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(56) Documents cited
 GB 2249416 A GB 1352742 A WO 90/11572 A1

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(54) Warehouse control system

(57) A warehouse control system 1 controls operations in a frozen goods and chilled goods warehouse. A control unit 3 includes a sales and warehouse control circuit 9 having channel processing circuits 12, each for processing of sales orders for a particular channel which is determined according to the type of goods being ordered, the type of customer, the source of the sales order and warehouse location. Thus, warehouse pick lists which are printed at the printers 13 are easy to understand and include lists of goods which are easy to retrieve in the difficult working conditions of a low temperature warehouse. Verification operations carried out at the communications controller 22 ensure that degraded data does not enter the control unit 3.

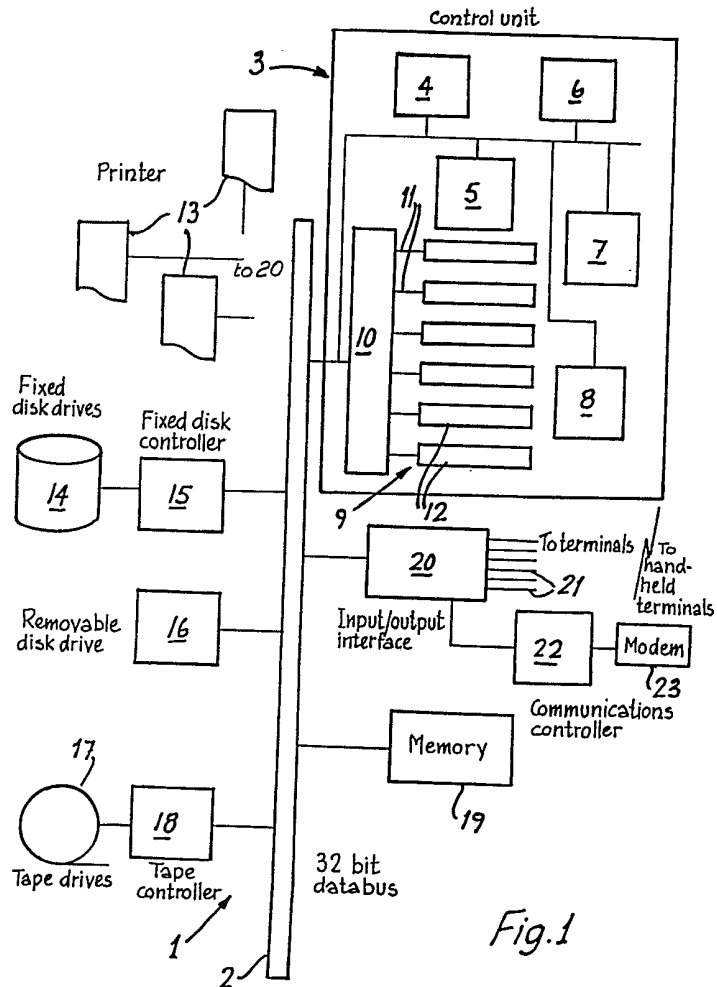
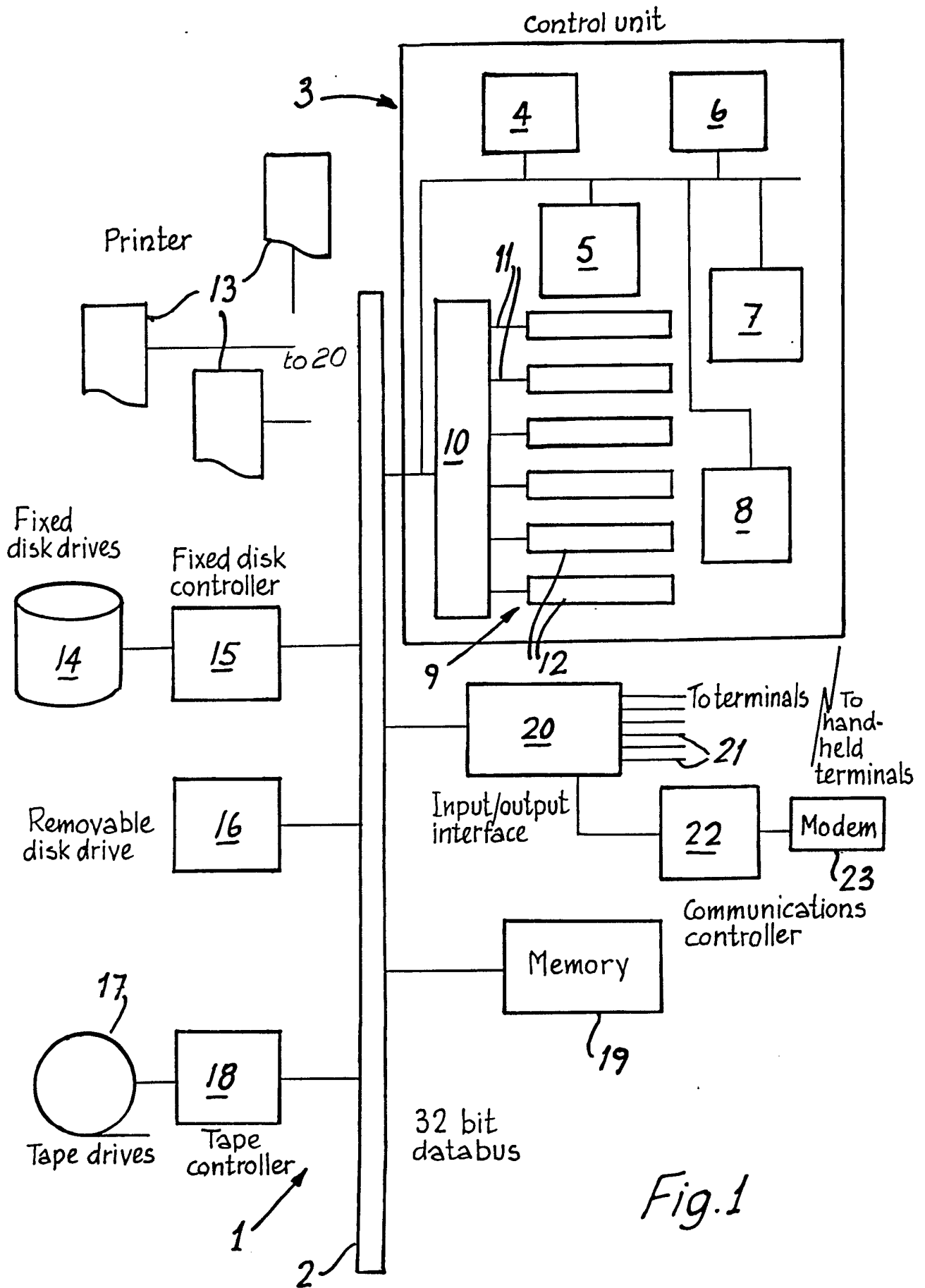


Fig.1



2/2

route \ channel	1	2	3	4	5	6
P1	0	3	0	1	0	0
P4	0	0	0	2	1	0
PA	1	0	0	0	0	1
R3	0	0	0	0	3	0
R4	2	0	0	1	1	2

Fig. 2

- 1 -

"A system for efficient storage and retrieval of
goods that require controlled conditions"

The invention relates to a warehouse control apparatus, and in particular to such an apparatus for use in a warehouse which stores goods which are perishable and where working conditions within the warehouse are difficult because of low ambient
5 temperatures. Such a warehouse may include a frozen food section where the ambient temperature is approximately -18°C and a chilled section where the ambient temperature may be as low as -5°C.

At present, for control of such a warehouse, a system such as
10 that described in European Patent Specification No. 176354 is used. Such a system would generally carry out, not only direct warehouse control operations but also indirect control processing functions such as accounting and invoicing functions.

15 Warehousing appears to be a relatively mundane operation since it is merely a matter of receiving goods from suppliers and then dividing them into orders and dispatching them to the customer. However, distribution costs of many goods,

particularly perishable goods, is a large percentage of the total cost of goods to the consumer and the major portion of distribution cost is warehousing. Warehousing is a vital element in the distribution chain. There are also questions of public health and safety so that warehousing operations of chilled and particularly frozen foods which must under no circumstances be refrozen causes considerable difficulties and has led to very stringent legislation and control of such operations which in turn has increased the cost of the operation. There are also public health indications.

For control of a warehouse for frozen and chilled foods, the parameters of vital importance include the following:-

- (1) the response time between receiving of an order and delivery of the goods,
- (2) the manner in which goods are retrieved from the warehouse,
- (3) the accuracy to which orders are prepared, and
- (4) the manner in which progress of work flow is indicated for administration purposes.

Where there is a quick response time to an order in such circumstances, deterioration of goods during handling is

unlikely to occur and further, deterioration of the goods at the customer's premises is unlikely to occur because he or she will hold the goods for a greater proportion of the shelf life. Further, a quick response time results in lower stock costs, which is extremely important in distribution of food where margins are generally quite small.

Regarding the manner in which goods are retrieved from a warehouse, it is extremely important that people working in very low temperature conditions have clear instructions as to what must be retrieved and they should spend the minimum possible amount of time retrieving goods.

If orders are inaccurately prepared, retrieval of goods already despatched and re-storage of these goods considerably increases costs and reduces efficiency of distribution because not only is extra handling required but additional records must be created and the chances of the goods being damaged are considerably increased.

Finally, in a business where there are relatively low profit margins and success depends on the turnover of a large quantity of goods, administrative monitoring of progress is essential so that decisions may be made on a timely basis and that problems may be averted.

Presently available apparatus such as that mentioned above for carrying out the warehouse control functions are generally quite satisfactory at carrying out the various auxiliary functions, however, problems arise in processing of sales
5 orders and generation of pick lists for retrieving goods from the warehouse. Problems may arise where, for example, in a busy period quite a number of orders are received simultaneously and the processor of the relevant control unit is unable to process the orders quickly enough in order to
10 ensure a quick response time. At worst, data may be lost, causing considerable confusion. A further problem is that the pick list generated makes it very difficult for personnel to reduce the amount of time spent retrieving goods in a warehouse to a minimum. Not only does this reduce efficiency
15 for distribution of goods but also makes working conditions for personnel quite difficult. Because sales orders are handled according to customer order files, if a mistake occurs in retrieval of goods it may not be detected and the goods may be returned. Finally, output interfaces for indicating
20 progress in retrieval of goods which have been ordered are quite complex and it is difficult to monitor progress of sales order processing.

The invention is directed towards providing a warehouse control apparatus to address these problems.

According to the invention, there is provided a warehouse control apparatus comprising a data bus and the following units connected to it:-

5 an input/output interface having ports connected to a plurality of user terminals and to printers;

a communications controller connected to the input/output interface and to a modem for communication with portable terminals for receipt of orders;

a random access memory circuit;

10 a fixed disk drive and associated controller;

a removable disk drive and associated controller;

15 a control unit having a plurality of circuits including a sales and warehouse control, a purchase control, an administration, a stock control and an invoicing circuit, said sales and warehouse circuit having a general controller connected by separate channel links to associated channel processing circuits; wherein the general controller comprises:-

20 a monitor for monitoring on-line incoming sales order signals from the input/output interface via

the data bus for event indications including signal source;

user channel indications and parameters for the type of stock ordered; and

5 a signal transmitter for directing the sales order signals through an appropriate channel link in response to said monitoring,

and wherein each channel processing circuit comprises:-

a sales order signal processor;

10 a data maintenance sub-circuit for generating a signal for amendment of data stored elsewhere in the control unit in response to said processing;

a printer controller for generating a printing control signal for printing of a customer order; and

15 means for merging customer order data to generate a warehouse pick list associated with the channel, and

wherein the general controller further comprises means for generating display control signals for display of a sales order progress chart indicating progress of

processing of the sales order signals by the channel processing circuits.

In one embodiment, each channel processing circuit comprises means for sorting stock data in sequential order according to physical warehouse location when generating printing control signals for the warehouse pick list.

Preferably, the communications controller comprises means for automatically verifying all signals for an individual sales order, for temporarily storing the data in a file in the random access memory circuit and for clearing data and transmitting a fault signal to the portable terminal if a faulty signal is received.

In another embodiment, each channel processing circuit comprises means for retrieving the file generated by the communications processor of text, processing of sales order signals and for cross-checking data for generation of warehouse pick list printing control signals with data of this file to verify processing.

The invention will be more clearly understood from the following description of some preferred embodiments thereof, given by way of example only with reference to the accompanying drawings in which:-

Fig. 1 is a representation of a warehouse control apparatus of the invention; and

Fig. 2 is a representation of a display indicating sales order processing.

5 Referring to the drawings, there is illustrated a warehouse control apparatus of the invention indicated generally by the reference numeral 1. The apparatus 1 comprises a 32 bit data bus 2 to which is connected a control unit 3. The control unit 3 controls operation of the apparatus 1 and includes
10 various interconnected circuits for carrying out the different operations associated with managing a warehouse for frozen and chilled goods. More specifically, the warehouse includes a chilled store at a sub-zero temperature, a frozen goods store at a temperature of -18 to -20°C, and a "breakdown area" which
15 is also at a sub-zero temperature and which is used for handling of goods after retrieval from the relevant warehouse to make up specific customer orders. Goods are received in bulk, are stored in the relevant warehouse, and on receipt of a customer sales order the goods are retrieved and are
20 despatched to the customer.

The control unit 3 has circuits for warehouse and sales control, described in more detail below, and comprises an administration circuit 4 for the carrying out of administration data processing operations such as payroll.

Further, the control unit 3 has a stock control circuit 5 for carrying out operations in relation to the stock level, and an invoicing circuit 6 for generation of invoices for--0 customers in response to a sales order. In addition, the control unit 3 includes a nominal ledger circuit 7 and a sales ledger circuit 8. Finally, the control unit 3 includes a sales and warehouse control circuit 9 which includes a general controller 10 connected by six channel links 11 to six channel processing circuits 12. These are described in more detail below.

The apparatus 1 also includes three printers 13 connected to the data bus 2, and a set of fixed disk drives 14 and an associated controller 15. A removable disk drive 16 is also connected to the data bus 2. The apparatus 1 also includes a tape controller 18 connected to tape drives 17. A random access memory circuit 19 is connected to the data bus 2. For input and output of signals, the apparatus 1 includes an input/output interface 20 having several ports 21 for connection with user terminals. The interface 20 is also connected to a communications controller 22, which is in turn connected to a modem 23 for remote communication.

In more detail, the fixed disk controller 15 has an on-board microprocessor and dual DMA controller with 512 Kbit of dual-ported, on-board parity-protected DRAM. In this embodiment, there are four fixed disk drives 14. The tape drive 17 is for

use with 125 Mbit cartridges which operate at 1.25 Mbytes per second. The input/output interface 20 uses a dual 8-bit microprocessor and has shared memory buffers. The ports 21 include a synchronous RS232 interfaces for transmission of data at 9600 baud. The control unit 3 includes an Intel 80486 microprocessor operating at 25 Mhertz with a two-set 512 byte instruction/data cache. Each of the individual circuits within the control unit 2 in this embodiment comprises a combination of software and hardware components connected to the microprocessor for carrying out the various operations. Although each circuit is illustrated as a discrete unit, some components of the control unit 3 are common to different circuits. The random access memory circuit 19 is of modular construction and comprises 8 x 4 Mbyte circuits.

In use, the printers 13 and terminals connected to the port 21 of the interface 20 are located at various parts of the building, including offices at the warehouse area. Sales representatives for the goods stored in the warehouse carry hand-held terminals with modems. These are used for taking customer's orders and for transmitting signals representing the orders via a modem to the modem 23 connected to the communications controller 22. The sales order data includes a customer code, required delivery times, codes for each item of stock required, quantities and an indication of price for the goods. In this embodiment, the invoicing circuit 6 generates several price levels for each stock item and for a

sales representative to transmit a price for the items to be sold he or she must simply select one of the price levels. It will be appreciated that this considerably simplifies the inputting of sales orders and also eliminates the chances of
5 completely wrong prices being used. It also allows flexibility because the invoicing circuit 6 may generate the same price for each level if lower prices are not available for a certain item.

On receiving the information via the modem 23, the
10 communications controller 22 opens a file in the random access memory circuit 19 and automatically verifies the signals being received and transmits them for temporary storage in the file. If there is an error in a signal caused by a communications fault or by an incorrect input at the hand-held terminal, the
15 controller 22 clears data in the file of the random access memory circuit 19 and transmits a signal via the modem 23 that all of the data should be re-transmitted. Accordingly, degradation of data caused by communications or input problems are avoided.

20 In addition to receiving sales orders via remote terminals, the apparatus 1 also receives orders which are keyed in at in-house terminals connected to the ports 21. These orders may be originally received by telephone or by letter. When inputting an order, a person may include an indication as to
25 the channel through which the order is to be processed. In

this embodiment, there are six channels, each of which has an associated channel link 11 and channel processing circuit 12 within the warehouse control circuit 9. Each sales order will have an associated channel depending on the type of goods being ordered, and the source of the order. For example, in this embodiment, three of the channels are assigned exclusively to orders received via the modem 23 to ensure that there is available processing capacity to handle all orders which are received from a remote source. Further, there is an additional channel for processing of orders received in-house for items which are frozen and are for the retail market and another channel for processing of such orders for items which are frozen and for the catering market. There is also a channel for chilled goods. The general controller 10 of the sales and warehouse control circuit 9 includes a monitor for continuously monitoring all signals representing sales orders which are received. Signals for a particular sales order may include an indication as to the channel to be used in which case the controller 10 simply directs the signals through that channel. Where there is no indication, the controller 10 monitors the source of the order and also the type of goods involved and automatically selects the channel. As each channel is selected, the signals are transmitted to the relevant processing circuit 12.

Each channel processing circuit 12 includes a sales order signal processor to process sales orders, and a data

maintenance sub-circuit for transmitting signals for amendment of data associated with other circuits within the control unit 3. For example, when a signal is transmitted to the stock control circuit 5 for reduction of the appropriate stock levels. Each channel processing circuit 12 includes a printer controller for generating printing signals for printing of data for an individual customer order. In addition, this data is stored in a buffer until a required number of customer orders are stored and the data is then sorted and merged together to form an aggregate warehouse pick list. When carrying out these operations, the channel processing circuit 12 ensures that there is a set quantity of goods to be retrieved which is not so small that many visits to the warehouse are required of personnel, while at the same time it is not too large so that an excessive amount of time is not required to be spent in the warehouse. This is extremely important for personnel working at the very low temperatures involved. Further, in sorting the data, the channel-processing circuit 12 sorts the goods in sequential fashion according to the physical location in the warehouse. There is a code for each physical location and by sorting the data in this manner, goods may be retrieved for the warehouse pick list in sequential fashion from the list. Both the customer sales order and the warehouse pick list include an indication of the channel which is involved and this indicates to personnel at the warehouse the type of goods involved and the location in the breakdown area in which they should be

deposited so that they may be loaded efficiently. Both the warehouse pick list and the customer sales order include an indication as to the route to be used for despatch of the goods. However, before generating the printing control signals, the relevant channel processing circuit 12 retrieves data stored in the file opened by the communications controller 22 if the order has been received from a remote hand-held terminal and cross-checks the data generated with that received to ensure accuracy.

10 While each channel processing circuit 12 generates the signals for printing documents and for amendment of data, the general controller 12 monitors processing by each channel processing circuit 12 and continuously transmits signals by the interface 20 to the in-house terminals for generation of a progress chart for continuous monitoring of progress. Such as chart is 15 illustrated in Fig. 2. The columns are for the channels and the rows are for the despatch routes for the goods. Thus, in this example, the channel processing circuit 12 is processing one sale order for route PA and two sales orders for route R4.

20 No sales orders are being processed for channel three. It will be appreciated that this table gives an immediate and clear indication of progress in processing of received sales orders. Such "at a glance" monitoring is extremely important for administration because it is absolutely essential that 25 there are quick response times to sales orders.

When personnel at the warehouse receive the printed pick lists and the sales orders, the pick lists are used for retrieval of goods from the warehouse in sequential order of physical location. These goods are then left in the breakdown area at
5 which personnel break down the lots of goods into the individual orders according to the customer order document. Different personnel break down the orders so that there is an inherent cross-check to ensure that the correct goods were indeed retrieved from the warehouse.

10 It will be appreciated that the apparatus 1 is constructed to carry out the operations required for control of a warehouse in an efficient manner. The construction of the sales and warehouse control circuit 9 avoids the problems of sorting of data at peak times because the incoming sales order data is
15 broken down into the relevant categories for processing by separate circuits. Designation of goods in the various channels also helps in the physical tasks of retrieval of goods and breakdowns because each individual pick list will be for one type of good so that travel within a low temperature
20 warehouse is minimised and personnel who are familiar with the goods for one particular type of channel may work for most of the time at retrieving goods for that channel. This greatly simplifies the tasks involved in retrieving and breakdown of goods. It will also be appreciated that the manner in which
25 data is received and verified ensures quality of work, thus considerably reducing special deliveries and taking goods

back. Further, administration is greatly simplified by the generation of this display indicating progress of orders.

The invention is not limited to the embodiments hereinbefore described, but may be varied in construction and detail.

CLAIMS

1. A warehouse control apparatus comprising a data bus and the following units connected to it:-

5 an input/output interface having ports connected to a plurality of user terminals and to printers;

a communications controller connected to the input/output interface and to a modem for communication with portable terminals for receipt of orders;

10 a random access memory circuit;

a fixed disk drive and associated controller;

a removable disk drive and associated controller;

15 a control unit having a plurality of circuits including a sales and warehouse control, a purchase control, an administration, a stock control and an invoicing circuit, said sales and warehouse circuit having a general controller connected by separate channel links to associated channel processing circuits; wherein the general controller comprises:-

a monitor for monitoring on-line incoming sales order signals from the input/output interface via the data bus for event indications including signal source;

5 user channel indications and parameters for the type of stock ordered; and

a signal transmitter for directing the sales order signals through an appropriate channel link in response to said monitoring,

10 and wherein each channel processing circuit comprises:-

a sales order signal processor;

15 a data maintenance sub-circuit for generating a signal for amendment of data stored elsewhere in the control unit in response to said processing;

a printer controller for generating a printing control signal for printing of a customer order; and

means for merging customer order data to generate a warehouse pick list associated with the channel, and

5 wherein the general controller further comprises means for generating display control signals for display of a sales order progress chart indicating progress of processing of the sales order signals by the channel processing circuits.

2. An apparatus as claimed in Claim 1, wherein each channel
10 processing circuit comprises means for sorting stock data in sequential order according to physical warehouse location when generating printing control signals for the warehouse pick list.

3. An apparatus as claimed in claims 1 or 2, wherein the
15 communications controller comprises means for automatically verifying all signals for an individual sales order, for temporarily storing the data in a file in the random access memory circuit and for clearing data and transmitting a fault signal to the portable terminal
20 if a faulty signal is received.

4. An apparatus as claimed in Claim 3, wherein each channel processing circuit comprises means for retrieving the file generated by the communications processor of text,

processing of sales order signals and for cross-checking data for generation of warehouse pick list printing control signals with data of this file to verify processing.

- 5 5. An apparatus substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

Amendments to the claims have been filed as follows

1. A warehouse control apparatus comprising a data bus and the following units connected to it:-

5 an input/output interface having ports connected to a plurality of user terminals and to printers;

a communications controller connected to the input/output interface and to a modem for communication with portable terminals for receipt of orders;

10 a random access memory circuit;

a fixed disk drive and associated controller;

a removable disk drive and associated controller;

15 a control unit having a plurality of circuits including a sales and warehouse control, a purchase control, an administration, a stock control and an invoicing circuit, said sales and warehouse circuit having a general controller connected by separate channel links to associated channel processing circuits; wherein the general controller comprises:-

a monitor for monitoring on-line incoming sales order signals from the input/output interface via the data bus for event indications including signal source;

5 user channel indications and parameters for the type of stock ordered; and

a signal transmitter for directing the sales order signals through an appropriate channel link in response to said monitoring,

10 and wherein each channel processing circuit comprises:-

a sales order signal processor;

15 a data maintenance sub-circuit for generating a signal for amendment of data stored elsewhere in the control unit in response to said processing;

a printer controller for generating a printing control signal for printing of a customer order;

means for sorting stock data in sequential order according to physical warehouse location when generating printing control signals for the warehouse pick list;

5 means for merging customer order data to generate a warehouse pick list associated with the channel,

wherein the general controller further comprises means for generating display control signals for display of a sales order progress chart indicating progress of processing of the sales order signals by the channel processing circuits, and

15 wherein the communications controller comprises means for automatically verifying all signals for an individual sales order, for temporarily storing the data in a file in the random access memory circuit and for clearing data and transmitting a fault signal to the portable terminal if a faulty signal is received.

20 2. An apparatus as claimed in Claim 1, wherein each channel processing circuit comprises means for retrieving the file generated by the communications processor of text, processing of sales order signals and for cross-checking

data for generation of warehouse pick list printing control signals with data of this file to verify processing.

3. An apparatus substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

5

Patents Act 1977
**Examiner's report to the Comptroller under
 Section 17 (The Search Report)**

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Relevant Technical fields

- (i) UK CI (Edition K) G4A (AUX)
- (ii) Int CL (Edition 5) G06F 15/24

Search Examiner

MISS A C CLARKE

Databases (see over)

- (i) UK Patent Office
- (ii)

Date of Search

23 JUNE 1992

Documents considered relevant following a search in respect of claims

1

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X,E	GB 2249416 A (RUEGO DEVELOPMENT) Figure 2	1
X	GB 1352742 A (NYMEYER) Figure 4	1
X	WO 90/11572 A1 (EPSTEIN) Figure 1	1

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

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P: Document published on or after the declared priority date but before the filing date of the present application.

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