conductor **57** and the control input of receive driver **42** through conductor **59** and a second output is connected to the control input of transmit preamplifier **26** through conductor **61** and the control input of transmit driver **40** through conductor **63**.

Scramble/clear switch **46** is such that when it is in the clear position, disabling signals are applied to the first input of transmit/receive switch **48** and the control input of oscillator **36** through conductor **51** but enabling signals are applied to transmit clear gate **30** through conductor **49** and receive clear gate **32** through conductor **50**. Thus the audio signals from microphone **12** pass through conductor **29** and the transmit clear gate **30** to the transmitter **18** and the signals from receiver **14** pass through conductor **31** and the receiver clear gate **32** to the speaker **22** essentially unchanged and the communication system is used in the normal manner.

When scramble/clear switch **46** is in the scramble position, disabling signals are applied to the transmit clear gate and the receive clear gate by removing the ground connection from conductors **49** and **50**, but enabling signals are applied to the oscillator and transmit/receive switch by grounding conductor **51**. The transmit/receive switch **48** is such that when it is disabled by scramble/clear switch **46**, disabling signals are applied from outputs **64** and **66** over conductors **61**, **57**, **63**, and **59** to transmit preamplifier **26**, receive preamplifier **28**, transmit driver **40**, and receive driver **42**, respectively, irrespective of the second push-to-talk switch **52**; when it is enabled by scramble/clear switch **46**, transmit/receive switch **46** normally supplies disabling signals to transmit preamplifier **26** and transmit driver **40** and enabling signals to receive preamplifier **28** and receive driver **42** when second push-to-talk switch **52** is released or open but enabling signals to transmit preamplifier **26** and transmit driver **40** and disabling signals to receive preamplifier **28** and receive driver **42** when second push-to-talk switch **52** is depressed or closed. Thus, the same push-to-talk switch **52** used to control the operation of receiver **14** and transmitter **18** also controls the operation of the transmit and receive channels of scrambler **10**.

Turning now to the details of the circuitry, microphone **12** is coupled through first push-to-talk switch **24** and capacitor **100** to the base of NPN transistor **102** in transmit preamplifier **26**. The base of that transistor is additionally coupled through a resistor **104** to a first source of positive voltage V1 and directly through conductor **29** to the base of NPN transistor **106** in transmit clear gate **30**. The emitter of transistor **102** is connected to ground through the series combination of a resistor **108** and a capacitor **110**. The value of resistor **108** may conveniently be varied to alter the gain of transmit preamplifier **26** and compensate for variations in the output levels of different microphones **12** used with the scrambler.

voltage V4. A second, "scramble" pole of switch **240** is connected through a resistor **248** to the fourth source of positive voltage V4, through the series combination of conductor **51**, a capacitor **250**, an incandescent lamp **252**, and a resistor **254** to the emitter of first oscillator transistor **144**, and directly through conductor **51** to the emitters of a first NPN transistor **256** and a second NPN transistor **258** in transmit/receive switch **48**. The common pole of switch **240** is connected to ground. Incandescent lamp **252** will be ignited when switch **240** is thrown to put the scrambler in the scramble mode.

The input from second push-to-talk switch **52** is coupled through conductor **53** and a resistor **260** to a circuit point **262** in transmit/receive switch **48** which is, in turn, coupled both to ground through a capacitor **264** and to the base of transistor **256** through a resistor **266**. The base of transistor **256** is additionally coupled to ground through a resistor **268** and the collector is coupled to the third source of positive voltage V3 through a resistor **270** and to the base of transistor **258** through a resistor **272**. A resistor **274** connects fourth positive voltage source V4 to the collector of transistor **258**. A first output **64** from transmit/receive switch **48** is taken from the collector of transistor **256** and coupled through a conductor **57** and a resistor **276** to the emitter of transistor **114** in receive preamplifier **22** and through conductor **59** and a resistor **278** to the emitter of transistor **198** in receive driver **42**. A second output **66** from transmit/receive switch **48** is taken from the collector of transistor **258** and coupled through conductor **61** and a resistor **280** to the emitter of transistor **102** in receive preamplifier **26** and through conductor **63** and a resistor **282** to the emitter of transistor **196** in transmit driver **40**.

In one application of the above-described embodiment, the components used had the following values:

Capacitor **100**	0.047 Microfarads
Resistor **104**	33 Kohms
Resistor **108**	470 Ohms
Capacitor **110**	100 Picofarads
Resistor **112**	4 Ohms
Resistor **116**	68 Kohms
Capacitor **118**	0.015 Microfarads
Resistor **120**	33 Kohms
Resistor **128**	1.5 Kohms
Resistor **146**	12 Kohms
Capacitor **148**	0.01 Microfarads
Resistor **150**	10 Kohms
Resistor **154**	5.1 Kohms
Capacitor **156**	0.01 Microfarads
Resistor **158**	4.7 Kohms
Resistor **160**	120 Ohms
Resistor **162**	330 Ohms
Resistor **164**	1.2 Megohms
Resistor **166**	1.2 Kohms
Capacitor **168**	0.047 Microfarads
Resistor **170**	1.8 Kohms
Capacitor **172**	0.047 Microfarads
Inductor **176**	100 Millihenries
Capacitor **178**	0.018 Microfarads
Inductor **182**	100 Millihenries
Capacitor **188**	0.082 Microfarads
Resistor **190**	1.5 Kohms
Capacitor **192**	0.01 Microfarads
Resistor **199**	330 Ohms
Capacitor **200**	100 Picofarads
Resistor **201**	470 Ohms
Resistor **202**	470 Ohms
Capacitor **204**	100 Picofarads
Resistor **206**	2.7 Kohms
Capacitor **210**	0.047 Microfarads
Resistor **212**	82 Kohms
Resistor **214**	10 Kohms
Resistor **220**	220 Ohms
Resistor **222**	2.2 Kohms
Resistor **226**	10 Kohms
Capacitor **230**	150 Picofarads
Resistor **232**	15 Ohms
Capacitor **236**	400 Picofarads
Resistor **238**	220 Ohms
Resistor **242**	470 Ohms
Resistor **244**	3.9 Kohms
Resistor **246**	10 Kohms
Resistor **248**	10 Kohms
Capacitor **250**	30 Picofarads
Resistor **254**	220 Ohms
Resistor **260**	22 Kohms
Capacitor **264**	15 Picofarads
Resistor **266**	2.2 Kohms
Resistor **268**	10 Kohms
Resistor **270**	10 Kohms
Resistor **272**	22 Kohms
Resistor **274**	3.3 Kohms
Resistor **276**	1 Kohm
Resistor **278**	1 Kohm
Resistor **280**	1 Kohm
Resistor **282**	470 Ohms

The first through fourth positive voltage sources, **V1**, **V2**, **V3**, and **V4**, were 2.5 volts, 10 volts, 12 volts, and 5 volts, respectively. In other applications of this invention, resistors **190**,**199**, and **202** and capacitors **200** and **204** may be deleted.

In the one application of the embodiment described above, all of the circuitry of scrambler **10** and a power supply developing the required voltages from a positive 12-volt source were contained within a single enclosure approximately 5 inches by 4 inches by 8 inches.

It will be obvious that certain modifications of the specific embodiment described may be made without departing from the spirit and scope of this invention. For example, the circuits of the amplifiers, the gates, the modulator, the oscillator, and the low pass filter are subject to wide variation. The frequency ranges of the band limited signals and the frequency of the subcarrier signal onto which the speech signals are modulated may be altered. The described embodiment might also be modified to be used with communication systems having different configuration from that shown. Further, scramblers incorporating this invention might be used to scramble information in forms other than speech.

It will thus be seen that a scrambler has been provided which fulfills all of the above-mentioned objects. While a particular embodiment of this invention is shown above, it will be understood, of course, that the invention is not to be limited thereto, since many modifications may be made. It is contemplated, therefore, by the appended claims, to cover any such modifications that fall within the true spirit and scope of this invention.

I claim:

1. A speech scrambler unit for use with a communication station having a speech signal originator, a speech signal reproducer, a radio frequency transmitter, a radio frequency receiver, and first switching means for alternately enabling said transmitter or said receiver, said scrambler comprising:

input means for coupling to an output of said speech signal originator and an audio signal output of said receiver;

output means for coupling to said speech signal reproducer and an audio signal input of said transmitter;

speech coding means having input means and output means for coding and decoding speech signals applied to said speech coding means input means;

The output 27 of receiver 14 is coupled to ground through a resistor 112 and to the base of an NPN transistor 114 in receive preamplifier 28 through the series combination of a resistor 116 and a capacitor 118. The base of that transistor is additionally coupled to the first source of positive voltage V2 through a resistor 120 and directly through conductor 31 to the base of an NPN transistor 122 in receive clear gate 32. Resistor 112 determines the load impedance of receiver 18 and has a value required to match the receiver output impedance. It should also have a relatively high power rating, typically about 5 watts, depending upon the output power of the receiver.

The collectors of transistors 102 and 114 are connected together and coupled through a primary winding 124 on a first modulator transformer 126 to a second source of positive voltage V2. Resistor 128 is connected across primary winding 124. A first end of a secondary winding 130 of transformer 126 is coupled through a diode 132 to a first end of a primary winding 134 of a second modulator transformer 136 and a second end of secondary winding 130 of transformer 126 is coupled through a diode 138 to a second end of primary winding 134 of second transformer 136. A diode 140 connects the first end of primary winding 134 to the second end of secondary winding 130 and diode 142 connects the first end of secondary winding 130 to the second end of primary winding 134. Diodes 132 and 138 are oriented so that their direction of high positive conductivity is from secondary winding 130 to primary winding 134; diodes 140 and 142 are oriented so that their direction of high positive conductivity is from primary winding 134 to secondary winding 130. A center tap of secondary winding 130 is connected to ground.

The base of an NPN transistor 144 in oscillator 36 is coupled to ground through the parallel combination of a resistor 146 and a capacitor 148, to the second positive voltage source V2 through a resistor 150, and to the collector of a PNP transistor 152 through the series combination of a resistor 154 and a capacitor 156. The collector of transistor 144 is coupled through a resistor 158 to second positive voltage source V2 and directly to the base of transistor 152. A resistor 160 is connected between the emitter of transistor 152 and the second positive voltage source V2. The collector of transistor 152 is additionally coupled to ground through a resistor 162, to the collector of transistor 122 in receive clear gate 32 through a resistor 164 and conductor 165, to the emitter of transistor 144 through a resistor 166, and to a center tap on primary winding 134 of second modulator transformer 136 through a capacitor 168 and a resistor 170. Transistors 144 and 152 and their associated components form an RC bridge oscillator. The oscillator frequency must be relatively accurately controlled and at a predetermined value to insure that scrambled received signals will be properly demodulated by an oscillator signal very close in frequency to that used to scramble the signal. This may be achieved by using components for capacitors 148 and 156 and resistors 150 and 154 which have close tolerances, such as two per cent for the resistors and five per cent for the capacitors. Resistor 164 couples oscillator 34 with the input to amplifier 45 to cancel out any 3 KHertz signal in the audio output.

A capacitor 172 (in filter 38 of FIG. 1*b*) is connected across a secondary winding 174 of second modulator transformer 136. In filter 38, a first end of secondary winding 174 is coupled through the parallel combination of an iron core inductor 176 and a capacitor 178 to a circuit point 180 and then through an iron core inductor 182 to a first end of a primary winding 184 on a variable core coupling transformer 186. A second end of secondary winding 174 is connected to first positive voltage source V1, to circuit point 180 through a capacitor 188, to the first end of primary winding 184 through a resistor 190, and to a second end of primary winding 184 through a capacitor 192. The second end of primary winding 184 is coupled through a secondary winding 194 on coupling transformer 186 to the bases of both an NPN transistor 196 in transmit driver 40 and an NPN transistor 198 in receive driver 42.

The emitter of transistor 196 is connected, in turn, to resistor 199, capacitor 200, and ground. The collector of transistor 196 is coupled through conductor 41 to the collector of transistor 106 in transmit clear gate 30 and thence through a resistor 201 to the second source of positive voltage V2 and through conductor 42 to the audio input of transmitter 18. The emitter of transistor 106 is connected, in turn, to a resistor 202, a capacitor 204, and ground.

The collector of transistor 198 in receive driver 42 is coupled to the collector of transistor 122 in receive clear gate 32 through conductor 43, to the second source of positive voltage V2 through a resistor 206, and to the base of an NPN transistor 208 in power amplifier 45 through conductor 44 and a capacitor 210. The base of transistor 208 is also coupled to the second source of positive voltage V2 through a resistor 212 and to ground through the series combination of a resistor 214 and a diode 216, the diode being oriented so that its direction of high positive conductivity is towards ground; the collector is coupled to the base of a PNP inverter transistor 218; and the emitter is coupled both through a resistor 220 to ground and through a resistor 222 to a circuit point 224. The base and emitter of transistor 218 are connected together through a resistor 226, the emitter being additionally coupled to a third source of positive voltage V3, to the collector of an NPN first complementary output transistor 228, and through a bypass capacitor 230 to ground. The collector of transistor 218 is coupled directly to the base of transistor 228 and through the series combination of a diode 230 and a resistor 232 to the base of a PNP second complementary output transistor 234. The collector of transistor 234 is connected to ground. The emitters of transistors 228 and 234 are connected to circuit point 224 and that circuit point is coupled through the series combination of a capacitor 236 and a resistor 238 to the base of transistor 234. The output of receive power amplifier 45 is taken from the junction of capacitor 236 and resistor 238 and applied to speaker 22.

A first, "clear" pole of single pole double throw scramble/clear switch 240 in switch circuit 46 is coupled through a conductor 49 and a resistor 242 to the emitter of transmit clear gate transistor 106, through conductor 50 and a resistor 244 to the emitter of receive clear gate transistor 122, and through conductor 50 and a resistor 246 to a fourth source of positive

first gating means coupled to said input means, said speech coding means input means, and said switching means for applying the signal generated by said speech signal originator to said speech coding means input means when said transmitter is enabled and applying the signal at said receiver audio output to said speech coding means input means when said receiver is enabled;

second gating means coupled to said output means, said speech coding means output means, and said switching means for applying the signal at said speech coding means output means to said transmitter audio input when said transmitter is enabled and applying the signal at said speech coding means output means to said speech signal reproducer when said receiver is enabled; and

second switching means for selectively defeating said speech coding means and applying the signal generated by said speech signal originator to said transmitter audio input and applying the signal at said receiver audio output to said speech signal reproducer.

2. The speech scrambler unit of claim **1** wherein said speech coding means comprises:

an oscillator for generating a subcarrier signal;

a balanced modulator coupled to said speech coding means input means; and

a filter for attenuating the relative amplitude of signals having a frequency greater than that of said subcarrier signal coupled to the output of said balanced modulator and said speech coding means output means.

3. The speech scrambler unit of claim **2** wherein said speech signal originator comprises a microphone and said speech signal reproducer comprises a speaker.

4. A speech scrambler unit for use with a communications station having a speech signal originator, a speech signal reproducer, a radio frequency transmitter, a radio frequency receiver, and first switching means for alternately enabling said transmitter or said receiver, said scrambler comprising:

a first input for coupling to an output of said originator;

a second input for coupling to an audio signal output of said receiver;

a first output for coupling to an audio signal input of said transmitter;

a second output for coupling to said reproducer;

speech coding means having an input and an output for coding and decoding speech signals applied to said speech coding means input;

first gating means coupled to said first switching means, said first input, said second input, and said coding means input for delivering the signal present at said first input to said coding means input and isolating said second input from said coding means input when said first switching means enables said transmitter and delivering the signal present at said second input to said coding means input and isolating said first input from said coding means input when said first switching means enables said receiver;

second gating means coupled to said first switching means, said first output, said second output, and said coding means output for delivering the signal present at said coding means output to said first output and isolating said coding means output from said second output when said first switching means enables said transmitter and delivering the signal present at said coding means output to said second output and isolating said coding means output from said first output when said first switching means enables said receiver; and

second switching means for selectively defeating said processor and delivering said signal at said first input to said first output and delivering the signal at said second input to said second output.

5. The speech scrambler unit of claim **4** wherein said first switching means is manually operable.

6. The speech scrambler unit of claim **5** wherein said coding means comprises means for frequency inverting the signal applied to said coding means input means.

7. A communications unit comprising:

radio frequency signal transmitting means;

radio frequency signal receiving means;

speech signal origination means;

speech signal reproducer means;

coding means having input means and output means for coding and decoding signals applied to said coding means input means;

first switching means for rendering said coding means responsive to a signal from said origination means and said coding means nonresponsive to a signal from said receiving means when said first switching means is in a first state and rendering said coding means responsive to a signal from said receiving means and nonresponsive to a signal from said origination means when said first switching means is in a second state;

second switching means for rendering said reproducer means responsive to the coding means output means and said transmitting means nonresponsive to the coding means output means when said first switching means is in said first state and rendering said transmitting means responsive to said coding means output means and said reproducer means nonresponsive to said coding means output means when said first switching means is in said second state; and

third switching means for selectively defeating said coding means and rendering said transmitting means responsive to a signal from said origination means and rendering said reproducer means responsive to a signal from said receiving means.

8. The communications unit of claim **7** further comprising fourth switching means for manually controlling the states of said first and second switching means.

9. The communications unit of claim **8** wherein said coding means comprises means for frequency inverting the signal applied to said coding means input means.

10. The communications unit of claim **9** wherein said frequency inverting means comprises:

oscillation means for generating a subcarrier signal;

a balanced modulator coupled to said coding means input means and said oscillation means;

a filter for attenuating the relative amplitude of signals having a frequency greater than that of said subcarrier signal coupled to the output of said balanced modulator and said coding means output means.

* * * * *