980,141

PATENT SPECIFICATION

DRAWINGS ATTACHED

980,141

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COMPLETE SPECIFICATION

Improvements in or relating to Secrecy Systems

We, TELEPHONE MANUFACTURING COMPANY LIMITED, a British Company of Hollingsworth Works, Martell Road, West Dulwich, London, S.E.21, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention relates to electrical communication systems particularly to so-called secrecy systems in which intelligence is modified to render it unintelligible for transmission over a line or radio link and is again rendered intelligible after reception.

The various features and advantages of the invention will be apparent from the following description of two exemplary embodiments thereof taken in conjunction with the drawing accompanying the provisional specification of Application No. 23432/62 (Serial No. 980,141). At each end of the system speech the arrangement of a simple secrecy system and the drawing accompanying the provisional specification of Application No. 25622/62 which is a schematic diagram of the terminal equipment at both ends of a modified form of such simple system.

According to the invention there is provided a secrecy communication system wherein intelligence signals are scrambled at the transmitter by a cyclic switching operation and unscrambled at the receiver by an identical cyclic switching operation comprising means for generating two distinct electrical oscillations and applying such oscillations to the path between transmitter and receiver and means at each of said transmitter and receiver responsive to both said oscillations to derive therefrom identical switching control signals for controlling said switching operations.

Preferably the scrambling is effected by switching between two different forms of the intelligence the rate of switching between the different forms being preferably at about the average syllabic rate of normal speech, in a system employing two different signal waveforms, and a convenient rate has been found to be ten times per second.

In its simplest form of secrecy system embodying the invention, as applied to speech transmission, employs, as the two signal waveforms, a direct electrical equivalent of the speech sounds and a modulated or inverted version of such equivalent and switches alternately between the two forms so that in effect alternate syllables are of plain speech and inverted speech.

The apparatus of this simple form of system is shown diagrammatically in the drawing accompanying the provisional specification of application No. 23432/62 (Serial No. 980,141). At each end of the system speech is converted into electrical signals in conventional manner by a normal telephone instrument T. These signals are fed to a switching device S1, which may for example be an electronic switch, having alternative outputs one of which is connected directly to a first input of a similar switch device S2 and the other of which is connected through a low pass filter LP1 to a modulator MO then through a second low pass filter LP2 to a second input of switch S2. The latter switch has a single output connected to line or to a radio link terminal and switches its two inputs alternately to its output. In the modulator MO the signals from the telephone microphone are modulated with a locally generated carrier oscillation and the upper side band and carrier frequency are filtered out by filter LP2 leaving only the inverted lower side band for transmission over the line or link.

The local oscillations, conveniently at 2500 c.p.s. are supplied by a first signal generator O1 which together with a second signal generator O2 also feeds oscillations to a mixing circuit M1. Generator O2 operates at a frequency 40 c.p.s. away from that of generator O1 and a beat frequency of 40 c.p.s. is pro-

[*Price 4s. 6d.*]

vided at the output of M1. This beat signal is applied to a frequency dividing circuit D1 which divides its frequency by four to provide a 10 c.p.s. switching signal for the control of switching devices S1 and S2. Generators O1 and O2 are also connected to the output transformer TO by which the plain and inverted speech signals are applied to the outgoing channel and at the other end of the channel the receiving station equipment includes a mixing circuit M2 having one input connected directly to the input transformer TI of the station and one connected to such transformer through a band pass filter BP which rejects one of the two local oscillation frequencies and accepts the other. Thus M2 produces a 40 c.p.s. beat signal from the same oscillations as were employed at the sending station and from this beat signal derives a 10 c.p.s. switching signal to control its switching devices in synchronism with the arrival of the speech signal samples at the receiving station. These speech signal samples are routed, either directly in the case of plain speech samples, or through a demodulator DM in the case of inverted speech samples, to the receiver of the telephone instrument by the operation of switching devices S1 and S2 at that station. The demodulator DM is fed with a 2,500 c.p.s. oscillation to recover the speech signal samples inverted by the modulator MO at the transmitting station.

Whilst only one direction of transmission has been referred to it will be appreciated that the equipment at both stations will serve to both modulate and demodulate to invert and recover the alternate speech samples.

Since in the above described simple system the modulator used for deriving the inverted form of signal in each direction of communication is only in use for one half of the time of any connection between two parties an economy in equipment can be achieved by utilising a single modulator for both directions of communication at each terminal, the modulator serving to invert outgoing signals for one half the time it is in use and serving to convert incoming inverted signals during the other half. Such a modification of the simple system is illustrated in the drawing accompanying the provisional specification of application No. 25622/62 which is a schematic diagram of the terminal equipment at both ends of a modified two-way communication system. In this latter drawing a modulator MO at each terminal is selectively connectible between the microphone MIC and the outgoing part of the hybrid network HN coupling the terminal equipment to the line or radio link, and between the earpiece EAR and the incoming part of the hybrid network HN by four switches S1 to S4 arranged to operate in synchronism in such a manner that whenever switches S1, S2 connect the microphone at one end of the link to line, the switches S3, S4 at that end connect the earpiece directly to line to receive plain speech signals from the other end of the link due to the switches S1, S2 at such other end being operative to connect the microphone at that end directly to line.

As shown in the drawing of Application No. 25622/62 the system is intended to be controlled by a switching signal derived by division of the output of a single oscillator O which, in addition to feeding a shaper circuit SC1 and divider circuit D1 also feeds to fine at a point beyond the low pass section of the hybrid network HN at one end of the connection and its oscillations are extracted at the same point at the other end of the connection and applied to a shaper SC2 and a divider D2 to control the switches S1 to S4 at such other end.

The system, however, may be controlled in the same manner as the system of the earlier described embodiment in which case the oscillator O is to be considered as consisting of the two oscillators O1, O2 and the shapers SC1 and SC2 as consisting of the modulators M1 and M2 of the earlier embodiment.

WHAT WE CLAIM IS:—

1. A secrecy communication system wherein intelligence signals are scrambled at the transmitter by a cyclic switching operation and unscrambled at the receiver by an identical cyclic switching operation comprising means for generating two distinct electrical oscillations and applying such oscillations to the path between transmitter and receiver and means at each of said transmitter and receiver responsive to both said oscillations to derive therefrom identical switching control signals for controlling said switching operations.

2. A system as claimed in claim 1 wherein said generating means is arranged to generate two oscillations having frequencies separated by a difference frequency which is a desired function of the desired frequency of said switching operations.

3. A system as claimed in claim 2 wherein said generating means is arranged to generate two oscillations having frequencies spaced by a whole multiple of the desired switching frequency and said responsive means comprises means for mixing the two oscillations to produce a beat frequency and frequency dividing means connected to receive the output of said mixing means to yield said switching control signals.

4. A system as claimed in claim 1, 2, or 3 wherein said generating means also serves to provide a local oscillation for modulation of said intelligence signal in producing the scrambling of such information.

5. A system as claimed in any one of claims 1 to 4 including means for deriving a pluality of different forms of electrical signal each representing the same intelligence and switching means arranged to perform said cyclic

switching operation for intermittently transmitting samples of the different signal forms in sequence.

6. A system as claimed in any one of claims 1 to 4 including switching means arranged to perform said cyclic switching operation for intermittently deriving alternatively different forms of electrical signal representations of consecutive portions of an intelligence item and means for transmitting said different forms of signal representations in sequence.

7. A system as claimed in claim 5 or 6 in which said means for deriving differnt signal forms includes first means for deriving a direct electrical representation and second means for deriving a frequency inverted electrical representation of intelligence items.

8. A system as claimed in claim 7 wherein said switching means is arranged for alternately connecting the outputs of said first means and said second means for transmission over the system.

9. A system as claimed in claim 8 in which said switching means is also operative to connect the output of said first means to the input of said second means to derive said inverted signal form from said direct signal form.

10. A system as claimed in claim 8 or 9 for communicating speech intelligence wherein said switching means is arranged to operate at an average syllabic rate.

11. A system as claimed in claim 10 wherein said switching means is arranged to operate at a rate of ten operations per second.

12. A system as claimed in any one of claims 7 to 11 wherein said second means is arranged to derive said inverted signal form by modulating the direct signal with locally generated oscillations and selecting the lower inverted side band for transmission.

13. A system as claimed in any one of claims 7 to 12 wherein said switching means is arranged to switch said second means alternately to the go and return paths of the system whereby the said means when not in use in one such path is connected for use in the other such path.

14. A secrecy communication system substantially as herein claimed and described with reference to the drawings accompanying the provisional specifications.

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1 SHEET

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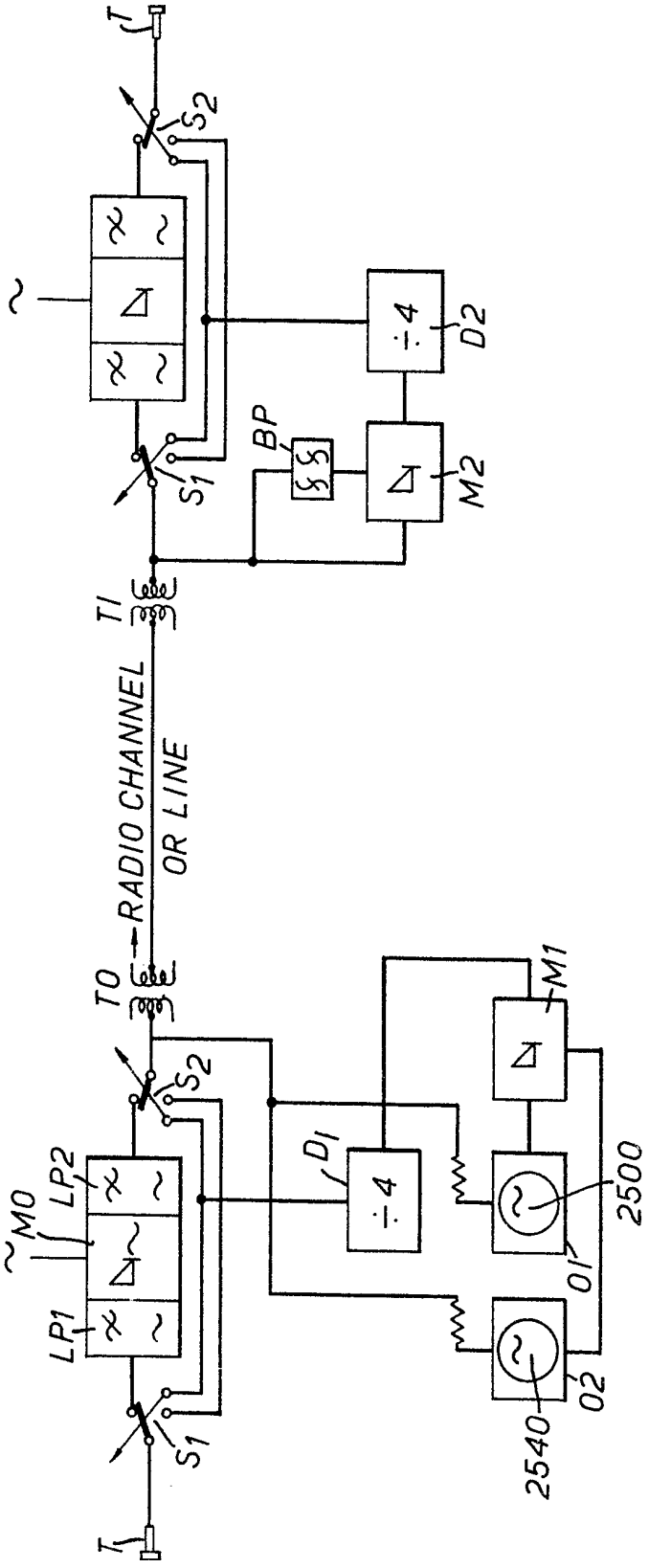

980,141 PROVISIONAL SPECIFICATION No. 25622/62
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