PATENT SPECIFICATION

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656,611

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PROVISIONAL SPECIFICATION

Improvements in and relating to Telephone Apparatus

We, TELEPHONE MANUFACTURING COMPANY LIMITED, a British Company, of Hollingsworth Works, Martell Road, West Dulwich, London, S.E.21, do hereby declare the nature of this invention to be as follows:—

This invention relates to telephone apparatus in which a subscriber has available secrecy apparatus, such as a frequency inverter or other signal modifying apparatus, to prevent eavesdropping or to afford a greater or less degree of secrecy, in addition to normal, non-secret, communication.

According to the present invention in such a system there is used a microphone of which the response is substantially free from amplitude distortion for both secret and normal communication. Amplifying means are used to produce a signal voltage comparable with that obtainable from the more usual carbon microphone, and when the apparatus is used for normal speech, the amplifying means is used either with the distortion-free microphone or to amplify an incoming signal, whereby the efficiency of the system is enhanced.

All ordinary telephone systems at the present time make use of a carbon microphone largely because of the high sensitivity of this type. Such microphones have various disadvantages, notably in quality of reproduction being poor, and in addition the microphone requires a local battery for its operation. Further, pronounced peaks in the frequency response characteristic of the microphone tend to overload amplifying equipment located between one subscriber and another. The quality of reproduction is further affected when secrecy equipment is used, since the microphone distortion is supplemented by the inherent distortion of the secrecy apparatus.

In an apparatus according to the invention each subscriber's apparatus is fitted with a high quality microphone such as of the electro-magnetic, electrostatic, piezo-electric, or electro-dynamic type, which produces relatively low amplitude distortion. However, such microphones have a relatively low output and we, therefore, include amplifying means to increase the output level to that of a carbon microphone so that the voice currents sent to line will be comparable with those obtained from a normal telephone.

The receiving apparatus of the telephone instrument may be of existing type and with a single compound handset used for both secret or normal speech but incorporating a sensitive receiver of a type having a substantially constant frequency response; an electromagnetic or electrodynamic type is very suitable. Each subscriber's instrument includes a secrecy apparatus consisting, for example, of a frequency inverter for outgoing and an inverter for incoming signals. When the telephone is being used for secret purposes, speech currents from the microphone are passed to a modulator with or without a low pass filter to restrict the frequency-band applied to the modulator, and followed by another low pass filter to eliminate the unwanted side-band; after amplification, the currents are transmitted directly to line in the case of a 4-wire system, or through a hybrid coil when a 2-wire line is used.

The receiver comprises a similar modulator, local oscillator and amplifier to convert the incoming currents to intelligible speech signals which after amplification are applied to the telephone receiver.

With an arrangement as described, it is possible to have a secret or normal telephone system at will and under the control of the subscriber and embodying high quality microphones and/or receivers,

and means for switching from one system to the other, and by using common components such as amplifiers, transformers and the like, to obtain a unit occupying the minimum space and utilising the smallest number of elements.

A unit of the type mentioned may be operated from alternating current supply mains with suitable rectifiers, to provide the necessary L.T. and H.T. currents. If desired, the power supply may be made as a unit separate from the telephone instrument.

In a further embodiment of the invention it is proposed, by using miniature valves, inductances and other components, to arrange for the telephone and secrecy equipment to be fitted as an integral part or base for an ordinary telephone set, complete with switch for converting the telephone from secret to normal, at the will of the subscriber, and with provision, if desired, for reversion to normal whenever the handset is replaced. Where miniature inductances are used for the filters of the secrecy equipment, it is desirable that the applied voltage should be small and it is, therefore, suitable that the frequency inversion or other process should be accomplished at a low level; the microphone voltages should, therefore, be applied to this stage without amplification.

Where a high sensitivity receiver is used, this may mean that secret speech can be transmitted at a lower level than the normal, less amplification then being necessary. In such a case, an attenuator may be required for the receiver when normal speech is transmitted.

Dated this 17th day of February, 1948.
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For the Applicants.

COMPLETE SPECIFICATION

Improvements in and relating to Telephone Apparatus

We, TELEPHONE MANUFACTURING COMPANY LIMITED, a British Company, of Hollingsworth Works, Martell Road, West Dulwich, London, S.E.21, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to telephone apparatus in which a subscriber has available secrecy apparatus, such as a frequency inverted or other signal modifying apparatus, to prevent eavesdropping or to afford a greater or less degree of secrecy, in addition to normal, non-secret, communication.

According to the present invention in such a system there is used a microphone of which the response is substantially free from amplitude distortion for both secret and normal communication. Amplifying means are used to produce a signal voltage comparable with that obtainable from the more usual carbon microphone, and when the apparatus is used for normal speech, the amplifying means are used both with the distortion-free microphone and to amplify an incoming signal, whereby the efficiency of the system is enhanced.

All ordinary telephone systems at the present time make use of a carbon microphone largely because of the high sensitivity of this type. Such microphones have various disadvantages, notably in the quality of reproduction being poor, and in addition the microphone requires a local battery for its operation. Further, pronounced peaks in the frequency response characteristic of the microphone tend to overload amplifying equipment located between one subscriber and another. The quality of reproduction is further affected when secrecy equipment is used, since the microphone distortion is supplemented by the inherent distortion of the secrecy apparatus.

In the accompanying drawing is shown by way of example one embodiment of the invention. This drawing is a block schematic diagram of the apparatus which is peculiar to each subscriber.

In an apparatus according to the invention each subscriber's apparatus is fitted with a high quality microphone such as of the electro-magnetic, electro-static, piezo-electric or electro-dynamic type, which produces relatively low amplitude distortion. However, such microphones have a relatively low output compared with the conventional carbon type and there is therefore included amplifying means to increase the output level to that of a carbon microphone so that the voice currents sent to line will be comparable with those obtained from a normal telephone. While the statement that a microphone is substantially free from amplitude distortion is one which is rela-

tive, for the purposes of the present invention a microphone for use in accordance with the invention may be such that within the normal speech frequency range of say 200 to 3000 c.p.s. the output of the microphone does not vary by more than plus or minus three decibels from the mean output level.

In the embodiment shown in the drawing the microphone 10, of the type described, is coupled through an impedance matching and/or correcting pad 11; the output of pad 11, by means of a switch 12*a*, can be connected either to a secrecy device shown as consisting of a pad 13, modulator 14 and low pass filter 15, and thence through switch 12*b* to amplifier 16 balancing transformer 17 to line terminals 18 or alternatively the pad can be connected through switches 12*a* and 12*b* direct to amplifier 16. In the lower position of the switches, as shown, speech transmission to line will be normal while in the alternative upper position the speech will be frequency inverted to provide the desired degree of secrecy.

Incoming signals are applied from line 18, through transformer 17 to a pad 19 and thence either through switch 12*c*, switch 12*d* and amplifier 20 to receiver 21, or alternatively through switch 12*c*, modulator 22, attenuator pad 23, low-pass filter 24 and switch 12*d* to the amplifier and receiver. All the switches 12*a* to 12*d* are conveniently coupled together.

The oscillations necessary to feed the modulators 14 and 21 to produce the desired frequency inversion are derived from a local generator 25.

The receiving apparatus of the telephone instrument may be of existing type and with a single compound handset used for both secret or normal speech but incorporating a sensitive receiver of a type having a substantially constant frequency response; an electromagnetic or electrodynamic type is very suitable.

With an arrangement as described, it is possible to have a secret or normal telephone system at will and under the control of the subscriber and embodying high quality microphones and/or receivers, and means for switching from one system to the other, and by using common components such as amplifiers, transformers and the like, to obtain a unit occupying the minimum space and utilising the smallest number of elements.

A unit of the type mentioned may be operated from alternating current supply mains with suitable rectifiers, to provide the necessary L.T. and H.T. currents. If desired, the power supply may be made as a unit separate from the telephone instrument. Thus such a unit may be incorporated as at 26 in the drawing.

By using miniature valves, inductances and other components, it is possible to arrange for the telephone and secrecy equipment to be fitted as an integral part or base for an ordinary telephone set, complete with switch for converting the telephone from secret to normal, at the will of the subscriber, and with provision, if desired, for reversion to normal whenever the handset is replaced. Where miniature inductances are used for the filters of the secrecy equipment, it is desirable that the applied voltage should be small and it is, therefore, suitable that the frequency inversion or other process should be accomplished at a low level; the microphone voltages should, therefore, be applied to this stage without amplification, as shown in the drawing.

Where a high sensitivity receiver is used, this may mean that secret speech can be transmitted at a lower level than the normal, less amplification then being necessary. In such a case, an attenuator may be required for the receiver when normal speech is transmitted.

We are aware of Patent Specification No. 511,420, also in the name of our Company, which describes a telephone system comprising means for establishing normal communication in the system and means for including in the system under the control of a subscriber a frequency inverting device. It is stated that the system may comprise thermionic amplifying apparatus and means whereby the apparatus may be brought into operation both with inverted and with normal communication. Naturally the system utilises a microphone or transmitter, but no reference is made in Specification No. 511,420 to the use of any particular kind of microphone nor is any indication given that the microphone should possess any special qualities.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. An apparatus of the type described, and comprising a substantially distortion-free microphone and an amplifying means, said amplifier being employed for normal and for secret communication.

2. An apparatus according to Claim 1, wherein said microphone is of the electromagnetic, electrostatic, electrodynamic or piezo-electric type.

3. An apparatus according to either of the preceding Claims, wherein said secrecy equipment is of the frequency-inversion type.

4. An apparatus according to any of the preceding Claims, and comprising a handset including a receiver and said microphone, a casing, a rest on said casing for said handset, wherein said secrecy equipment is mounted in said casing.

5. An apparatus according to Claim 4, and comprising switch means mounted on said casing for selecting secret or normal transmission at will, and means operating in response to replacement of said handset on said rest to restore said switch means to the position corresponding to normal transmission.

6. An apparatus of the type described, and substantially as described herein and shown in the accompanying drawings.

Dated this 7th day of February, 1949.
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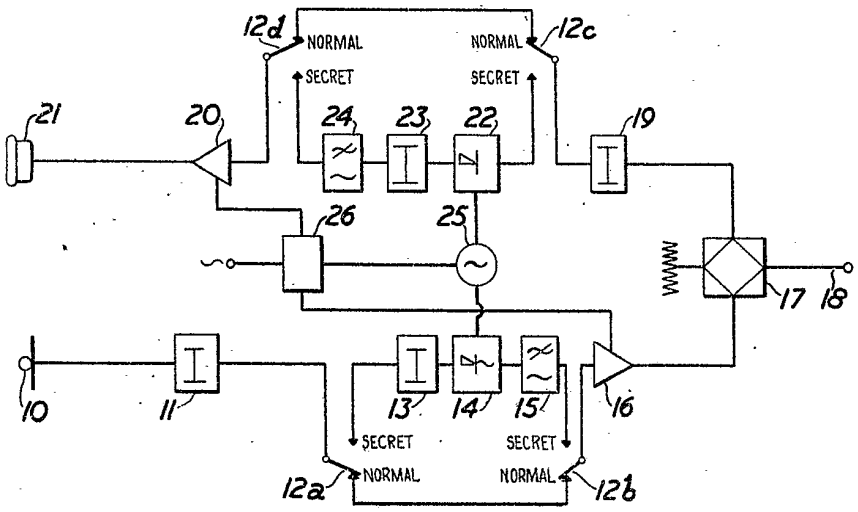

H.M.S.O. (M.F.P.)