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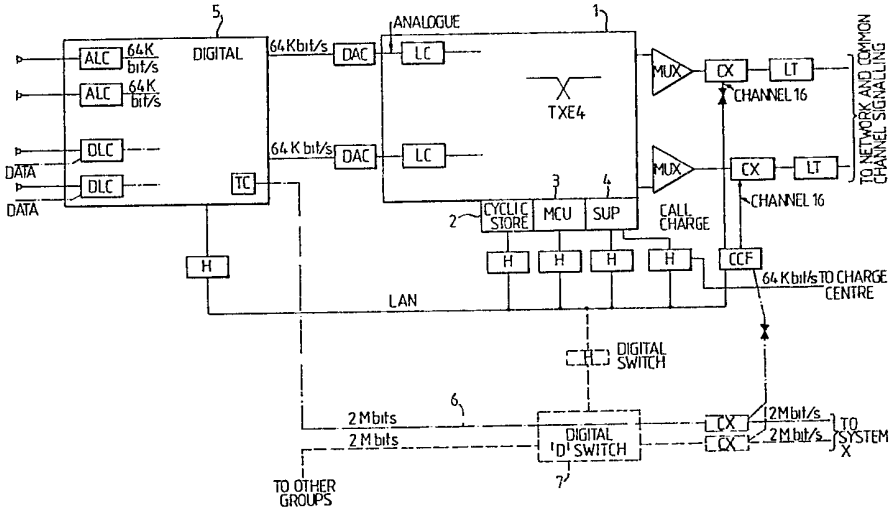
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(54) Telephone exchanges

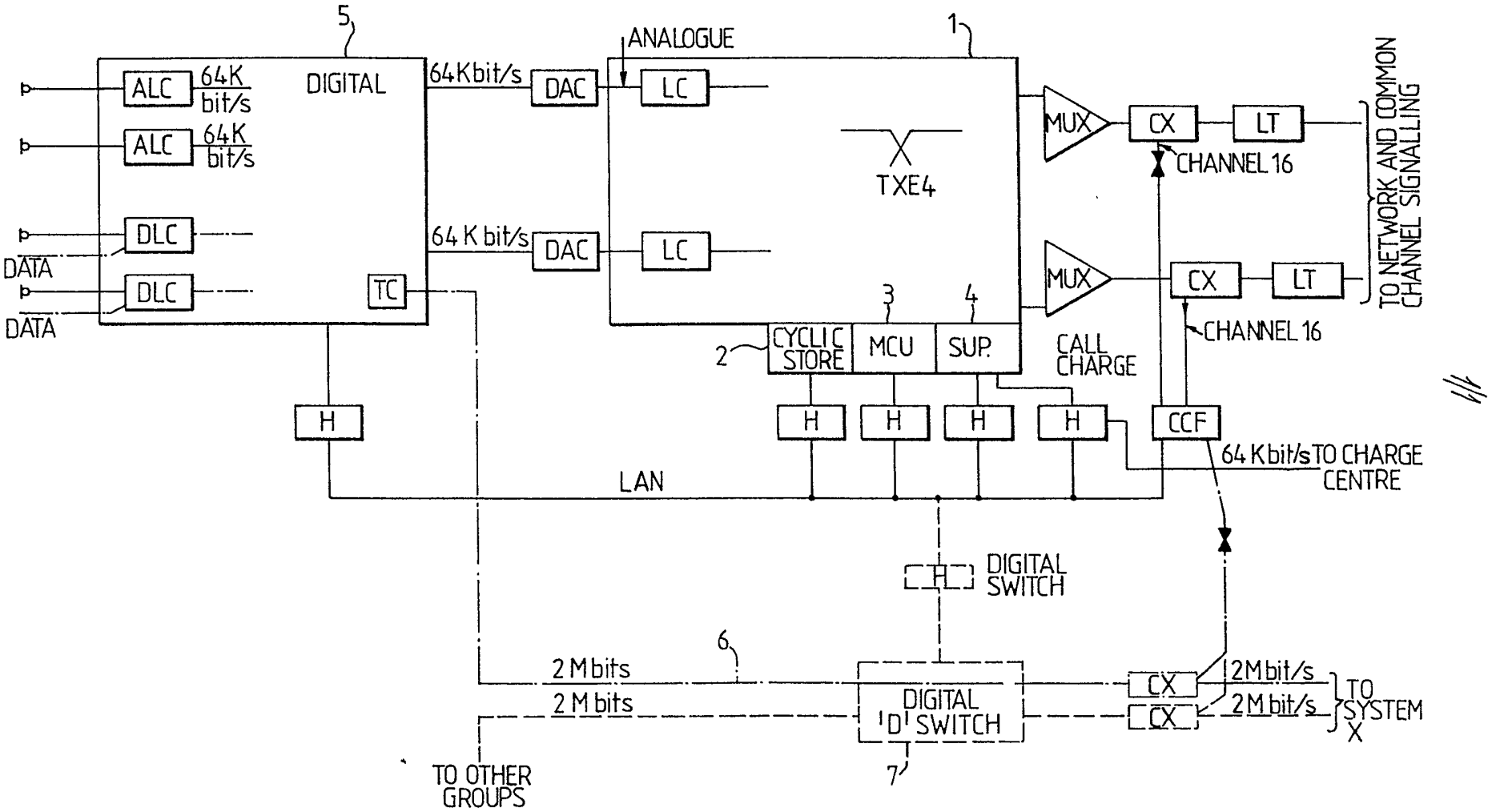
(57) In our Application No. 8406721 (C.D. Pratt 2) we have described and claimed a system in which a non-digital exchange is enhanced to give some subscribers access to facilities normally only available on a digital exchange. This uses a front-end switch for a group of such "enchanced" lines, which switch connects those lines to a lesser-numbered group of terminations on the non-digital exchange.

In the present arrangement, in which the front end switch (5) is a digital arrangement, the front-end switch has access to TDM/PCM busses 6 to a remote digital exchange. If the number of enhanced subscribers warrants, two or more front end switches are used with access for the lines on the front-end switch or switches, to the junctions to the remote digital exchange via a further digital switch network.

As described the non-digital exchange is TXE4 or TXE4A, the digital exchange is System X, and the first digital switch is based on the OCS 300 small exchange.



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5
ANALOGUE
1
ALC
64K bit/s
DIGITAL
64Kbit/s
DAC
LC
MUX
CX
LT
TXE4
CHANNEL 16
TO NETWORK AND COMMON CHANNEL SIGNALLING
DLC
DATA
64 K bit/s
DAC
LC
MUX
CX
LT
TC
3
4
2
CYCLIC STORE
MCU
SUP.
CALL CHARGE
CHANNEL 16
H
H
H
H
H
CCF
64 Kbit/s TO CHARGE CENTRE
LAN
DIGITAL SWITCH
6
2 M bits
2 M bits
DIGITAL 'D' SWITCH
CX
CX
2 Mbit/s
2 Mbit/s
TO SYSTEM X
TO OTHER GROUPS
7

SPECIFICATION

Telephone exchanges

This invention relates to automatic telecommunication exchanges, and especially to the enhancement of existing exchanges in a network being penetrated by more modern exchanges.

The development of processor-controlled exchanges mean that it is simpler than in the past to provide subscribers with facilities additional to the so-called plain ordinary telephone service (POTS). Further, there are now a number of types of exchanges in the network; thus in Great Britain in addition to the older electro-mechanical exchanges, such as Strowger and cross-bar exchanges, there are TXE4 and TXE4A exchanges. These latter are processor controlled, but provide less than the more modern and fully digital exchanges such as System X exchanges. As the penetration of the more "sophisticated" exchanges into the network increases, subscribers on the older exchanges tend more and more to ask for modern facilities provided by the new exchanges. In further such developments we have recently developed a system with special provision for giving some subscribers of an existing exchange enhanced facilities. This is described and claimed in our Application No. 8406721 (C. D. Pratt 2). In that arrangement to provide such facilities for a block of the lines served, that block is connected to an additional switching unit, called a Front End Switch (FES), which connects the lines of that block to the main switching network of the exchange. Thus the FES is analogous (rather vaguely) to a concentrator. The control means for the FES and the main exchange's control means are interconnected by a signalling link to co-ordinate the operation os the main network and the FES.

Such an interconnecting link can be a local area network (LAN), as described and claimed in our Application No. 8319223 (M. B. Kelly 1).

An object of the invention is to extend the principles of the above-mentioned Application No. 8406721 in an advantageous manner.

According to the invention, there is provided an automatic telecommunication exchange system, which includes a non-digital telephone exchange switching network, a digital switch network serving a number of subscribers' lines for whom additional facilities are to be provided, the lines served by the digital switch network including both digital and non-digital lines, with analogue to digital and digital to analogue conversion means for the non-digital lines, links from the digital switch network to the non-digital switch network which links are less in number than the number of lines served by the digital switch network and include digital to analogue and analogue to digital conversion means, and digital links of the digital switch network via which that network has access to a remote digital exchange, which access to the remote digital exchange does not extend via the non-digital switching network.

According to a somewhat different aspect of the invention, there is provided an automatic telecommunication exchange system, which includes a non-digital telephone exchange, a first digital switch network which serves a number of subscribers' lines of that exchange and gives those subscribers' lines access to a plurality of line circuits connected to the non-digital exchange, which access provides for digital to analogue and analogue to digital conversion, a further digital switch network to which the first digital switch network has access and via which the subscribers served by the first digital switch network have access to outgoing digital channels to a remote digital telecommunication exchange, and control means associated with the non-digital exchange and the two digital switch networks.

Such a system needs signalling equipment for communications between its various elements, and thus can follow the principles of our Application No. 8321092 (G. Harland 15). This relates to a telecommunication exchange network including analogue exchanges of relatively modern types, e.g. TXE4 or TXE4A, with fully digital exchanges being introduced into the network. In Great Britain these digital exchanges are currently of the System X type, although other types (e.g. ITT System 12) are also possible. To communicate with such digital exchanges, TDM/PCM junctions extend from the analogue exchanges to the digital exchanges, each such junction providing a number of channels. On these channels signalling is done in a common channel manner; with 32 channel highways channel 16 is used for common channel signalling and channel 0 is used for synchronisation. Access to channel 16 is under the control of a processor, via a suitable interface.

An embodiment of the invention will now be described with reference to the accompanying highly schematic block diagram.

In the present arrangement a group of fully digital subscribers' lines is connected to an analogue exchange, e.g. TXE4A, via a fully digital switch, so that in this respect it resembles the system of our Application No. 8406721, referred to above. However, as will be seen, the principles of this arrangement are greatly and advantageously extended. Although the invention is not so limited it is described herein as applied to a network including TXE4 and TXE4A exchanges, which is being penetrated by System X exchanges.

In the drawing, there is a TXE4 exchange whose main switching network is represented by a block 1, with which are associated other smaller blocks representing various parts of the control equipment of the TXE4. These include a cyclic store 2 which contains stored information about the lines served, and several such stores are provided. Block 3 represents one of a number of Main Control Units, which are the main processors of the exchange, and block 4 represents one of a number of supervisory processing units used in the exchange. TXE4 and its characteristics are well known, and for further information reference is directed to a number of papers on the TXE4 system which appeared in "Electrical Communication", Volume 51, Number 4, 1976.

A number of lines requiring enhanced features, shown at the left-hand side of the drawing, are connected to a digital switch 5, which could, for example, be the main portion of a small digital exchange such as one of the OCS 300 type. Some of the lines served are analogue lines, with analogue line

circuits ALC, which provide analogue-digital and digital-to-analogue conversion, to, for instance 64 Kbits/sec. Others of the lines are digital, with data facility, and these have digital line circuits DLC. The enhanced facilities contemplated can include detailed billing, call diversion, advise duration and charge, and three party connections.

Such a switch 5 gives access to TDM/PCM links to the TXE4 network 1, and these connections go via digital-analogue (and analogue digital) access blocks DAC to line circuits LC on the TXE4 network. The outlets from the TXE4 network go via multiplexers MUX to the network and common channel signalling arrangements, as in Application No. 8321092 referred to above. These connections include channel extraction units CX for extraction from and insertion onto channel 16 of signalling information, and line terminations LT.

The digital switch, e.g. an OCS 300 switch in this case, provides a concentration function providing access to the TXE4 switching network via normal line circuits LC, as mentioned above. It is in this digital switch that a calling subscriber's identity is known, and this switch can prtvide access to the appropriate one of a number of handlers H, and thereby provide the desired augmentation of the TXE4 function. These handlers are connected to a local area network LAN, which thus interconnects the various control devices, as in Application No. 8319223, referred to above. As will be seen many of these handlers are in effect interfaces between the LAN and the various TXE4 control units.

In the case of a call terminating on one of the lines connected to the front end switch 5, the desired subscriber is selected via the LAN and via a terminal on the TXE4 network 1 which accesses the digital switch 5. The additional facilities are then brought into line as required to handle the connection. Thus the enhanced facilities are available on both originating and terminating connections, but the system as so far described does not provide for connection via a digital path to give a fully digital interconnection.

A second stage in the development of the system is to enable the digital switch 5 to select a digital path without traversing the TXE4 switching network giving digital connection to the System X network via unit TC in the switch 5 and a 2 Mbit/sec link 6, which goes direct to the System X network, apart from another channel extraction/insertion block CX. This avoids use of the block 7. In a similar way calls to a digital subscriber on the switch 5 can be made directly from the System X exchange, with the common channel signalling system supplying the necessary information for calls set up via the respective handlers H. The common channel signalling links associated with circuits terminated on the TXE4 (analogue) network may either carry all signalling messages for all-digital connection, or provide a reliability back-up for signalling links associated with the direct digital circuits.

The remainder of the system, needed as the number of subscribers requiring connection to the System X network grows, includes a further digital switch 7, called a digital D switch, by analogy with the D switch stage of TXE4. This is also coupled via handler H to the LAN. The input to the switch 7 from the digital switch 5 connects the unit TC and the 2 Mb/sec link 6 to the switch 7. This switch 7 has other similar links to other groups, i.e. other switches such as 5. The connection to the System X network is via further channel extraction/insertion units CX, which like the other CX units give access to a block CCF connected to the LAN.

Thus a digital path can be selected without traversing the TXE4 switching network, providing direct connection via the digital D switch 7 to the System X network.

Thus the present arrangement permits growth from an "all-space" exchange such as TXE4 (or TXE4A) to "all-digital" working for increasing numbers of subscribers. All-digital working gives the subscribers the ability to use the interconnection for speech or data, as desired, so that the full features of the Integrated Services Digital Network (ISDN) can be achieved.

Hence full "all-digital" working can be achieved by add-on stages allowing the best and continuing use of the existing network.

CLAIMS

1. An automatic telecommunication exchange system, which includes a non-digital telephone exchange switching network, a digital switch network serving a number of subscribers' lines for whom additional facilities are to be provided, the lines served by the digital switch network including both digital and non-digital lines, with analogue to digital and digital to analogue conversion means for the non-digital lines, links from the digital switch network to the non-digital switch network which links are less in number than the number of lines served by the digital switch network and include digital to analogue and analogue to digital conversion means, and digital links of the digital switch network via which that network has access to a remote digital exchange, which access to the remote digital exchange does not extend via the non-digital switching network.

2. An automatic telecommunication exchange system, which includes a non-digital telephone exchange, a first digital switch network which serves a number of subscribers' lines of that exchange and gives those subscribers' lines access to a plurality of line circuits connected to the non-digital exchange, which access provides for digital to analogue and analogue to digital conversion, a further digital switch network to which the first digital switch network has access and via which the subscribers served by the first digital switch network have access to outgoing digital channels to a remote digital telecommunication exchange, and control means associated with the non-digital exchange and the two digital switch networks.

3. A system as claimed in claim 2, and in which a plurality of first digital switch networks is provided, each of which serves a block of subscriber lines, and all of which are connected to the further digital switch network.

4. A system as claimed in claim 1, 2 or 3, and in which the control devices associated with the switching networks are interconnected by a local area network.

5. A system as claimed in claim 4, and in which control of digital connections is effected with the use of common channel signalling means which com-

municates with the units of the system via the local area network.

6. A system as claimed in claim 5, and in which the common channel signalling means includes links shared with junctions to remote exchanges which are accessed via analogue switching means.

7. A system as claimed in claim 5 or 6, and in which on fully digital calls, only the digital control devices and switching means, together with the common channel signalling means, are used.

8. An automatic telecommunication exchange system, substantially as described with reference to the accompanying drawing.

New claims or amendments to claims filed on 20 July 1984.

New or amended claims:—

9. An automatic telecommunication exchange system, which includes a non-digital telephone exchange switching network, a first digital switch network serving a number of subscribers' lines for whom additional facilities are to be provided, the lines served by the digital switch network including both digital and non-digital lines, with analogue-to-digital and digital-to-analogue conversion means for the non-digital lines, links from the digital switch network to the non-digital switch network which links are less in number than the number of lines served by the digital switch network and include digital-to-analogue and analogue-to-digital conversion means, line circuits on the non-digital switch circuits each of which terminates one of said links from the digital switch network, and a further digital switch network to which the first digital switch network has access via digital links and which itself has access to digital links to one or more remote digital exchanges, whereby said access to a said remote digital exchange does not extend via the non-digital switching network.

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