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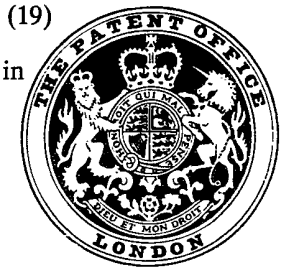

(54) IMPROVEMENTS IN OR RELATING TO TELEPHONE SUBSCRIBER CONNECTION DEVICES

(71) We, SIEMENS AKTIENGESELLSCHAFT, a German Company, of Berlin and Munich, Federal Republic of Germany, 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 a telephone subscriber connection device, for connecting a telephone subscriber station to an exchange, comprising a first part for connection to the subscriber station and a second part for connection to the exchange each of which parts comprises a four-wire speech path and two signal wires, one for each direction of transmission, the speech paths and signal wires in the two parts being coupled together via a multiplex transmission system. In such a connection device each part also includes a two-wire/four-wire junction, and the first part includes a loop state detector for detecting and forwarding a signal corresponding to the state of the subscriber loop, means for supplying call signals from a call signal generator to the subscriber station, and a counting signal generator for supplying counting signals to the subscriber station to enable due fees, e.g. in trunk calls, to be immediately determined by the subscriber.

Such a connection device is useful in a telephone network in which remote telephone subscribers must be connected via a frequency or time multiplexed transmission system to the nearest exchange, where as a result of too great a distance or inaccessible country (e.g. mountains or water) the usual connection technique is not suitable.

At the subscriber's request he must be fed with the counting signals referred to above. Signals which are transmitted to this end from the second part to the first part of the connection device must be able to be satisfactorily distinguished in this first part from call signals which are transmitted in the same direction. This differentiation could easily be effected by providing an additional signal channel and assigning each of two signal types a separate signal channel via the frequency time multiplex transmission system, but this would result in an undesirable outlay. This invention seeks to provide a connection device in which such an additional signal channel is not required but in which it is still possible to make a clear and simple differentiation between the two signals types.

According to this invention there is provided a telephone subscriber connection device, for connecting a telephone subscriber station to an exchange, comprising a first part for connection to the subscriber station and a second part for connection to the exchange each of which parts comprises a four-wire speech path and two signal wires, one for each direction of transmission, the speech paths and signal wires in the two parts being coupled together via a multiplex transmission system, wherein the first part comprises a two-wire/four wire junction coupling a two-wire speech path, a loop state detector arranged to detect the loop state of the two-wire path and to emit a corresponding signal to one of the signal wires, a counting signal generator responsive to an actuating signal to emit counting signals which are conveyed to the two-wire path, and a logic circuit responsive to a signal on the other of the signal wires such as to cause a call signal generator to emit a call signal to the two-wire path and such as to supply an actuating signal to the counting signal generator selectively in dependence upon a signal supplied thereto from the loop state detector and dependent upon

ion coupling the four-wire speech path via a switch to a two-wire path for connection to the exchange, means responsive to a signal on one of the signal wires, which is coupled to said one of the signal wires in the first part, to close said switch, and means responsive to a call signal and to counting signals on the two-wire path to emit a signal to the other of the signal wires.

Thus the distinction between a signal on said other signal wire indicating a counting signal and a signal on the same signal wire indicating a call signal is made in dependence upon the open or closed loop state of the subscriber station loop.

Preferably the first part further comprises a relay having a contact, via which the call signal is supplied to the two-wire path when the relay is energised, and a delay element having an input connected to an output of the loop state detector, and the logic circuit comprises a first AND element and a second AND element each having a first input connected to said other of the signal wires, the first AND element having an output connected to the relay for supplying an energising signal thereto, and each of the first and second AND elements having a second input connected to receive the output signal of the delay element respectively in non-inverted and inverted form.

The delay element advantageously ensures that even a signal wire signal incoming immediately after the opening of the subscriber two-wire loop at the end of a conversation is fed, as a counting signal, to the subscriber.

Preferably in the first part the output of the counting signal generator is connected to the subscriber station end incoming arm of the four-wire path. This results in the advnatage that no special measures are necessary in order to prevent the e.g. 16 kHz counting signals reaching the subscriber station and outgoing arm of the four-wire path, as would be necessary if the output of the counting signal generator were connected to the subscriber-end two-wire path, as the hybrid circuit of the two-wire/four-wire junction sufficiently damps the counting signals.

The invention will be further understood from the following description by way of example of an embodiment thereof with reference to the accompanying drawing, which schematically illustrates a telephone subscriber connection device connected to a subscriber station and an exchange. Only those components which are necessary for understanding the invention are shown.

The drawing is divided into five sections by four vertical dash-dotted lines. Of these sections, the middle section 1 represents a frequency or time multiplex transmission system which couples together a first part 5 and a second part 6 of the connection device and hence via which a subscriber station 2 connected to the first part 5 via a two-wire subscriber connection line 8a is connected to an exchange 3, comprising dialling devices 4, which is connected to the part 6 via a two-wire subscriber connection line 8b which can be regarded as a continuation of the line 8a. The frequency or time multiplex transmission system can for example be a carrier-frequency (CF) transmission system having information channels 7 running across radio relay paths; for example the subscriber station 2 may be on a drilling rig and the exchange 3 may be on land. Each of the two-wire lines 8a and 8b is connected to a respective two-wire/four-wire junction 9 with a hybrid circuit, which serve to fit the CF system into the subscriber connection line, the two resultant four-wire paths being coupled together via the information channels 7.

A call request is emitted by the subscriber station 2, for communication to the exchange 3, by closing the subscriber-end two-wire loop 8a. The loop closure is detected by a loop state detector 10, which is permanently connected to the line 8a, which detector 10 consequently emits a signal to a relay 11, which could be replaced by a corresponding electronic device, to cause a contact 12 controlled thereby to close to effect a change in potential on a signal wire 13. This change in potential is transmitted via a signal channel 14 of the CF system to a corresponding signal wire 13 in the second part 6 of the connection device where it causes a relay 15 to respond. The relay 15 closes a contact 16 which closes the exchange-end two-wire loop 8b. As a result a dialling device 4 is seized. In the same manner temporary openings of the two-wire loop 8a caused by dialling in the subscribers station 2 are communicated as dialling pulses to the exchange 3.

When the contact 16 is open, a call signal from the exchange 3 to the subscriber connection line 8b activates a call signal receiver 17, which consequently energises a relay 18 to close a contact 19 which, in the same manner as the contact 12, effects a change in potential on a signal wire 20 provided for the transmission direction to the subscriber station 2. The signal which is produced on the signal wire 20 as a result of this potential change is transmitted via a signal channel 31 of the CF system to a corresponding signal wire 20 in the first part 5 of the connection device. and thence to an input of each of two gates 21 and 22 comprising AND

elements. When the subscriber station 2 is not seized, and thus when the subscriber-end two-wire loop 8a is open, a line 23, which connects the output of the loop state detector 10 via a delay element 24 to another input of each of the gates 21 and 22, carries no signal. As the latter input of the gate 21 is an inverting input, this gate 21 produces an output signal which energises a relay 25 to close a contact 26, via which a call signal is conducted from a call signal generator (not shown) to the two-wire line 8a and hence to the subscriber station 2. If a loop closure occurs on this line due to the lifting of the hand-set in the subscriber station 2, the detector 10 produces an output signal so that the exchange-end two-wire loop 8b is closed via the relay 11, the contact 12, the signal wires 13, the relay 15 and the contact 16. The output signal from the detector 10 also passes via the line 23 and the delay element 24 to the gate 21, so that the connection of the call signal generator to the two-wire loop 8a is terminated, and thus the transmission of a further call signal to the subscriber station 2 is prevented, at the end of a delay time determined by the delay element 24. The output signal of the delay element 24 is also conducted to the gate 22, but this gate does not produce an output signal because by the end of the delay time the relay 15 has responded and thus the transmission of a signal via the signal wire 20 in response to the call signal receiver 17 has ended, the contact 19 again adopting its rest (open) position.

During a connection established between the subscriber station 2 and the exchange 3, counting signals also pass from the exchange 3 and must be forwarded to the subscriber station 2. For the reception of the counting signals formed by the keying of an a.c. of 16 kHz, the part 6 of the connection device includes a counting signal receiver 27 which is connected to the two-wire line 8b and energises the relay 18 to close the contact 19 when a counting signal is received from the exchange. Consequently, with each counting signal, a signal is fed via the signal wires 20 and the signal channel 31 to the gate 22. Thus after the closure of the subscriber-end two-wire loop 8a and the expiration of the delay time, each closure of the contact 19 results in an actuating signal being produced by the gate 22 and applied to a counting signal generator 29 whose output is connected to the subscriber-end incoming arm 28 of the four-wire path with the result that a counting signal is fed to the two-wire loop 8a via the junction 9 in the first part 5 of the connection device. A charge meter 30 connected to the two-wire loop 8a in the subscriber station 2 is controlled by these counting signals and allows incurred fees to be determined at all times.

Thus the transmission of call signals and counting signals to the subscriber station 2 requires only one signal wire 20 and thus also only one signal channel 31 in the connection device, and yet a reliable differentiation is made between these signals and a particularly simple construction of the subscriber connection device is facilitated.

WHAT WE CLAIM IS:-

1. A telephone subscriber connection device, for connecting a telephone subscriber station to an exchange, comprising a first part for connection to the subscriber station and a second part for connection to the exchange each of which parts comprises a four-wire speech path and two signal wires, one for each direction of transmission, the speech paths and signal wires in the two parts being coupled together via a multiplex transmission system, wherein the first part comprises a two-wire/four-wire junction coupling a two-wire path for connection to the subscriber station to the four-wire speech path, a loop state detector arranged to detect the loop state of the two-wire path and to emit a corresponding signal to one of the signal wires, a counting signal generator responsive to an actuating signal to emit counting signals which are conveyed to the two-wire path, and a logic circuit responsive to a signal on the other of the signal wires such as to cause a call signal generator to emit a call signal to the two-wire path and such as to supply an actuating signal to the counting signal generator selectively in dependence upon a signal supplied thereto from the loop state detector and dependent upon the detected loop state, and wherein the second part comprises a two-wire/four-wire junction coupling the four-wire speech path via a switch to a two-wire path for connection to the exchange, means responsive to a signal on one of the signal wires, which is coupled to said one of the signal wires in the first part, to close said switch, and means responsive to a call signal and to counting signals on the two-wire path to emit a signal to the other of the signal wires.

2. A connection device as claimed in Claim 1 wherein the first part further comprises a relay having a contact, via which the call signal is supplied to the two-wire path when the relay is energised, and a delay element having an input connected to an output of the loop state detector, wherein the logic circuit comprises a first AND element and a second AND element each having a first input

connected to said other of the signal wires, wherein the first AND element has an output connected to the counting signal generator for supplying the actuating signal thereto, wherein the second AND element has an output connected to the relay for supplying an energising signal thereto, and wherein each of the first and second AND elements has a second input connected to receive the output signal of the delay element respectively in non-inverted and inverted form.

3. A connection device as claimed in Claim or Claim 2 wherein the first part of the output of the counting signal generator is connected to the subscriber station end incoming arm of the four-wire path which conveys said signals to the two-wire path.

4. A telephone subscriber connection device substantially as herein described with reference to the accompanying drawing.

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