

Oct. 22, 1946.

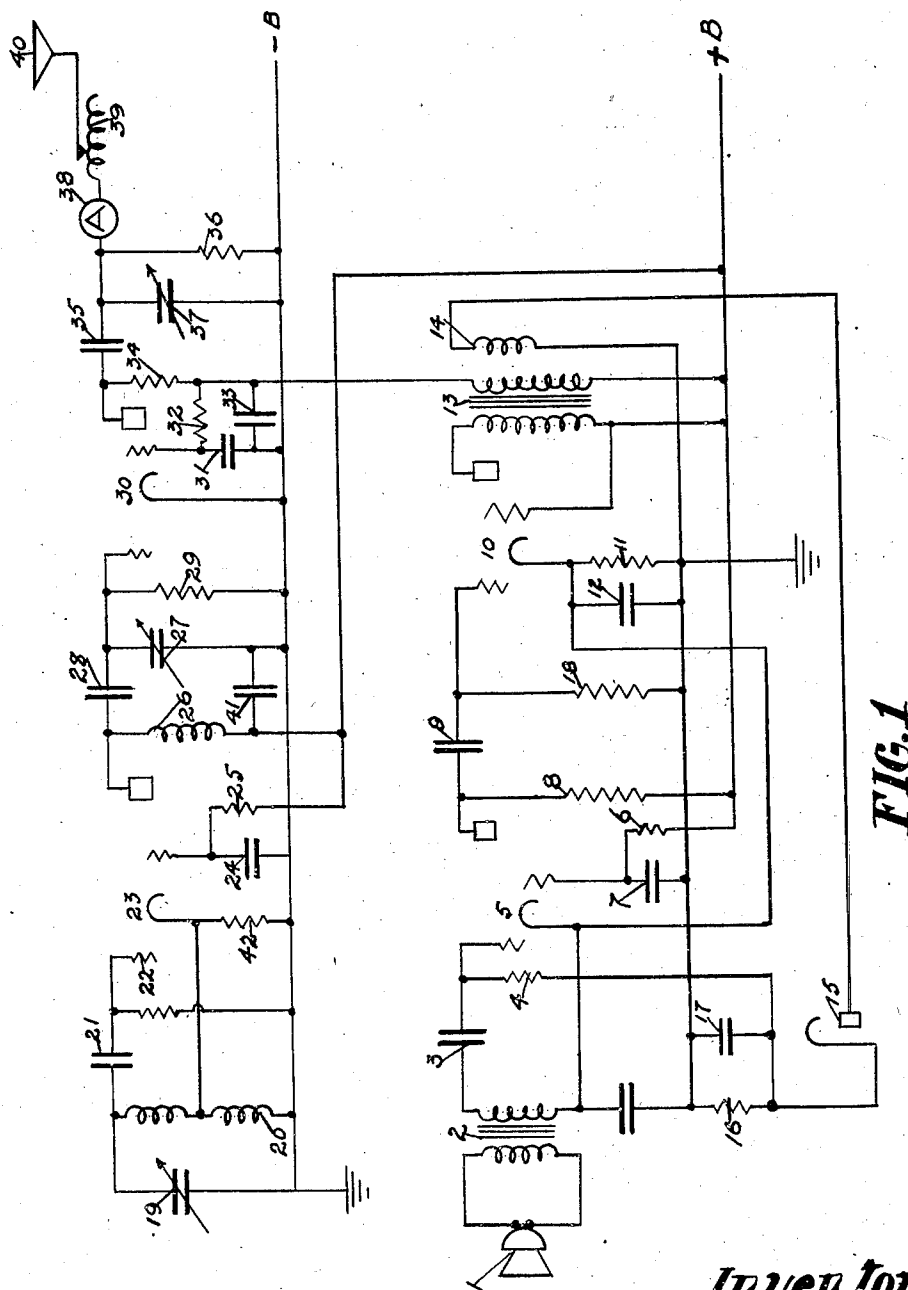
S. T. FISHER

2,409,977

MEANS FOR SUPPRESSION OF NOISE IN COMMUNICATION SYSTEMS

Filed June 14, 1944

3 Sheets-Sheet 1



Inventor
SIDNEY T. FISHER

per
J. J. Hardman
Attorney

Oct. 22, 1946.

S. T. FISHER

2,409,977

MEANS FOR SUPPRESSION OF NOISE IN COMMUNICATION SYSTEMS

Filed June 14, 1944

3 Sheets-Sheet 2

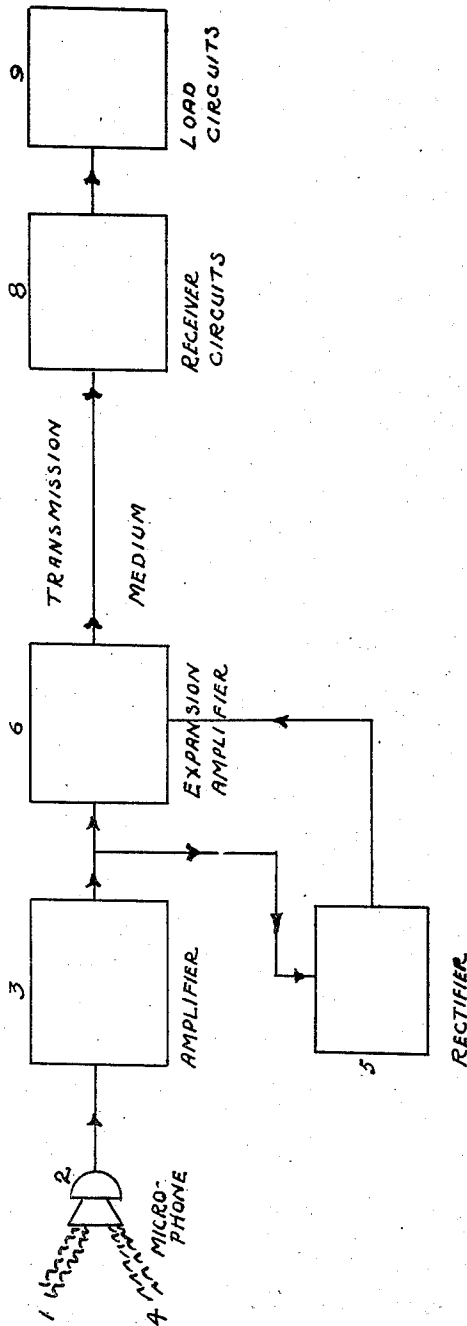


FIG. 2

Inventor

SIDNEY T. FISHER

per *J. Herdman*
Attorney

Oct. 22, 1946.

S. T. FISHER

2,409,977

MEANS FOR SUPPRESSION OF NOISE IN COMMUNICATION SYSTEMS

Filed June 14, 1944

3 Sheets-Sheet 3

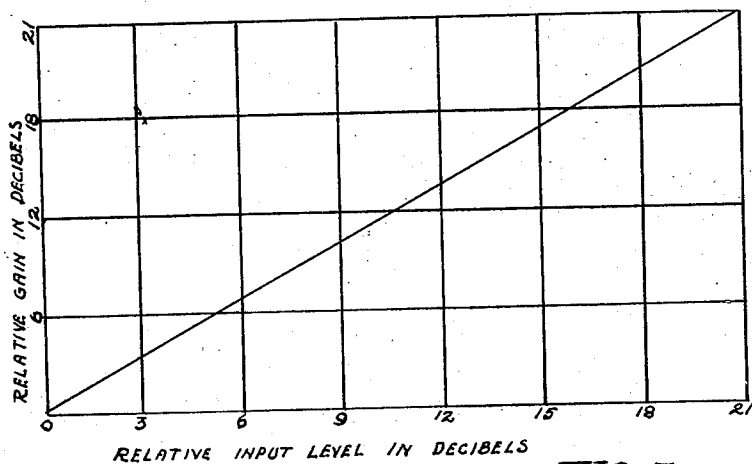


FIG. 3

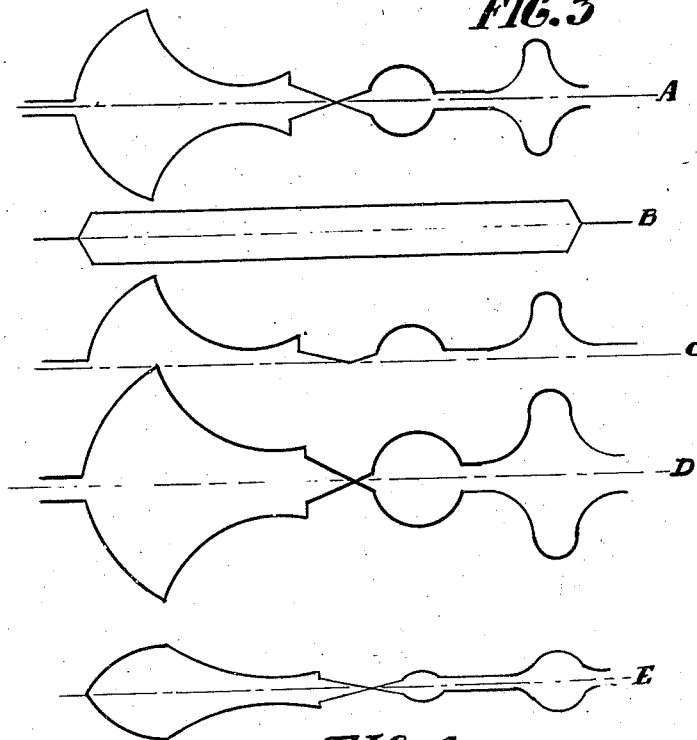


FIG. 4

Inventor
SIDNEY T. FISHER
per *J. Herdman*
Attorney

UNITED STATES PATENT OFFICE

2,409,977

MEANS FOR SUPPRESSION OF NOISE IN
COMMUNICATION SYSTEMS

Sidney T. Fisher, Toronto, Ontario, Canada, as-
signor to Rogers Majestic Corporation, Dover,
Del., a corporation of Delaware

Application June 14, 1944, Serial No. 540,238
In Canada November 9, 1943

3 Claims. (Cl. 179-1)

1

This invention relates to a method of controlling and diminishing undesired extraneous noises and sounds that may be impressed on the microphone of a communication system during such time as the transmission of speech is being made over and by means of such transmission system.

Volume expansion, I have discovered, is an effective and novel method whereby most undesired sounds and noises can be reduced and substantially eliminated while the spoken word is transmitted in a clear manner.

One object of the invention is to permit an improvement in the radio reception of voice sounds which emanate from sources or points where other sounds and noises are much in evidence. Such sources include the interior of military tanks in operation, locomotive cabs and the interior of airplanes during flight. This novel system of volume expansion will also improve radio reception when the transmitted programmes originate in the vicinity of operating machinery or at any place or location where work is in progress, such work generating noises and sounds which may be considered to be detrimental to the normal transmission of voice or music over radio transmitting systems.

The operating basis of the novel application of volume expansion depends upon the established fact that sound waves arising from the operation of machinery and mechanical devices, the rush of wind and the escape of steam are characterized by having a relatively constant value and by possessing a peak value somewhat below the peak value of normal speech level.

Consideration and control of these two sound levels form the basis of the invention. This control is brought about by means of a novel transmission circuit.

All of the above noted desirable features and results and others which will hereinafter be apparent are accomplished by means of the novel arrangement of circuits and apparatus diagrammatically illustrated in the accompanying drawings, forming a part of this specification, and showing by way of example a typical embodiment of the invention.

Referring to the drawings:

Fig. 1 illustrates diagrammatically the circuits and apparatus of a transmitter equipped to carry out the invention.

Fig. 2 illustrates in block diagram the arrangement, relation and connections of the various units of the invention at a transmitting and receiving station.

2

Fig. 3 shows the gain-input level curve of the expansion amplifier.

Fig. 4 shows the characteristic envelope curves for the noise and signal sounds as received by the microphone and as received by the receiver.

Fig. 2 is a simple presentation of the main features of the invention and it would perhaps contribute to a better understanding of the invention to consider this figure and Fig. 3 before explaining in detail the circuit diagram of Fig. 2. In the drawings 1 represents voice sound waves being impressed on the microphone 2. During such impression of 1 on 2 a different set of sound waves 4 are also being impressed on the microphone 2. It is to be understood for purposes of this description, that the sound waves 4 are of an extraneous nature and are not desired in the transmission of the speech sound waves 1.

The electrical impulses, set up by this dual set of sound waves, pass from the microphone 2 to an amplifier 3. The output of the amplifier enters the expansion amplifier 6 by two channels.

A portion of the amplifier output from 3 goes, by means of the circuit shown, to the rectifier 5 and thence to the expansion amplifier 6. The balance of the output from 3 goes directly to the expansion amplifier 6.

From 6 the impulses are fed to an antenna and the ground and by means of the usual transmission medium reach the receiver circuits as shown at 9.

By use of this circuit it is found that the resultant voltage coming from the rectifier 5 is free from speech components and varies only at the syllabic frequency of the speech. This voltage output is used to control the gain of the expansion amplifier 6.

Fig. 3 shows the gain-input level curve of a typical expansion amplifier. From this curve it will be seen that the gain increases with the input level.

Fig. 2 shows the embodiment of the invention in a typical radio telephone transmitter. The microphone 1 is understood to be located at a point where undesired noises are of a volume sufficient to interfere with the normal transmission of speech sounds.

In Fig. 1 the microphone 1 is coupled to the input transformer 2 by way of the primary winding thereof. The secondary terminals of 2 lead to the expansion amplifier tube 5 through capacitor 3 across grid resistor 4.

6 is the screen resistor. 7 is the screen by-pass capacitor. 8 is the plate resistor. 9 is the

coupling capacitor for grid resistor 18 and the grid of the second amplifier tube 10.

Amplifier tube 10 has a cathode resistor 11 and a cathode by-pass capacitor 12, by means of which the cathode of tube 5 is maintained at a substantially constant positive potential with respect to the ground.

An output transformer for the second amplifier tube 10 is indicated at 13. This transformer has an extra secondary winding 14. The voltage from this extra secondary winding is delivered to a load resistor 16 and an audio-frequency by-pass capacitor 17. The positive bias generated across 16 is used to supply grid bias to the expansion amplifier 5.

The main portion of the power output from tube 10 is used to plate modulate a class C, radio-frequency amplifier tube 30 which is coupled by reactances 34, 35, 37 and 39 to an antenna 40. The adjustable reactance 39 is connected through 20 a radio-frequency ammeter designated by 38.

Tube 30 is supplied carrier energy from a master oscillator tube 23, with an oscillating circuit made up from a variable reactance 19, and a split inductor 20. There are also two screen by-pass 25 capacitors indicated by 21 and 24.

The coupling circuit is formed by a radio-frequency choke 26, a variable condenser 27, two by-pass capacitors 28 and 41, and a grid return resistor 29.

The master oscillator tube filament 23 is connected to the ground through a radio-frequency choke 42.

In Fig. 4 are shown characteristic envelopes for sounds as received by the microphone 1; and as received by the receiver circuit 8 in Fig. 1.

A in Fig. 4 represents the envelope of the speech wave and B represents the envelope of the noise wave. The ratio of these two waves is the signal to noise ratio. It is seen to be poor during periods of low speech level.

Curve C shows the variation in amplifier gain brought about by the speech wave. D represents the speech wave at the output of the amplifier. E represents the noise wave at the output of the amplifier.

The ratio of A to E is the signal to noise ratio at the output of the amplifier. A comparison of these sound envelope curves will indicate the manner in which the undesired noises and sounds are modified by the invention.

From the foregoing it will be apparent that the invention will improve the transmission and reception of voice signals in radio transmission, under all conditions wherein the voice signal originates from sources subject to undesired noises and sounds and that the novel method of so improving such transmission of voice signals is

brought about by passing the combined signal and noise waves through a section of the circuit of which the transmission efficiency increases with the signal and noise combined level.

Having regard to the foregoing disclosures, the patent of which this specification forms part confers, subject to the conditions described in the patent act 1935, the exclusive right, privilege and liberty of making, constructing, using and vending to others to be used, the invention as defined in the claims submitted by the patentee as follows.

I claim:

1. Means for the suppression of noise in communication systems, comprising a microphone, means connected with said microphone for amplifying the electrical impulses set up in said microphone, means for splitting the output from said amplifier, a rectifier interposed in one branch of said split circuit, a volume expansion amplifier connecting both branches of said split circuit, means for transmitting said rectified and amplified impulses, and means for receiving said transmitting impulses.

2. Means for the suppression of noise in communication systems, comprising a microphone, a transformer connected with said microphone, an expansion amplifier tube connected with the secondary of said transformer, an amplifier tube connected with the aforesaid tube, means for maintaining the aforesaid tube at a substantially constant positive potential with respect to the ground, an output transformer for the said second amplifier tube, and radio frequency amplifying means connected with the output from said latter tube.

3. Means for the suppression of noise in communication systems, comprising a microphone, a transformer, an expansion amplifier tube having its cathodes connected with the secondary of said transformer, a capacitor and grid resistor connected with the secondary of said transformer, an amplifier tube connected with the aforesaid tube, a cathode resistor interposed between the cathode of the latter tube and ground, a by-pass capacitor interposed between the cathodes of the aforesaid tubes and maintaining the potential of the first tube substantially constant with respect to the ground, an output transformer connected with the second amplifier tube having an extra secondary winding, a load resistor and an audio-frequency by-pass capacitor affecting a positive bias and supplying grid bias to the first mentioned tube, means for transmitting the output from the aforesaid tubes, and means for translating the received output.

SIDNEY T. FISHER.