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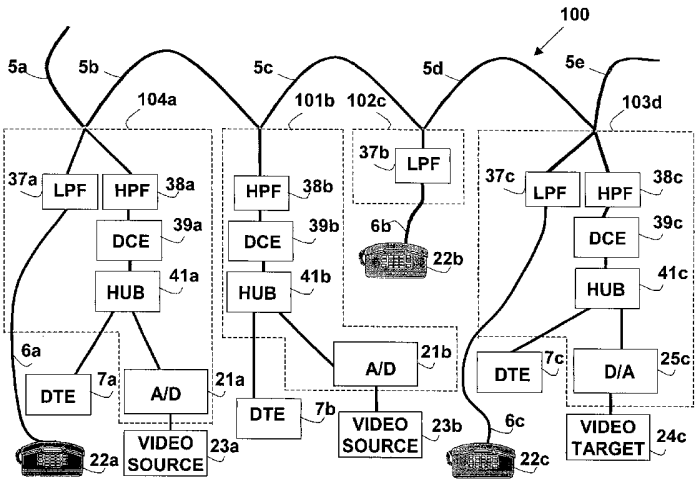
(54) Title: OUTLET WITH ANALOG SIGNAL ADAPTER, A METHOD FOR USE THEREOF AND A NETWORK USING SAID OUTLET



(57) Abstract: An outlet (70, 75, 76, 78, 79) for a Local Area Network (LAN), containing an integrated adapter (21, 25) that converts digital data to and from analog video signal. Such an outlet allows using analog video units in a digital data network (80), eliminating the need for a digital video units or external adapter. The outlet may include a hub (31, 41) that allows connecting both an analog video signal via an adapter, as well as retaining the data network connection, which may be accessed by a network jack (73). The invention may also be applied to a telephone line-based data networking system. In such an environment, the data networking circuitry as well as the analog video adapters are integrated into a telephone outlet, providing for regular telephone service, analog video connectivity, and data networking as well. In such a configuration, the outlet would have a standard telephone jack (71), an analog video jack (72) and at least one data networking jack (73). Outlets according to the invention can be used to retrofit existing LAN and in-building telephone wiring, as well as original equipment in new installation

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Outlet with analog signal adapter, a method for use thereof and a network using said outlet

FIELD OF THE INVENTION

The present invention relates to the field of conveying analog video, and, more specifically, to the transport of analog video signals within a Local Area Network (LAN) over wiring simultaneously used for analog telephony.

BACKGROUND OF THE INVENTION

Outlets

The term "outlet" herein denotes an electro-mechanical device, which enables connection to wiring installed within a building. Outlets are permanently connected to the wiring, and allow easy connection of external units as required to such wiring, commonly by means of an integrated, faceplate built-in connector. The outlet is normally mechanically attached to, or mounted in, the wall. Non-limiting examples of common outlets include: telephone outlets for connecting telephone sets; CATV outlets for connecting television sets, VCR's, and the like; and electrical outlets for connecting power to electrical appliances.

LAN Environment

Fig. 1 shows a typical Local Area Network **10**. Such a network, commonly using 10BaseT or 100BaseTX Ethernet IEEE802.3 interfaces and topology uses a hub **11** as a concentrating device, into which all devices are connected. Devices are connected to hub **11** by data connectors **14a**, **14b**, and **14c**, which are housed within respective network outlets **15a**, **15b**, and **15c** via respective cables **13a**, **13b**, and **13c**. Data connectors **14a**, **14b**, and **14c** may be,

for example, type RJ-45; and cables **13a**, **13b**, and **13c** may be, for example, Category 5 cabling. The data portion of network **10** uses data units (e.g. computers) **7a**, **7b**, and **7c**, which connect to network connectors **14a**, **14b**, and **14c** via respective cables **16a**, **16b**, and **16c**. A server **12** may also be connected to hub **11**, and can perform the external connection functionality, as well as other server functions as applied in the art.

Although Fig. 1 refers to the hub **11** as a concentrating device, it is understood that any type of device having multiple network interfaces and supporting a suitable connectivity can be used, non-limiting examples of which include a shared hub, switch (switched hub), router, and gateway. Hence, the term "hub" used herein denotes any such device. Furthermore, the network **10** can be any packet based network, either in-building or distributed, such as LAN or the Internet.

While the network **10** is specifically designed to carry digital signals, still many devices in the home or office environment are using an analog type of interface. Specifically, video associated equipment such as VCR, video monitors, video cameras uses standard analog video interface for networking. The term "video source" used herein denotes any device having analog video output, non-limiting examples being VCR (while playing), analog video camera, TV receiver. The term "video target" used herein denotes any device having analog video input, non-limiting examples being VCR (while recording), analog video monitor.

In order to employ video transportation from a video source to a video target via the digital data network, additional adapters converting analog to digital and *vice versa* are required. This will become clearer from Fig. 2 showing a digital data network **20**, used for carrying analog video signal. An Analog-to-Digital (A/D) **21** is used to connect a video source **23** to the network connector **14a** via respective the cable **16a**, and converts the analog video signal into digital data. Similarly, a digital-to-analog (D/A) **25** is used in the receiving side,

converting the network data signal into analog video, fed to a video target **24**. Such A/D **21** and D/A **25** serve as adapters for converting from analog to digital and *vice versa* and are expensive, require connection to a power outlet (or other power supply) and are not yet common in the marketplace.

Although the digital data network **20** facilitates the employment of common, low-cost standard video units, the adapters **21** and **25** are necessary, making installation and maintenance complex, and requiring additional equipment, connections, and cables. Furthermore, such adapters require a power connection, further complicating installation, use, and maintenance.

Furthermore, although Fig. 2 shows a network in which the outlets **15a** and **15c** are used solely for the connection of video units, LANs today are intended for use principally in data communication, to connect Data Terminal Equipment (DTE) devices (such as desktop personal computers, printers). In some cases, the number of outlets **15** (or connectors **14**) may not suffice for both telephony and data applications. For example, this may be the case in an office where each work area has a single network connection via a single outlet **15** having single connector **14**. In this case, a hub (or other multi-port unit) must be connected to expand to multiple network connections. Fig. 3 shows such a configuration in a prior-art network **30**. In order to allow both adapter **21a** and DTE **7a** to share a single network outlet **15a** via the connector **14a**, a hub **31a** is added. Similarly, a hub **31c** is added, facilitating the connection of both adapter **21c** and DTE **7c** to a single network outlet **15c** via the connector **14c**. Thus, in such a configuration, additional hubs **31a** and **31c** must be added, introducing additional complexity in installation and maintenance.

Analog Telephone Network

Analog telephony, popularly known as "Plain Old Telephone Service" ("POTS") has been in existence for over 100 years, and is well-designed and well-engineered for the transmission and switching of voice signals in the 3-4

KHz portion (or "band") of the audio spectrum. The familiar POTS network supports real-time, low-latency, high-reliability, moderate-fidelity voice telephony, and is capable of establishing a session between two end-points, each using an analog telephone set.

The terms "data unit", "computer" and "personal computer" ("PC") as used herein include workstations and other data terminal equipment (DTE) with interfaces for connection to a local area network. The term "telephone set" or "telephone device" as used herein includes any device which can connect to a Public Switch Telephone Network ("PSTN") using analog telephone signals, non-limiting examples of which are fax machines, automatic telephone answering machines, and dial-up modems.

Home Networking

In-home telephone service usually employs two or four wires, to which telephone sets are connected via telephone outlets.

Fig. 4 shows the wiring configuration of a prior-art telephone system including a network **40** for a residence or other building, wired with a telephone line **5**. The telephone line **5** comprises a single wire pair which connects to a junction-box **34**, which in turn connects to a Public Switched Telephone Network (PSTN) **41** via a cable **33**, terminating in a public switch **32**, which establishes and enables telephony from one telephone to another. The term "analog telephony" herein denotes traditional analog low-frequency audio voice signals typically under 3KHz, sometimes referred to as "POTS" ("Plain Old Telephone Service"), whereas the term "telephony" in general denotes any kind of telephone service, including digital service such as Integrated Services Digital Network (ISDN). The term "high-frequency" herein denotes any frequency substantially above such analog telephony audio frequencies, such as that used for data. ISDN typically uses frequencies not exceeding 100KHz (typically the energy is concentrated around 40KHz). The term "telephone line" herein denotes electrically-conducting lines which are intended primarily for the carrying and

distribution of analog telephony, and includes, but is not limited to, such electrically-conducting lines which may be pre-existing within a building and which may currently provide analog telephony service. The junction box **34** is used to separate the in-home circuitry from the PSTN and is used as a test facility for troubleshooting as well as for new wiring in the home. A plurality of telephones may connect to telephone lines **5** via a plurality of telephone outlets **35a**, **35b**, **35c**, and **35d**. Each outlet has a connector (often referred to as a "jack"), denoted in Fig. 4 as **36a**, **36b**, **36c**, and **36d**, respectively. In North America, RJ-11 is commonly used for a jack. Each outlet may be connected to a telephone unit via a "plug" connector that inserts into the jack.

Network **40** is normally configured into a serial or "daisy-chained" topology, wherein the wiring is connected from one outlet to the next in a linear manner, but other topologies such as star, tree, or any arbitrary topology may also be used. Regardless of the topology, however, the telephone wiring system within a residence always uses wired media: two or four copper wires along with one or more outlets which provide direct access to these wires for connecting to telephone sets.

It is often desirable to simultaneously use existing telephone wiring simultaneously for both telephony and data networking. In this way, establishing a new local area network in a home or other building is simplified, because there is no need to install additional wiring. U.S. Patent 4,766,402 to Crane (hereinafter referred to as "Crane") teaches a Local Area Network over standard two-wire telephone lines, but does not simultaneously support telephony.

The concept of frequency domain / division multiplexing (FDM) is well-known in the art, and provides means of splitting the bandwidth carried by a wire into a low-frequency band capable of carrying an analog telephony signal and a high-frequency band capable of carrying data communication or other signals. Such a mechanism is described, for example, in U.S. Patent 4,785,448 to Reichert *et al.* (hereinafter referred to as "Reichert").

This technique is exploited in U.S. Patent 5,896,443 to Dichter (hereinafter referred to as "Dichter"). Dichter suggests a method and apparatus for applying a frequency domain / division multiplexing (FDM) technique for residential telephone wiring, enabling the simultaneous carrying of telephony and data communication signals. The available bandwidth over the wiring is split into a low-frequency band capable of carrying an analog telephony signal, and a high-frequency band capable of carrying data communication signals. In such a mechanism, telephony is not affected, while a data communication capability is provided over existing telephone wiring within a home. FDM is also widely used are xDSL systems, primarily Asymmetric Digital Subscriber Loop (ADSL) systems.

In addition to illustrating a residential telephone system, Fig. 4 also shows the arrangement of a Dichter network. Network **40** both serves analog telephones and provides a local area network of data units. Data Terminal Equipment (DTE) units **7a**, **7b**, and **7c** are connected to the local area network via respective Data Communication Equipment (DCE) units **39a**, **39b**, and **39c**. Examples of Data Communication Equipment include, but are not limited to, modems, line drivers, line receivers, and transceivers (the term "transceiver" herein denotes a combined transmitter and receiver), which enables communication over telephone line **5**. DCE units **39a**, **39b**, and **39c** are connected to respective high pass filters (HPF) **38a**, **38b**, and **38c**, which allow access to the high-frequency band carried by telephone line **5**. In order to avoid interference to the data network caused by the telephones, low pass filters (LPFs) **37a**, **37b**, and **37c** are added to isolate the POTS carrying band, so that telephones **22a**, **22b**, and **22c** connect to telephone line **5** for providing PSTN. Furthermore, a low pass filter (not shown in the figure) may also be connected to Junction Box **34** in order to filter noise induced from or to PSTN wiring **33**.

Fig. 5 shows a telephone line-based LAN **50** wherein the data network is used for carrying both analog video and regular DTE network data. Hubs **31a**,

31b, and **31c** allow connecting respective DTE units **7a**, **7b**, and **7c** as well as respective video adapters **21a**, **21b**, and **25** to respective single network connections via DCE units **39a**, **39b**, and **39c**. The adapters **21a**, **21b**, and **25** are connected to the video units **23a**, **23b** and **24** respectively. Analog telephones **22a**, **22b**, and **22c** are also shown connected via respective low pass filters (LPFs) **37a**, **37b**, and **37c** to the telephone outlets **35a**, **35c**, **35d**. Thus, the analog telephones are connected directly to the analog telephone line **5**.

Fig. 5 demonstrates the complexity of such a configuration. At least three types of external devices are required: DCE units **39a**, **39b**, and **39c**; hubs **31a**, **31b**, and **31c**; and adapters **21a**, **21b**, and **25**. Each of these devices usually requires a separate power connection, which adds to the complexity of the connections. Thus, such a network is complex and difficult to install, operate, and maintain. In WO 01/71980 of the present inventor entitled "*Telephone outlet and system for a local area network over telephone lines*" published September 27, 2001, as well as other patent applications, it is suggested to integrate the DCE, HPF, and LPF components into outlets **35a**, **35b**, and **35c**. Nevertheless, external hubs **31a**, **31b**, and **31c**, as well as adapters **21a**, **21b**, and **25** still impose additional complexity in such a network.

There is thus a widely recognized need for, and it would be highly advantageous to have, a means for allowing the use of analog video units in LAN environment without requiring additional external devices and allowing easy installation, operation, and maintenance. This goal is met by the present invention.

SUMMARY OF THE INVENTION

The present invention makes it easy and convenient to convey analog video signals in a digital data network environment. The invention provides an outlet for a Local Area Network (LAN), with an integrated analog video adapter. The outlet has a standard analog video connector allowing an analog video unit to be directly connected to, and used with, a digital data network.

In a first embodiment, an outlet according to the present invention is used with an ordinary LAN environment, such as Ethernet 10BaseT (IEEE802.3). The outlet allows connecting analog video units to the LAN via the integrated analog video adapter, supports analog video over the LAN media, and can also support a standard network data connection using an integrated multi-port unit (e.g. hub, switch, or router). For standard network data connections, the outlet also includes at least one data networking jack (e.g. RJ-45 if 10BaseT or 100BaseTX is used) connected to a port.

In another embodiment, the outlet enables a LAN to be based on in-building telephone wiring, in a home or Small Office / Home Office (SoHo) environment. A packet-based LAN is implemented, and outlets according to the present invention serve as telephone outlets, network outlets and analog video. This allows for direct and convenient connection of analog video units over the data network. In such an arrangement, the regular analog telephony service remains unaffected, because the low-frequency analog portion of the spectrum is isolated by the FDM technique. As noted above, the outlet may also support a network data connection, using an integrated multi-port unit (e.g. hub, switch or router), and in this case also includes a data network jack (e.g. RJ-45 if 10BaseT or 100BaseTX is used) connected to a port.

Outlets according to the present invention can be installed as part of an original network installation, as a retrofit to an existing network, or to set up a network over existing telephone wiring.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is herein described, by way of non-limiting example only, with reference to the accompanying drawings, wherein:

Fig. 1 shows a prior art local area network.

Fig. 2 shows a prior art local area network supporting analog video transportation, using external analog video adapters.

Fig. 3 shows a prior art local area network supporting both analog video transportation and data terminal equipment using external adapters and DTE connectivity.

Fig. 4 shows a prior art local area network over telephone lines.

Fig. 5 shows a prior art local area network over telephone lines supporting both analog video transportation and DTE connectivity.

Figs. 6a, 6b, 6c and 6d show schematically outlets according to different embodiments of the invention.

Fig. 7 shows schematically an outlet according to another embodiment of the invention.

Fig. 8 shows a local area network supporting both analog video transportation using adapters and DTE connectivity, employing outlets according to the present invention.

Fig. 9 illustrates schematically an outlet supporting analog telephony, DTE connectivity and analog video transportation according to the invention.

Fig. 10 illustrates pictorially an outlet according to the present invention.

Fig. 11 illustrates a local area network over telephone lines supporting both analog video transportation using adapters and DTE connectivity, employing outlets according to the present invention.

Fig. 12 illustrates a general form of an outlet according to the present invention, which can serve in various wired network environments, such as CATV and electrical power networks.

DETAILED DESCRIPTION OF THE INVENTION

The principles and operation of a network according to the present invention may be understood with reference to the drawings and the accompanying description. The drawings and descriptions are conceptual only. In actual practice, a single component can implement one or more functions; alternatively, each function can be implemented by a plurality of components and circuits. In the drawings and descriptions, identical reference numerals indicate those components that are common to different embodiments or configurations.

Figs. 6a to 6d show schematically outlets **70, 75, 76** and **78** according to different embodiments of the invention. As shown in Fig. 6a, the outlet **75** includes a A/D **21**. Outlet **75** connects to data network wiring via a connector **71**. Connector **71** is preferably located at the rear of outlet **75**, where outlet **75** mechanically mounts to an interior wall of a building. Outlet **75** connects to an analog video signal source via a jack **72**. Jack **72** is preferably located at the front, or "panel" of outlet **75**, which is visible when outlet **75** is mounted on an interior wall of a building. Jack **72** can be a BNC jack, or any other analog video connector commonly used for analog video. Outlet **75** allows connecting an analog video source (via jack **72**) to the data network via connector **71**, bridged by an adapter **21**. Similarly, outlet **76** shown in Fig. 6b includes a D/A **25** and analog video connector **77**, allowing the connection of analog video target via connector **77** to the outlet **76**, wherein the analog signal is generated by the D/A **25**, and fed via connector **71** from the digital data network. Both outlets **75** and **76** allow the connection of a single video unit (either source or target) to the network via the outlet.

As shown in Fig. 6c, the outlet **70** also includes the A/D **21** (similar to outlet **75**), but further includes a hub **31** and a data jack **73**, which is connected directly to hub **31**. Because of the hub **31**, the outlet **70** allows both an analog video (via jack **72**) and a data unit (via jack **73**) to be connected to the data network via connector **71**. Preferably, both jack **72** and jack **73** are located at the

front, or "panel" of outlet **70**. Similarly, outlet **78** shown in Fig. 6d allows for both an analog video (via jack **77**) and a data unit (via jack **73**) to be connected to the data network via connector **71**.

Fig. 7 shows a particularly versatile outlet **79**. This outlet allows for connection of an analog video target via connector **77**, being fed from the network via D/A **25**, a connection of analog video source via connector **72**, being connected to the A/D **21** and data unit connection via connector **73**. A four-port hub **31** is thus required, allowing the data to be shared among the D/A **25**, A/D **21** and the data unit connected to connector **73**.

Fig. 8 shows a Local Area Network (LAN) **80** according to the present invention. Basically, the infrastructure of network **80** is the same as that of prior art network **10** (Fig. 1), in which hub **11** is connected in a 'star' topology to various end units via network wiring **13a**, **13b**, and **13c**, and outlets **15a**, **15b**, and **15c**. However, according to the present invention, outlets **15a**, **15b**, and **15c** of the prior art network **10** are replaced by outlets **70a**, **75b**, and **78c**, respectively, each of which contains an adapter as previously described with reference to Fig. 6 of the drawings. For example, outlet **75b** has a built-in A/D **21b** and allows for connection of an analog video source **23b**. Outlet **70a** allows analog video source **23a** and data unit **7a** to be connected to the network. Similarly, outlet **78c** allows analog video target **24c** and data unit **7c** to be connected to the network. Hubs **31a** and **31c** integrated within outlets **70a** and **78c**, respectively, allow for the connection of respective DTE units **7a** and **7c** to the network, in addition to respective analog video units **23a** and **24c**. Network **80** allows networking of both DTE units **7a** and **7c** and analog video units **23a**, **23b**, and **24c**, and instances of such a network may consist solely of instances of outlet **75** (Fig. 6a), supporting only analog video sources **23** over the network. It may likewise consist solely of instances of outlet **70** (Fig. 6c) or of outlet **78** (Fig. 6d), both supporting analog video units as well as data networking, or a mixed

configuration of any of outlets **79**, **75**, **76**, **70** and **78**, in any number and combination.

Powering any of the outlets mentioned above, can be implemented either locally by connecting a power supply to each outlet, or, preferably, via the network itself. In the latter case, commonly known as "Power over LAN", the power can be carried to the outlet from a central location either by an additional wire pair, using the well-known phantom configuration, or by the FDM (Frequency Division / Domain Multiplexing) method. The latter commonly employs DC feeding, which is frequency-isolated from the data carried in the higher part of the spectrum.

Network **80** offers the advantages of the carrying analog video, but requires the infrastructure of LAN wiring, which may not exist within a home. In another embodiment, the invention is used in a data network over in-building telephone lines, where the analog telephony signals are carried in the low-frequency portion of the spectrum, and the data communication signals are carried in the high-frequency portion. Fig. 9 shows an outlet **90** according the present invention, which is able to separate and combine signals in different portions of the spectrum. Outlet **90** connects to the telephone wiring via a connector **91**, preferably located at the rear part of outlet **90**, where outlet **90** mechanically mounts to an interior wall of the building. A Low Pass Filter (LPF) **37** in outlet **90** is used for isolating the analog telephony part of the spectrum, for connecting an analog telephone via a jack **92**. Jack **92** is preferably a standard telephone jack, such as RJ-11 in North-America. Data communication signals are isolated by a High Pass Filter (HPF) **38**, which connects to a Data Communications Equipment (DCE) unit **39**, containing a modem for data communications over the telephone line media. An integrated hub **41** allows sharing data between analog video adapters **21** and **25**, and a data jack **73**, for connecting external devices to the network via DCE unit **39** with a standard data networking interface (such as a 10BaseT interface per IEEE802.3). The adapters

21 and **25** allow connection of an analog video units to the jacks **72** and **77** respectively, as previously described, thereby allowing analog video signals produced by an analog video units connected to the jacks **72** and **77** to be combined in digital form with data signals received by the data jack **73**. Jack **92** is preferably a standard telephone jack, such as RJ-11 in North-America. Jack **72** and **77** are preferably standard analog video jacks such as BNC. Outlet **90** supports both standard analog telephony (via jack **92**) as well as analog video via jacks **72** and **77**.

Thus, outlet **90** supports four types of interface: Regular analog telephony (via jack **92**), data communications (via jack **73**), analog video source connection via jack **72** and analog video target connection via jack **77**. A subset of such functionalities can also be provided. For example, an outlet solely supporting analog video target connection can be implemented, eliminating the need for LPF **37** and jack **92**, and also eliminating hub **41** and jack **73** as well as A/D **21** and related jack **72**. In such a case, D/A **25** directly connects to DCE unit **39**. Fig. 10 demonstrates the outlet **90** pictorially. The outlet shape and structure fits into regular telephone outlet installation in North America, and the telephone jack **92** is of RJ-11 type, the data connector **73** is of RJ-45 type, and analog video connectors **72** and **77** uses BNC connector type.

Fig. 11 illustrates a network **100** that operates over telephone lines **5a**, **5b**, **5c**, **5d**, and **5e** according to the present invention. Network **100** employs outlets **104a, 101b**, **102c** and **103d**. Outlet **104a** differs from outlet **90** by not having analog video target connection support, because no D/A **25** and associated jack are present. Outlet **101b** differs from outlet **104a** by having no PSTN connection support, because no LPF **37** and associated jack are present. Similarly, outlet **102c** allows only for PSTN connection by employing LPF **37b** and an analog telephone connector jack. Outlet **103d** differs from outlet **90** by not having analog video source connection support, because no A/D **21** and associated jack are present. Outlet **101b** differs from outlet **104a** by having no PSTN connection

support, because no LPF **37** and associated jack are present. Any mixture of such outlets (**104a**, **101b**, **102c** and **103d**) or any other variants is possible.

Both networks **80** and **100** support the connectivity of both video units and DTEs. However, the analog video signal transportation is not to be limited to be carried solely between video units. For example, the analog video signal generated by video source **23** can be routed to a PC **17** (such as shown in Figs. 1 and 2), wherein the video signal is shown on the PC monitor or directly by digital monitor, as well as being stored in the PC memory. Similarly, digital content within a PC or any other digital storage can be output to a video target **24**.

Network **100** of Fig. 11 supports analog video signal transportation via analog video units **23a**, **23b**, and **24c**. Simultaneously, PSTN telephony services can be accessed by analog telephone sets **22a**, **22b**, and **22c**. In addition, data networking can be accomplished by data units **7a**, **7b** and **7c**.

Although outlets **79** and **90** and their variants are each described above as having up to one single video source connection, up to one video target connection, up to one data unit interface, it is understood that multiple such interfaces can be supported within a single outlet. For example, an additional video source interface can be added to an outlet by adding an auxiliary hub port (if required), connected to an auxiliary A/D unit **21** connected to an auxiliary connector **72**. Similarly, multiple data network interfaces can be included within an outlet, each connected to different ports of a respective hub (such as hub **41a**).

Although the invention has been so far described with regard to telephone wiring and telephone outlets, the invention can be similarly applied to any type of wired networking within a building, such as CATV or electrical power wiring. Fig. 12 illustrates an outlet **110**, which is a general embodiment of the present invention. Outlet **110** is similar in overall layout to outlet **90** (Fig. 9). Outlet **110** connects to the relevant wiring via a connector **111** and contains an integrated data/service splitter/combiner unit **112**, which isolates the data carried over the wiring from the main service signal. In the case of telephony, unit **112** contains a

low-pass filter (such as LPF **37**) and a high-pass filter (such as HPF **38**). In the case of electrical power wiring, the AC power is split by unit **112** and fed to a socket **114**, for supplying electrical power as normal. In such a case, a modem **113** being a power-line carrier (PLC) modem interfaces the hub **41** to the integrated data/service splitter/combiner unit **112**, and allows data communication over the power line. Similarly, in the case of a CATV application, where the CATV wiring is used for the network infrastructure, a coaxial cable modem is used as modem **113** and unit **112** isolates the CATV signal from the data signal.

Although the invention has been so far described as relating to Ethernet based data networks, the invention can be similarly applied to any type of wired network, including non-packet based. Furthermore, although packet networks are the most important for wide area networks, the invention is not restricted to packet networks only, and can be applied to any digital data network, where video signals are digitized and carried in digital form.

Although the invention has been so far described as relating to analog video transportation over a digital data networks, the invention can be similarly applied to any type of analog signals, including voice or analog sensors. For example, such a network can be used to carry analog audio signals from an audio system to remote analog speakers.

Although the invention has been so far described as relating to simple digitizing the incoming analog video or audio signal using A/D **21**, additional analog or digital processing can be applied within the outlet. For example, as shown in Fig. 9 there may be provided a processor 95 allowing compression techniques to be used in order to allow efficient use of the digital data network bandwidth. MPEG Encoding techniques are known in the art for compression of analog and audio signals. In such a scenario, the processor 95 is coupled to the output of the A/D 21 although the A/D 21 may be modified to include an MPEG encoder constituted by the processor 95. Similarly, relevant analog or digital

processing can be performed on the signal as part of D/A 25, such as MPEG decoder as part of the unit.

Furthermore, although the invention has been described as relating to networks based on continuous electrical conducting media (telephone, CATV, or electrical power), and the relevant modem and associated circuitry are connected in parallel to the wiring infrastructure, the invention can be applied equally to the case wherein the wiring is not continuous, but is cut into discrete segments as disclosed in WO 00/07322 to the present inventor, which is incorporated by reference for all purposes as if fully set forth herein.

The invention described can be equally used in new installations of data network in an office or home environment, as well as in retrofit applications, wherein the existing outlets (either LAN, telephone or any other) are substituted with outlets according to the invention.

While the invention has been described with respect to a limited number of embodiments, it will be appreciated that many variations, modifications and other applications of the invention may be made.

CLAIMS:

1. An outlet (75, 76) for connecting an analog signal unit (23, 24) to a digital data network (80) carrying analog signals in digital form, the digital network based on wiring, the outlet comprising:

(a) a first connector (71) for connecting the outlet to the wiring;

(b) at least one second connector (72, 77) for connecting an analog signal unit (23, 24); and

(c) an adapter (21, 25) coupled between the first connector and the at least one second connector for converting between analog signal in digital form and analog signal.

2. The outlet according to Claim 1, wherein the analog signal is selected from the group including video and audio.

3. The outlet according to Claim 1 or 2, furthermore operative to connecting at least one data unit (7) to the digital network, the outlet further comprising:

(d) at least one data communication jack (73) for connecting the at least one data unit; and

(e) a multi-port hub (31, 41) coupled to said first connector (71) and to said at least one data communication jack (73) and being operative to simultaneously connecting to said adapter (21, 25) and to the at least one data unit (7).

4. The outlet according to any one of Claims 1 to 3, further including a processor (95) to process the analog signal.

5. The outlet according to Claim 4, wherein the processor (95) is adapted to compress the analog signal.

6. The outlet according to any one of Claims 1 to 5, wherein the digital data network is based on the Internet Protocol.

7. The outlet (110) according to any one Claims 1 to 6, further including an integrated unit (112), for isolating a data signal carried over the wiring from a main service signal.

8. The outlet according to Claim 7, wherein the main service signal carried by said wiring is telephony, and the integrated unit (112) includes a low-pass filter (37) and a high-pass filter (38).

9. The outlet according to Claim 7, wherein the main service signal carried by said wiring is an electrical AC power signal and the integrated unit (112) is adapted to split the AC power and feed it to a socket (114), there being further included a power-line carrier (PLC) modem for interfacing the hub (41) to the integrated unit, and allowing data communication over the AC power line.

10. The outlet according to Claim 7, wherein the main service signal carried by said wiring is a CATV signal and the integrated unit (112) is adapted to isolate the CATV signal from the data signal, there being further included a coaxial cable modem for interfacing the hub (41) to the integrated unit, and allowing data communication over the CATV wiring.

11. A method for connecting an analog signal unit (23, 24) to a digital data network (80) carrying analog signals in digital form, the digital network based on wiring, the method comprising the steps of:

(a) connecting an outlet (75, 76) to the wiring via a first connector (71);

(b) connecting an analog signal unit (23, 24) to the outlet via at least one second connector (72, 77); and

(c) providing an adapter (21, 25) coupled between the first connector and the at least one second connector for converting between analog signal in digital form and analog signal.

12. The method according to Claim 11, wherein the analog signal is selected from the group including video and audio.

13. The method according to Claim 11 or 12, further comprising:

(d) providing at least one data communication jack (73) within the outlet (75,76) for connecting at least one data unit (7); and

(e) coupling to the first connector (71) and to the at least one data communication jack (73) a multi-port hub (31, 41) being operative to simultaneously connect to said adapter (21, 25) and to the at least one data unit (7).

14. The method according to any one of Claims 11 to 13, further including processing the analog signal within the outlet.

15. The method according to Claim 14, wherein step of processing includes compressing the analog signal.

16. The method according to any one of Claims 11 to 15, for use with a digital data network based on the Internet Protocol.

17. The method according to any one Claims 11 to 16, further including isolating a data signal carried over the wiring from a main service signal via an integrated unit (112) within the outlet.

18. The method according to Claim 17, wherein the main service signal carried by said wiring is telephony, and the step of isolating data includes low-pass filtering and a high-pass filtering the analog signal.

19. The method according to Claim 13, further including isolating data carried over the wiring from an electrical AC power signal carried by said wiring by splitting the AC power and feeding it to a socket (114) via an integrated unit (112) within the outlet, there being further included the step of interfacing the hub (41) to the integrated unit, and allowing data communication over the AC power line.

20. The method according to Claim 17, wherein the main service signal carried by said wiring is a CATV signal and the integrated unit (112) is adapted to isolate the CATV signal from the data signal, there being further included the

step of interfacing the hub (41) to the integrated unit via a coaxial cable modem for allowing data communication over the CATV wiring.

21. A wired digital data network (80) for carrying analog signals in digitized form, the network comprising:

network wiring (13) comprising at least two conductors, and

at least two outlets (70, 75, 76, 78, 79) allowing access to the network wiring wherein at least one of the outlets allows for connection of at least one analog signal unit (23, 24) for conveying a digitized analog signal through the network over the network wiring.

22. The wired digital data network according to Claim 21, wherein the analog signal is selected from the group audio and video.

23. The wired digital data network according to Claim 21 or 22, further including at least one data unit (7) connected to at least one of the outlets.

24. The wired digital data network according to any one of Claims 21 to 23, being based on the Internet Protocol.

25. The wired digital data network according to any one of Claims 21 to 24, wherein the wiring is constituted by existing in-building wiring.

26. The wired digital data network according to Claim 25, wherein the wiring is telephone wiring.

27. The wired digital data network according to Claim 25 or 26, wherein at least one of the outlets allows for connection of a telephone set.

28. The wired digital data network according to Claim 25, wherein the wiring is electrical power wiring.

29. The wired digital data network according to Claim 25 or 28, wherein at least one of the outlets allows for connection of electrical power.

30. The wired digital data network according to Claim 25, wherein the wiring is CATV wiring.

31. The wired digital data network according to Claim 25 or 30, wherein at least one of the outlets allows for connection of CATV.

32. The wired digital data network according to any one of Claims 21 to 31, further including a processor (95) to process the analog signal.

33. The wired digital data network according to claim 32, wherein the processor (95) is adapted to compress the analog signal.

34. The wired digital data network according to any one of Claims 21 to 33, wherein the wiring includes segments interconnecting adjacent outlets.

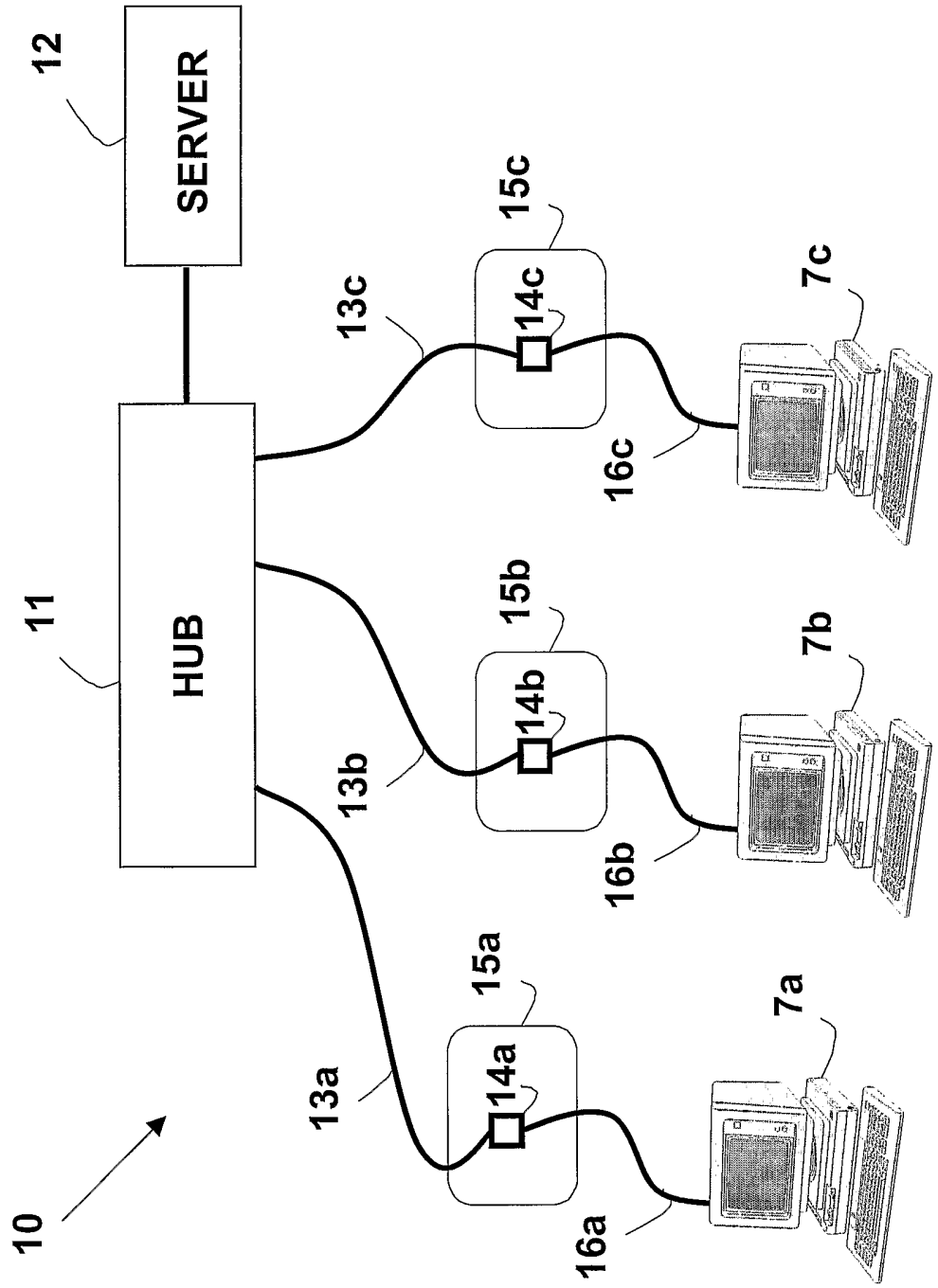


Fig. 1 (Prior-Art)

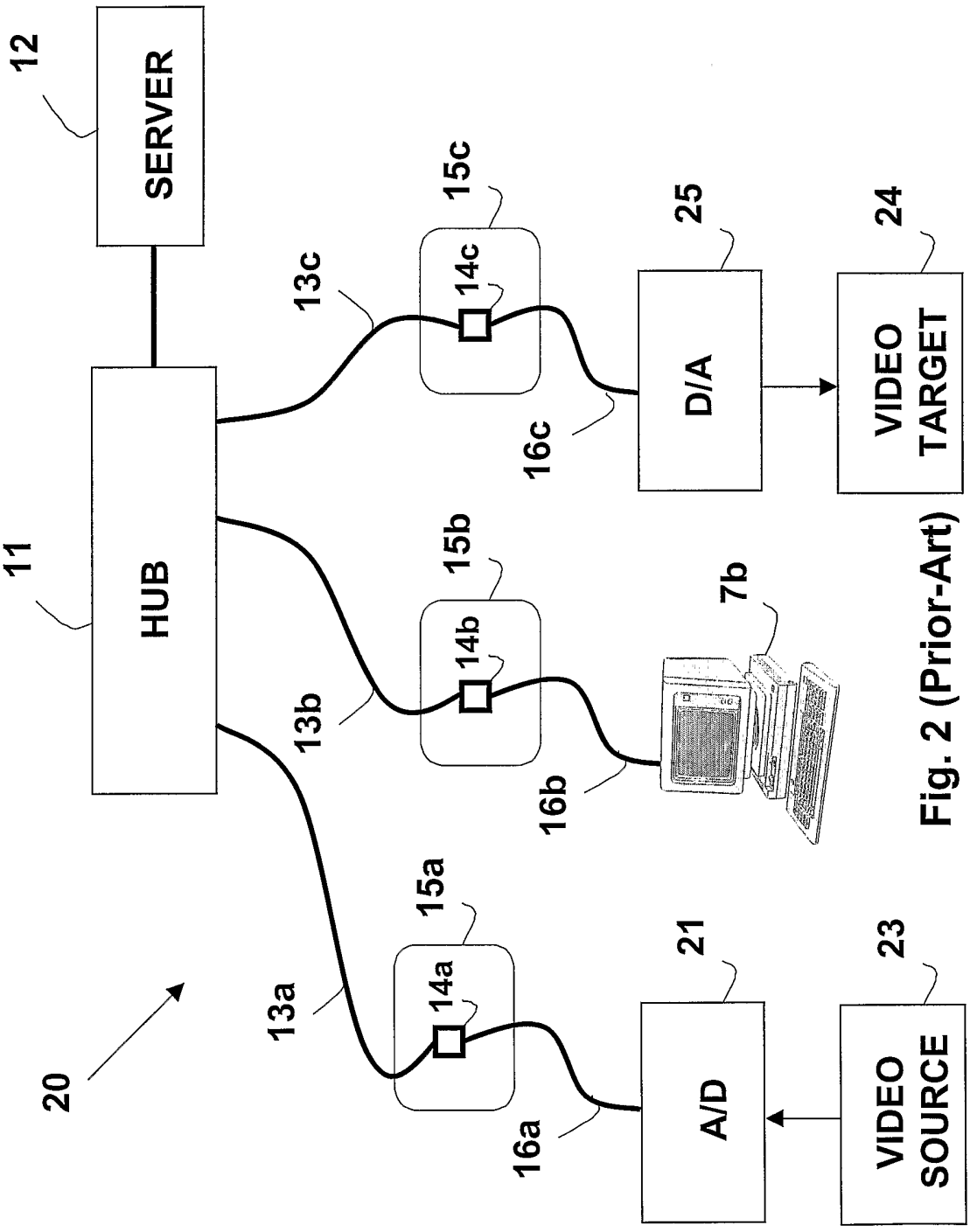


Fig. 2 (Prior-Art)

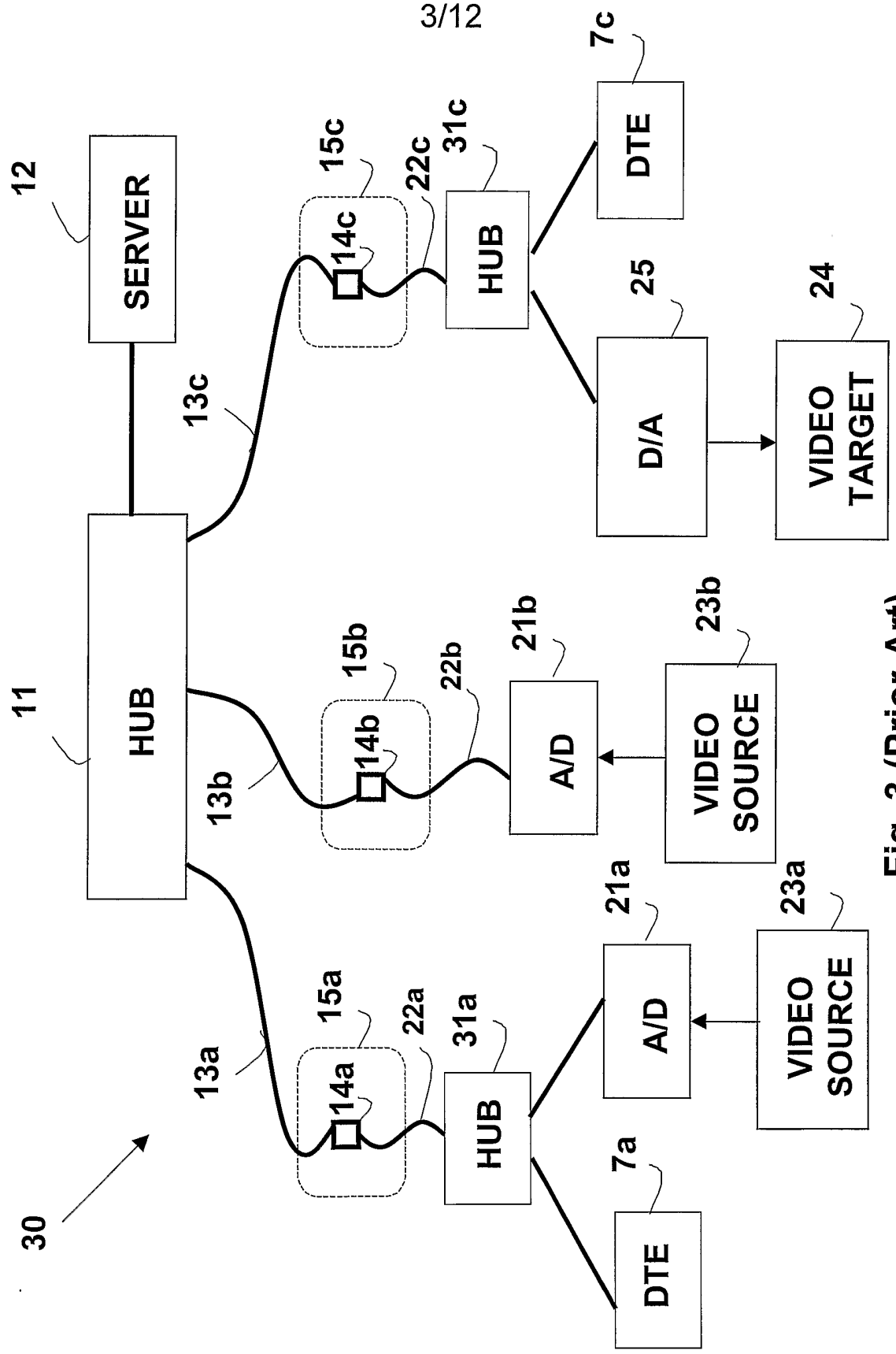


Fig. 3 (Prior-Art)

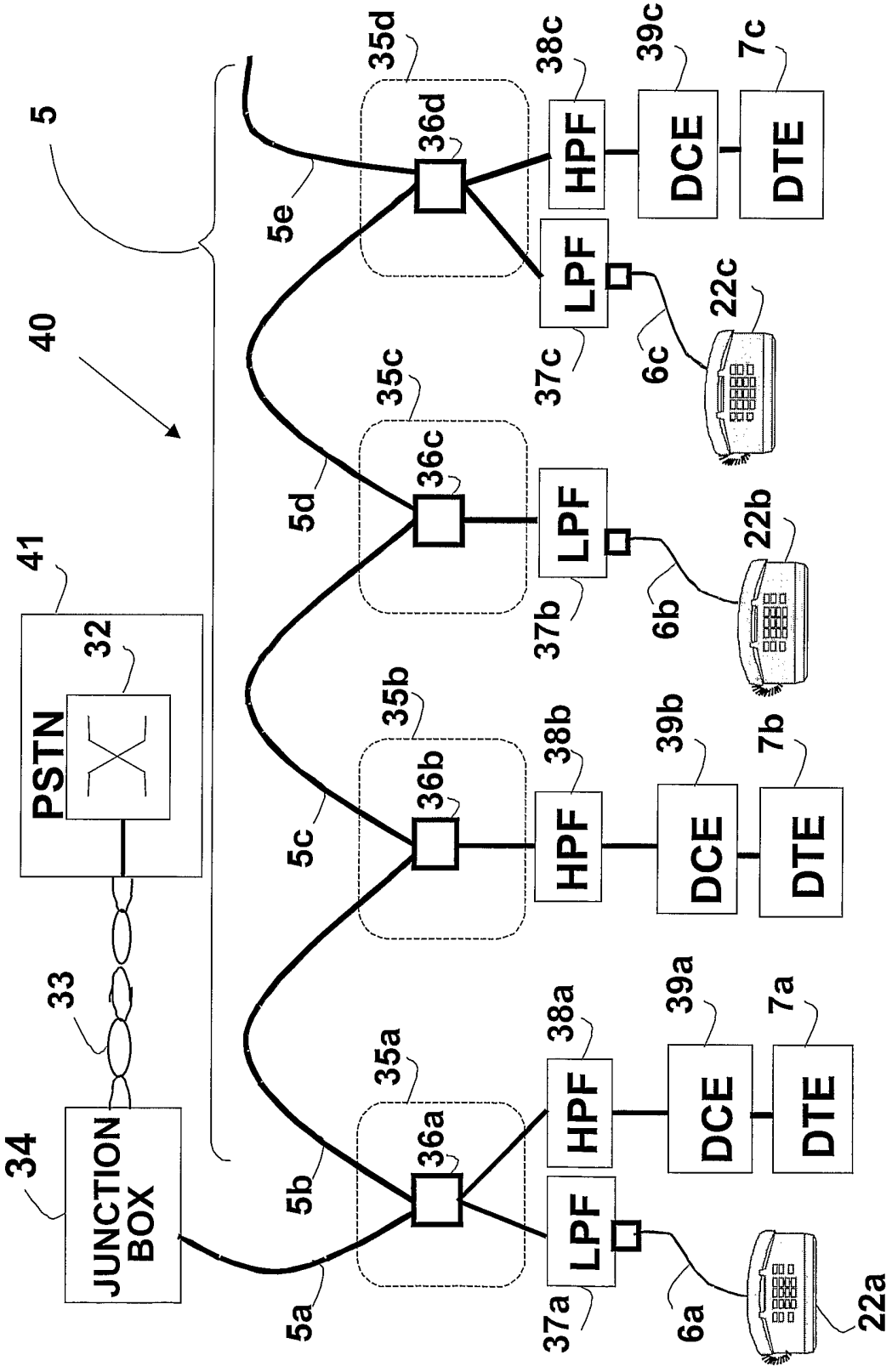


Fig. 4 (Prior-Art)

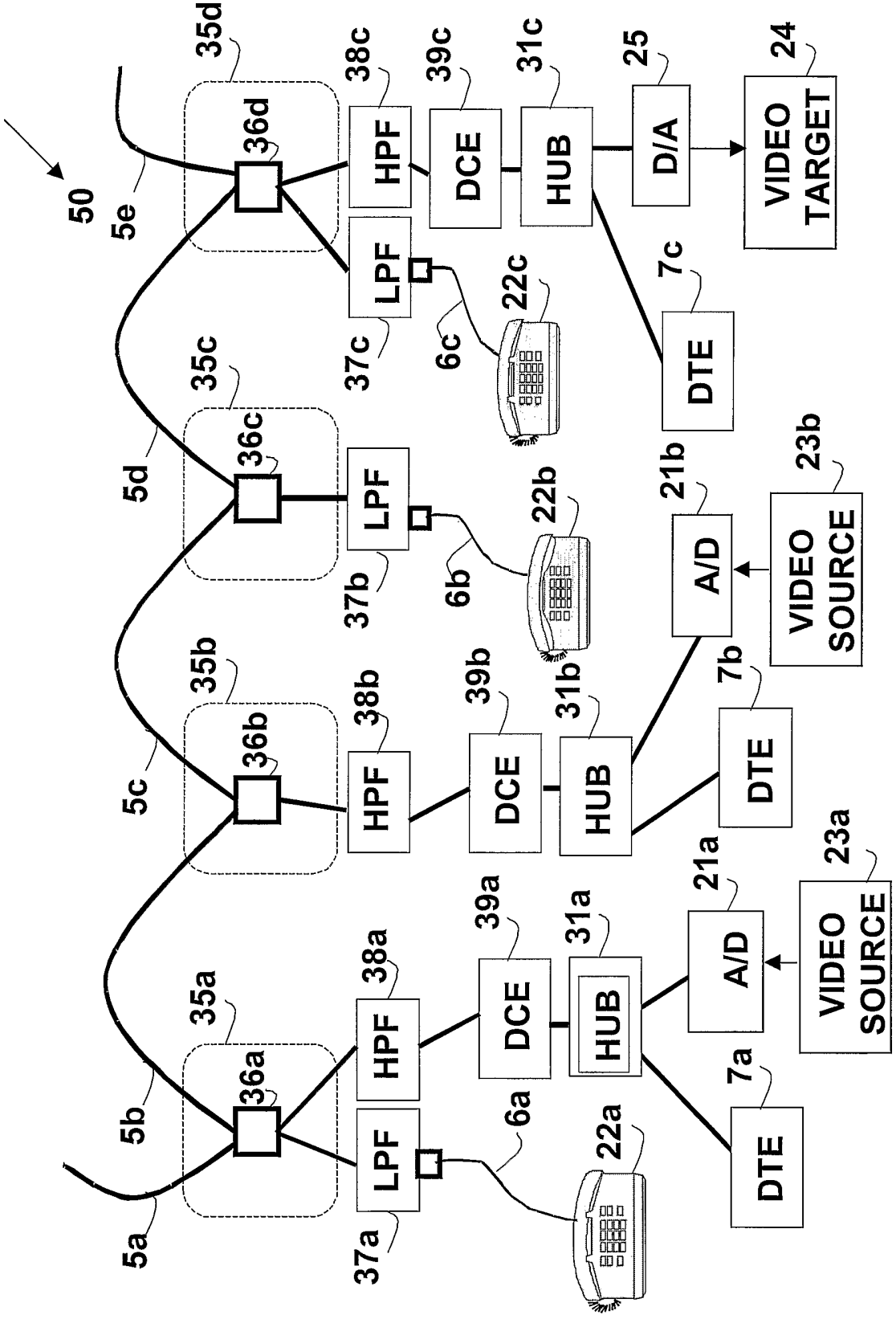


Fig. 5 (Prior-Art)

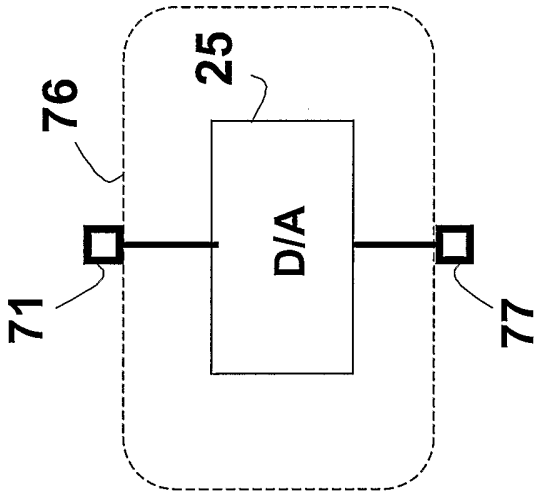


Fig. 6b

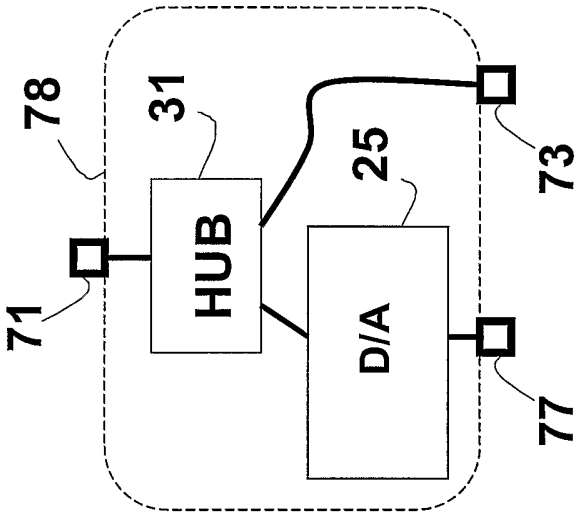


Fig. 6d

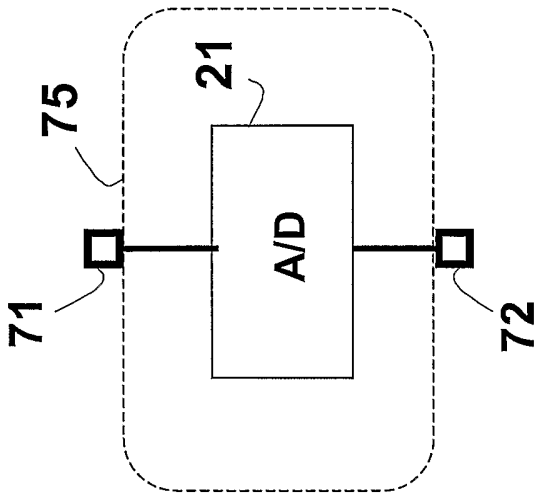


Fig. 6a

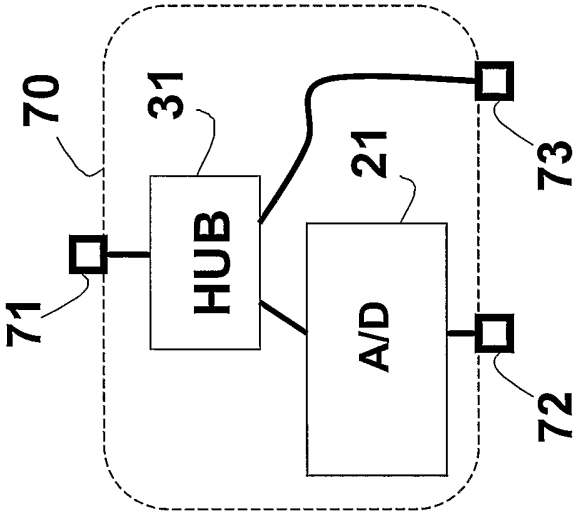


Fig. 6c

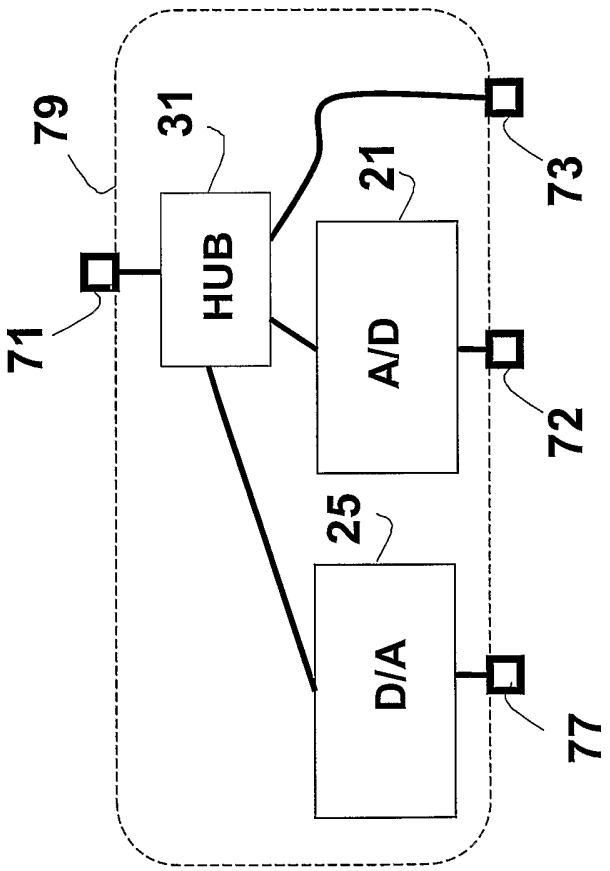
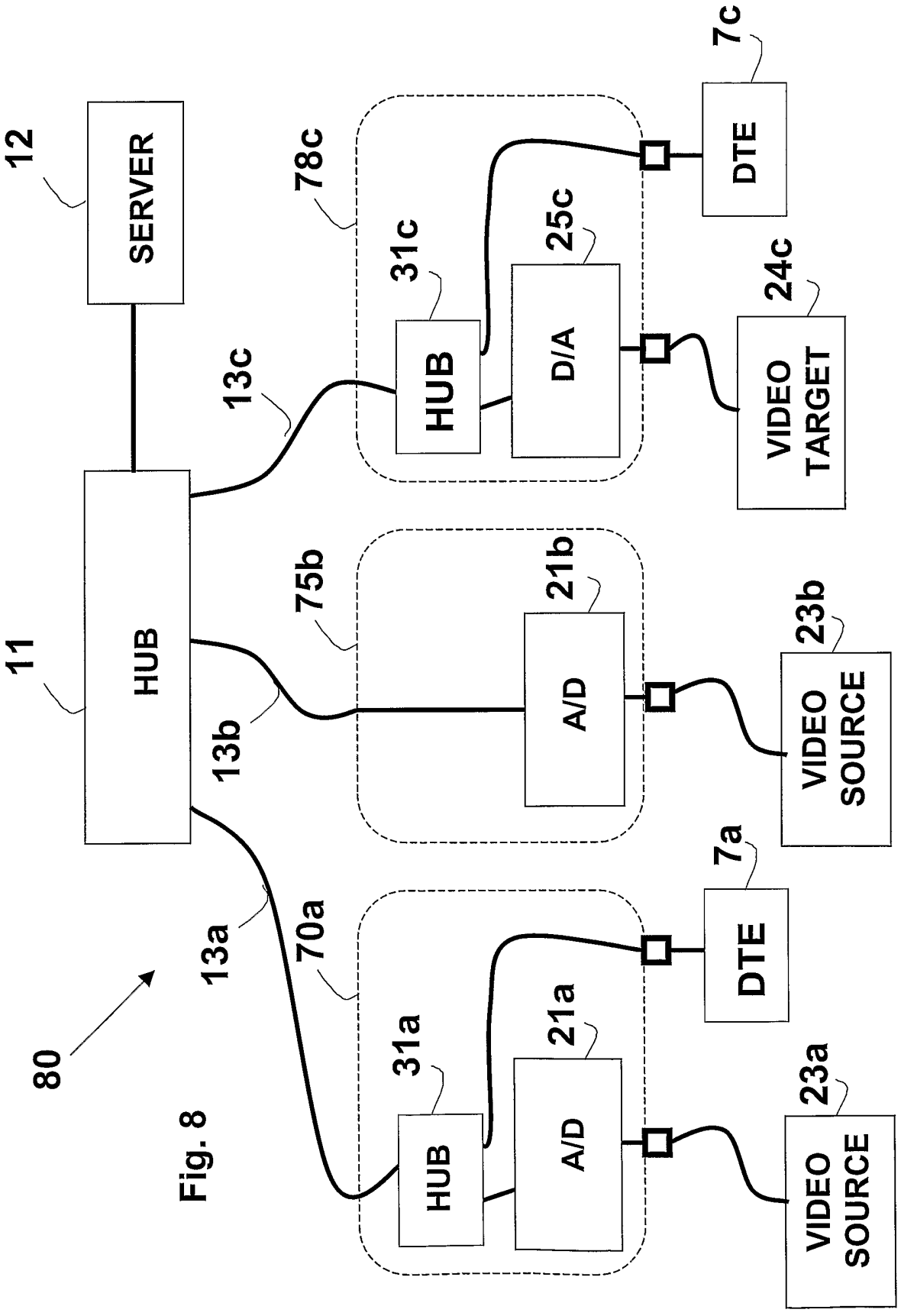


Fig. 7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SERVER
11
HUB
80
13a
13b
13c
70a
75b
78c
31a
HUB
21a
A/D
7a
DTE
23a
VIDEO SOURCE
21b
A/D
23b
VIDEO SOURCE
31c
HUB
25c
D/A
7c
DTE
24c
VIDEO TARGET

Fig. 8

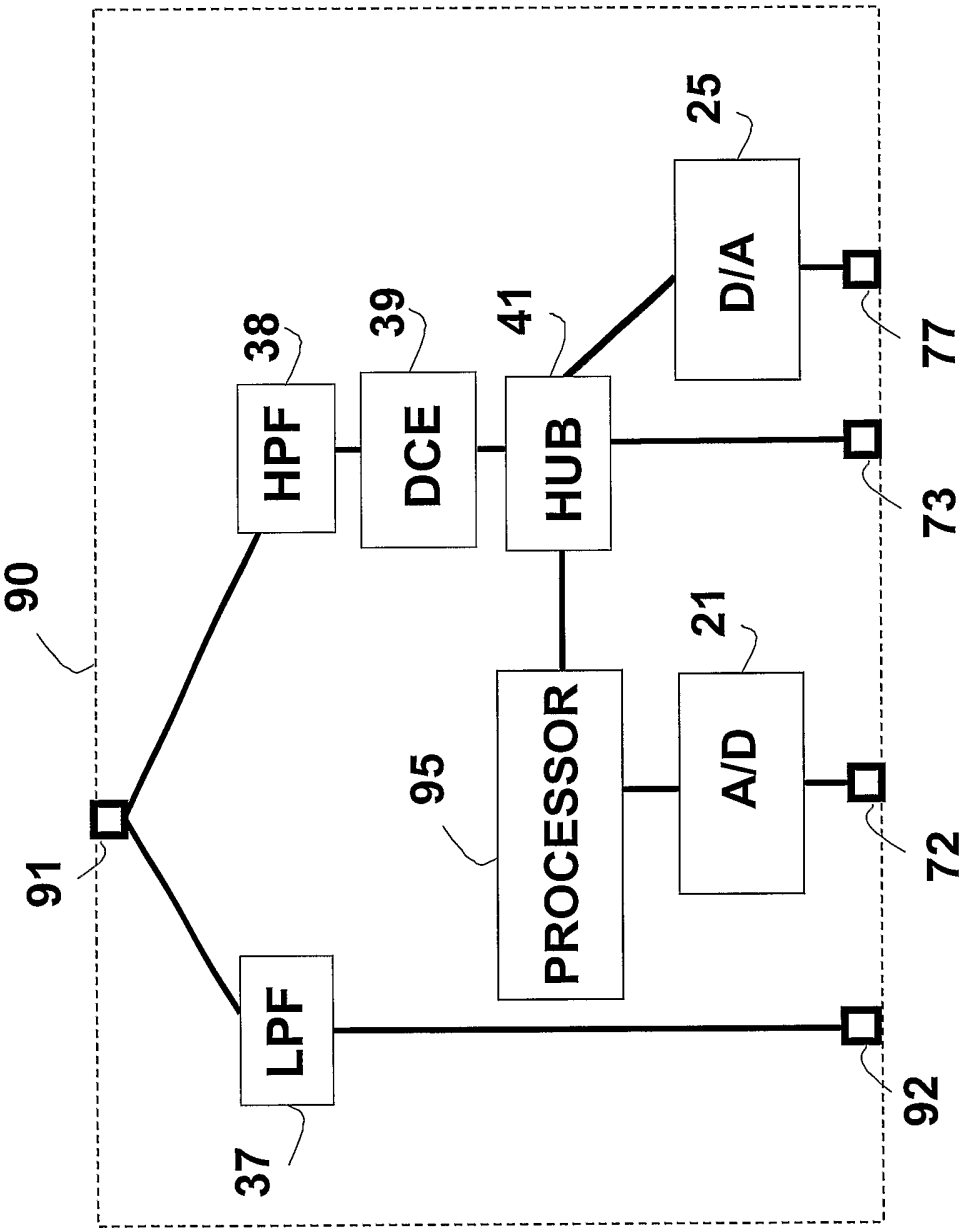
90
91
HPF
38
DCE
39
HUB
41
D/A
25
77
73
PROCESSOR
95
A/D
21
72
LPF
37
92

Fig. 9

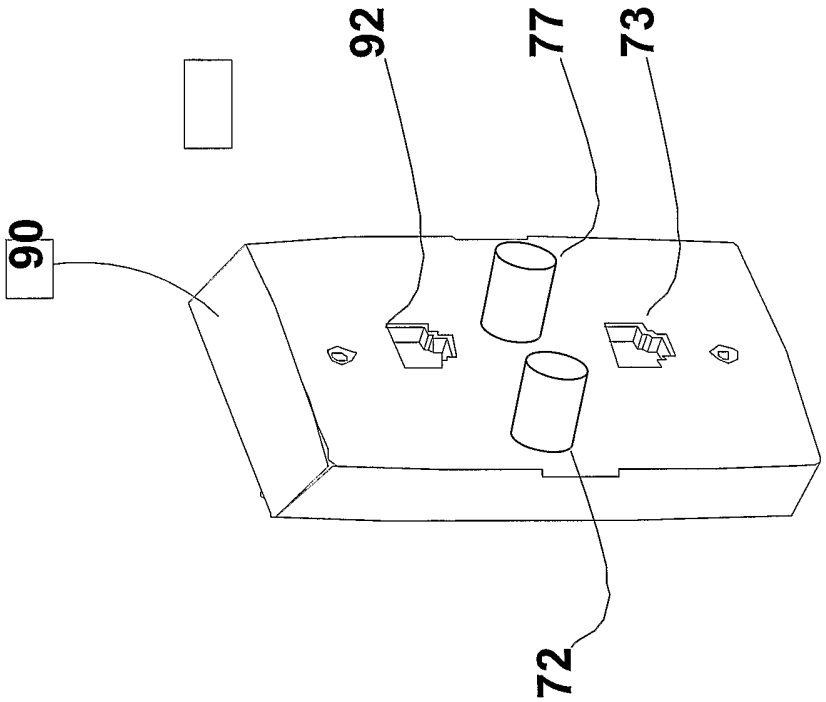

Fig. 10

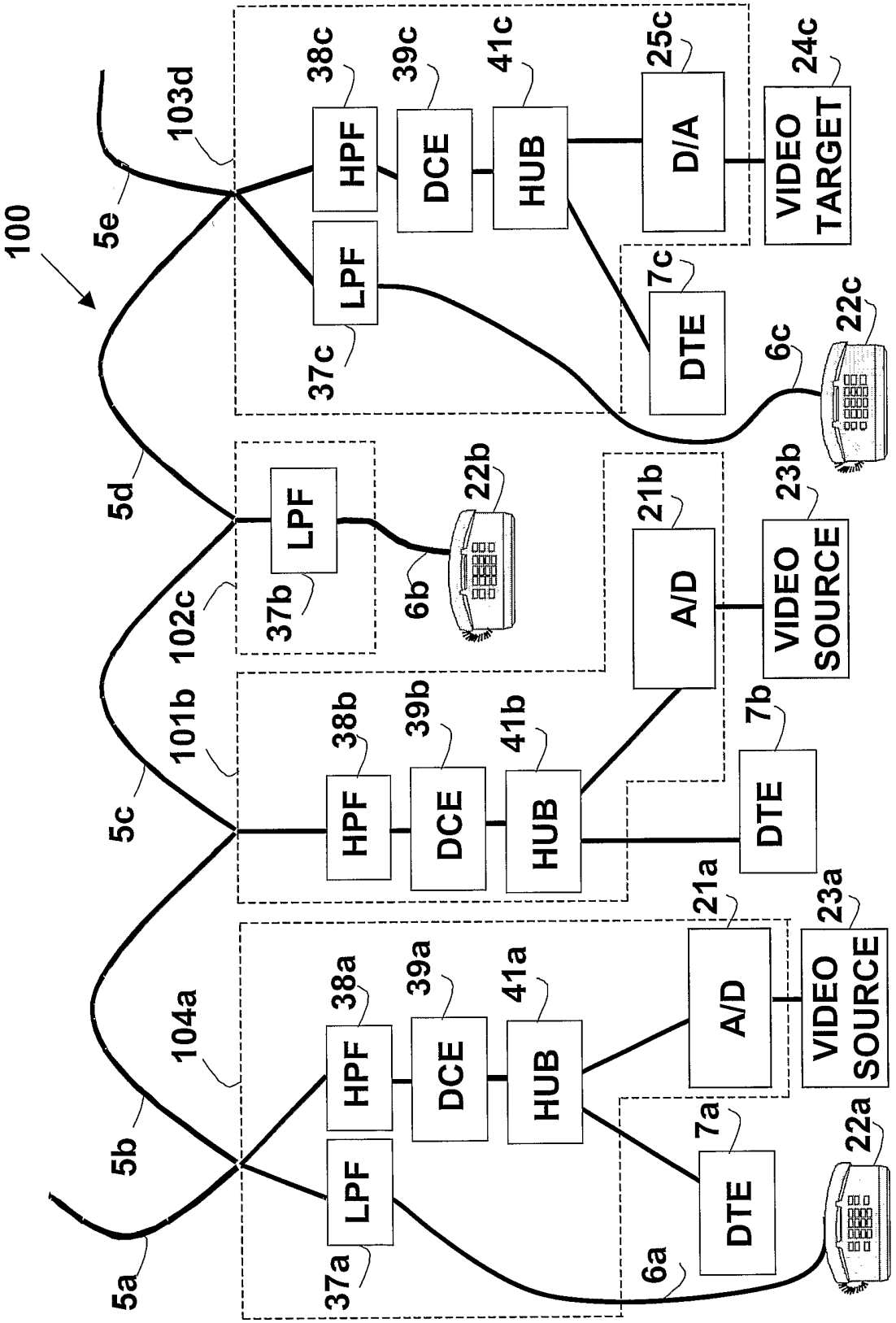
100
5a
5b
5c
5d
5e
104a
101b
102c
103d
HPF
DCE
HUB
LPF
A/D
D/A
DTE
VIDEO SOURCE
VIDEO TARGET
38a
39a
41a
37a
21a
23a
7a
22a
6a
38b
39b
41b
37b
21b
23b
7b
22b
6b
38c
39c
41c
37c
25c
24c
7c
22c
6c

Fig. 11

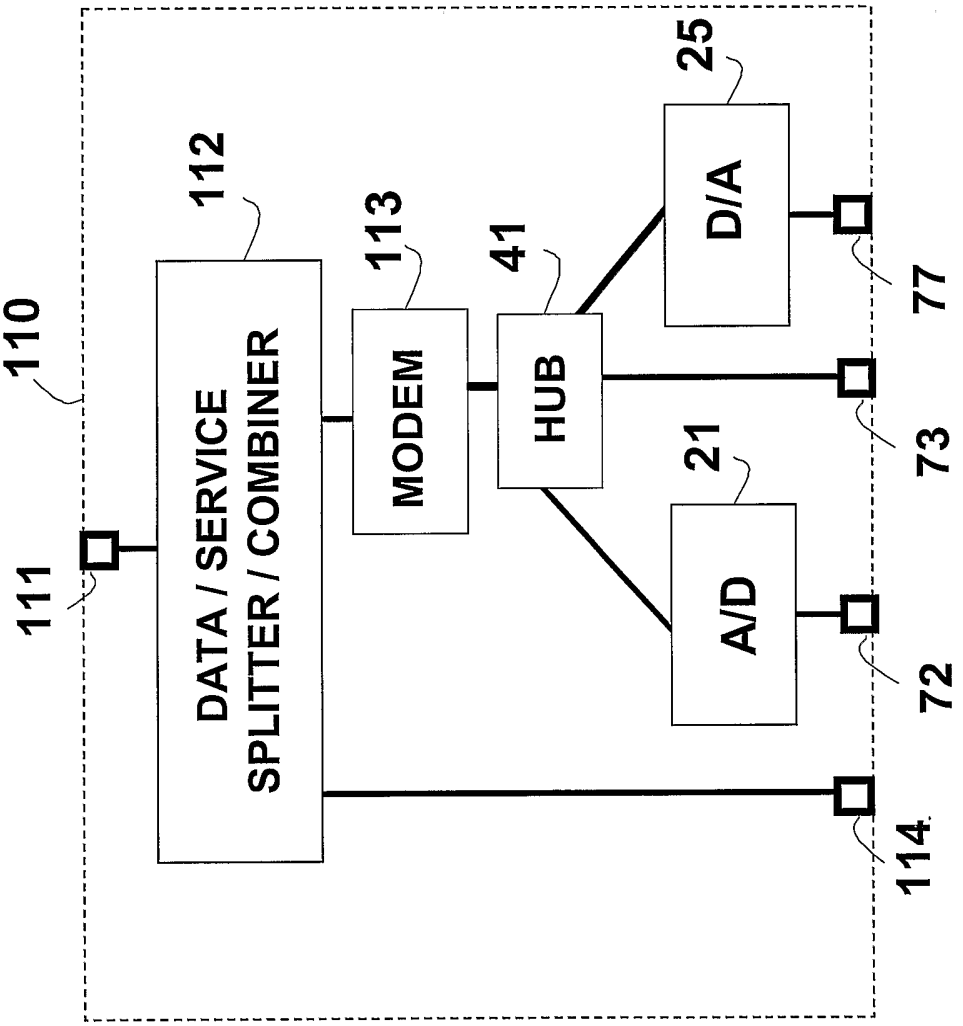
110
111
112
DATA / SERVICE SPLITTER / COMBINER
113
MODEM
41
HUB
25
D/A
21
A/D
77
73
72
114

Fig. 12

INTERNATIONAL SEARCH REPORT

In ional Application No
PCT/IL 01/00943

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04N7/10 H04N7/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 108 331 A (THOMPSON WILLIAM H) 22 August 2000 (2000-08-22)	1-6, 11-16, 21-34
Y	column 2, line 1 - line 9	7,8,17, 18
A	column 2, line 20 - line 28 column 3, line 5 - line 11 column 3, line 42 - line 53; figures 1,3 column 4, line 40 - line 47; figure 12 column 5, line 36 - line 47 column 5, line 67 -column 6, line 2	9,10,19, 20

Y	WO 01 71980 A (BINDER YEHUDA ;SERCONET LTD (IL)) 27 September 2001 (2001-09-27) cited in the application	7,8,17, 18
A	the whole document	1,11,21

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 June 2002	21/06/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Beaudoin, O

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/IL 01/00943

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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A	US 6 208 637 B1 (EAMES THOMAS R) 27 March 2001 (2001-03-27) column 15, line 36 - line 48; figures 7,16B column 16, line 39 -column 17, line 25	1-34
A	WO 95 19070 A (ABRAHAM CHARLES ;ELCOM TECH CORP (US)) 13 July 1995 (1995-07-13) page 12, line 4 - line 10; figures 1,3 page 12, line 34 -page 15, line 14	1-34
A	WO 00 39948 A (US WEST INC) 6 July 2000 (2000-07-06) page 9, line 1 - line 14; figure 4 page 10, line 3 - line 10	1,11,21

INTERNATIONAL SEARCH REPORT

nformation on patent family members

In :ional Application No
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