United States Patent

[11] 3,623,067

[72] Inventors **Joseph D. Deal, Jr.**
Newport News;
George A. Taylor, Hampton, both of Va.

[21] Appl. No. **866,255**
[22] Filed **Oct. 14, 1969**
[45] Patented **Nov. 23, 1971**

[73] Assignee **Newport News Shipbuilding and Dry Dock Company**
Newport News, Va.

[54] **DISPLAY SYSTEM FOR COMMUNICATING DATA AMONG UNITS IN DIVERSE AREAS**
42 Claims, 13 Drawing Figs.

[52] **U.S. Cl.** ..... **340/324 R,** 340/153, 235/92 AC
[51] **Int. Cl.** **G06f 3/14**
[50] **Field of Search** ..... 340/153, 324, 334; 178/4.1 B, 4.1 C; 235/92 AC; 186/1

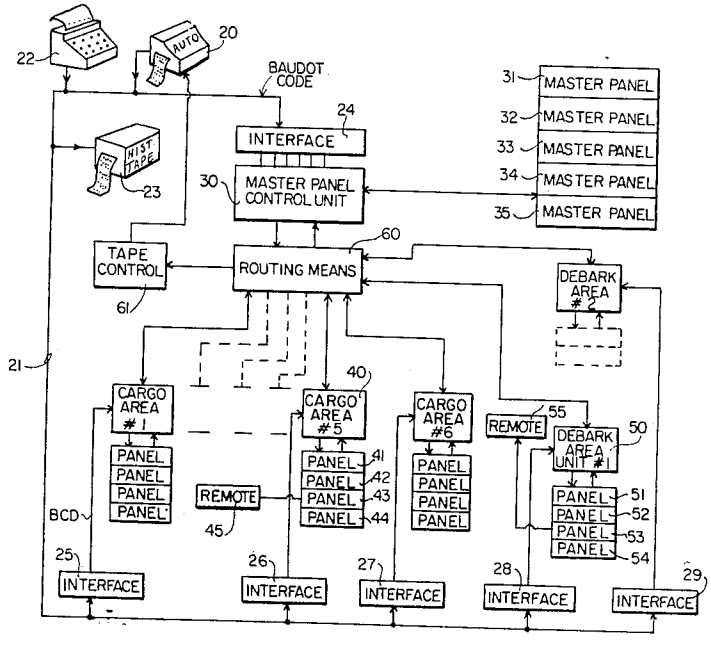
[56] **References Cited**

UNITED STATES PATENTS

2,622,142	12/1952	Jackel	340/153
3,071,753	1/1963	Fritze et al.	340/153
3,484,748	12/1969	Greenblum et al.	340/153
3,500,327	3/1970	Belcher et al.	340/324

Primary Examiner—John W. Caldwell
Assistant Examiner—Marshall M. Curtis
Attorney—Shoemaker and Mattare

ABSTRACT: A display system including plural master area display panels and multiple mutually distant display areas all having a number of display panels which can be selectively routed through a trunkline network to become associated with a particular master panel to receive display data. The slave panels retain the address of the associated master panel, and all panels which have been occupied by data relating to a particular transaction can then be decoupled from the display data lines of the network and left to display their data while these same lines are used to transfer data relating to another transaction to other selected panels, there being many available panels in each area. The occupied slave panels though decoupled from the data lines of the network, can still answer back to an associated master panel to indicate status of the transaction via other network lines which are connected in parallel to all master panels and which use the address of the associated master panel to enable the latter's answer back gating means. The system is responsive to encoded-format data and command signals from suitable input sources which communicate the data to the panels and control its routing either by accessing occupied panels by address, or else by searching out unoccupied panels to receive new data.

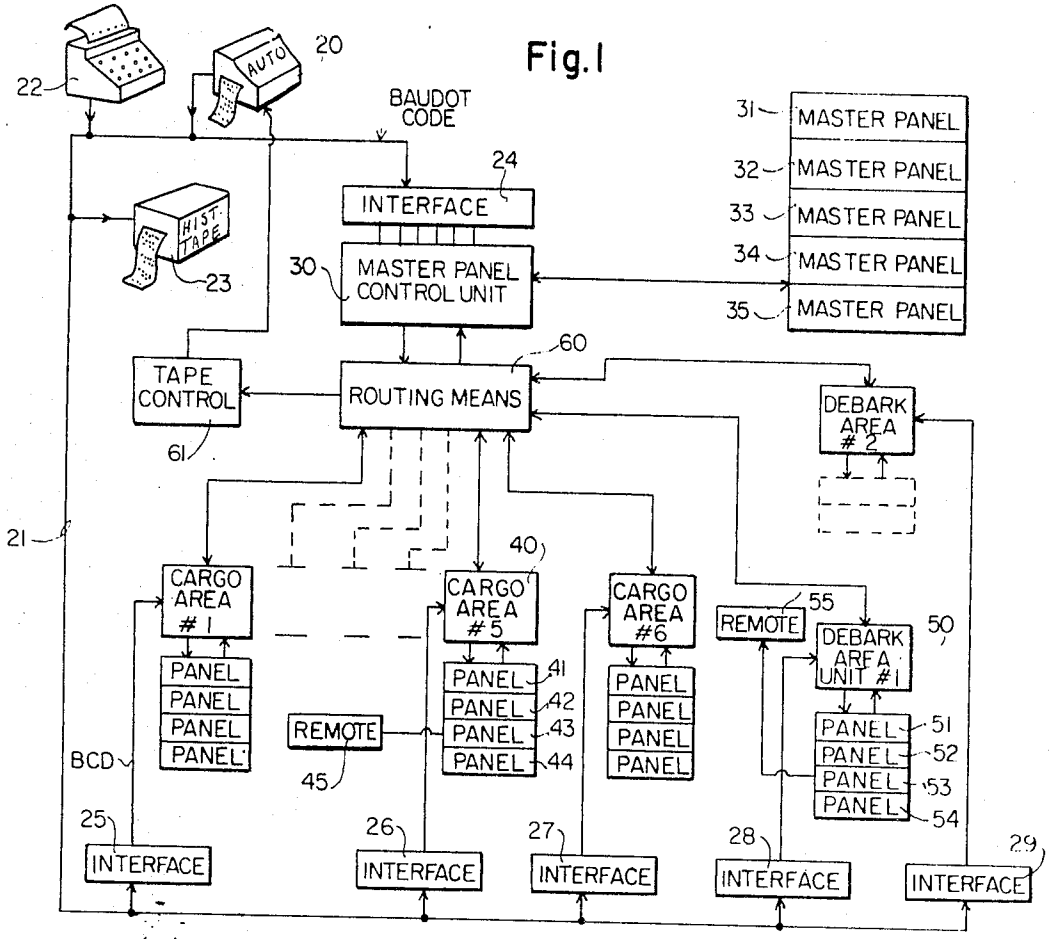


PATENTED NOV 23 1971

3,623,067

SHEET 1 OF 8

Fig. 1



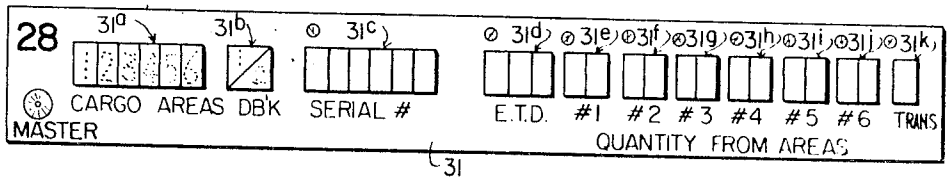


Fig. 2

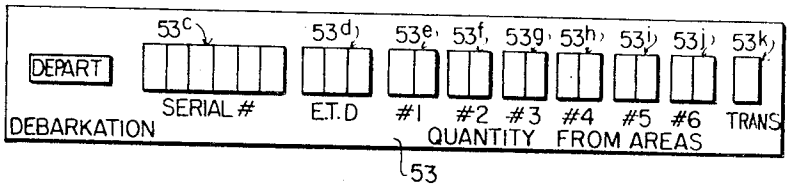


Fig. 3

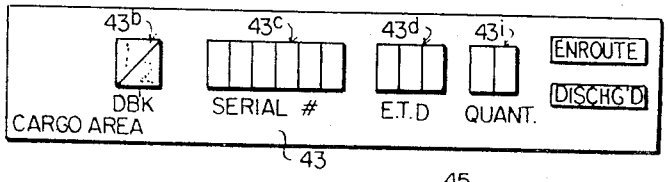


Fig. 4

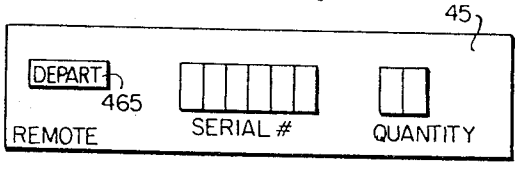


Fig. 5

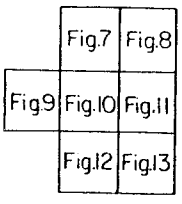


Fig. 6

INVENTORS
JOSEPH D. DEAL jr.
BY GEORGE A. TAYLOR
Shoemaker and Mattare
ATTORNEYS

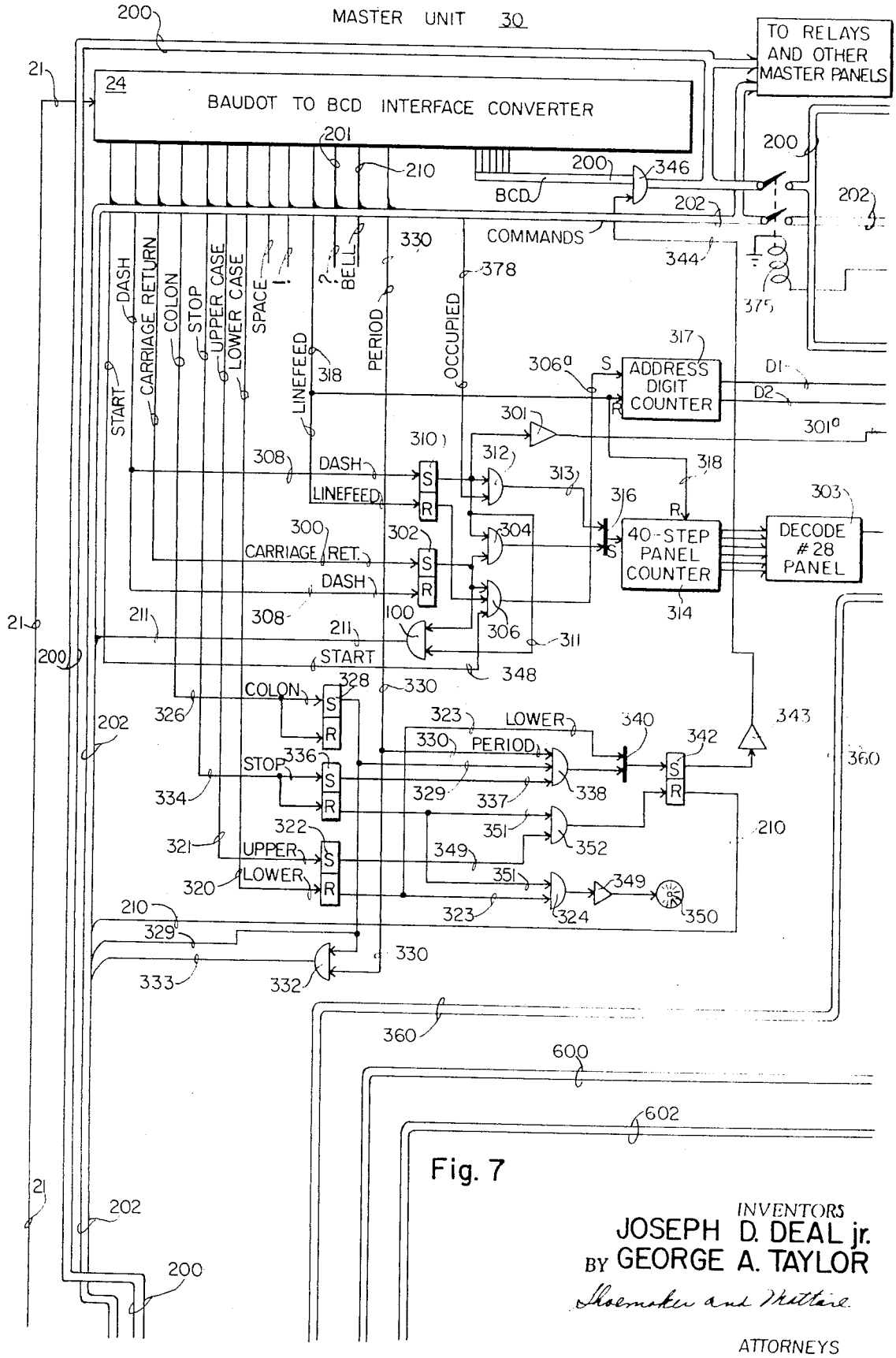


Fig. 7

INVENTORS
JOSEPH D. DEAL jr.
BY GEORGE A. TAYLOR
Shoemaker and Mattare
ATTORNEYS

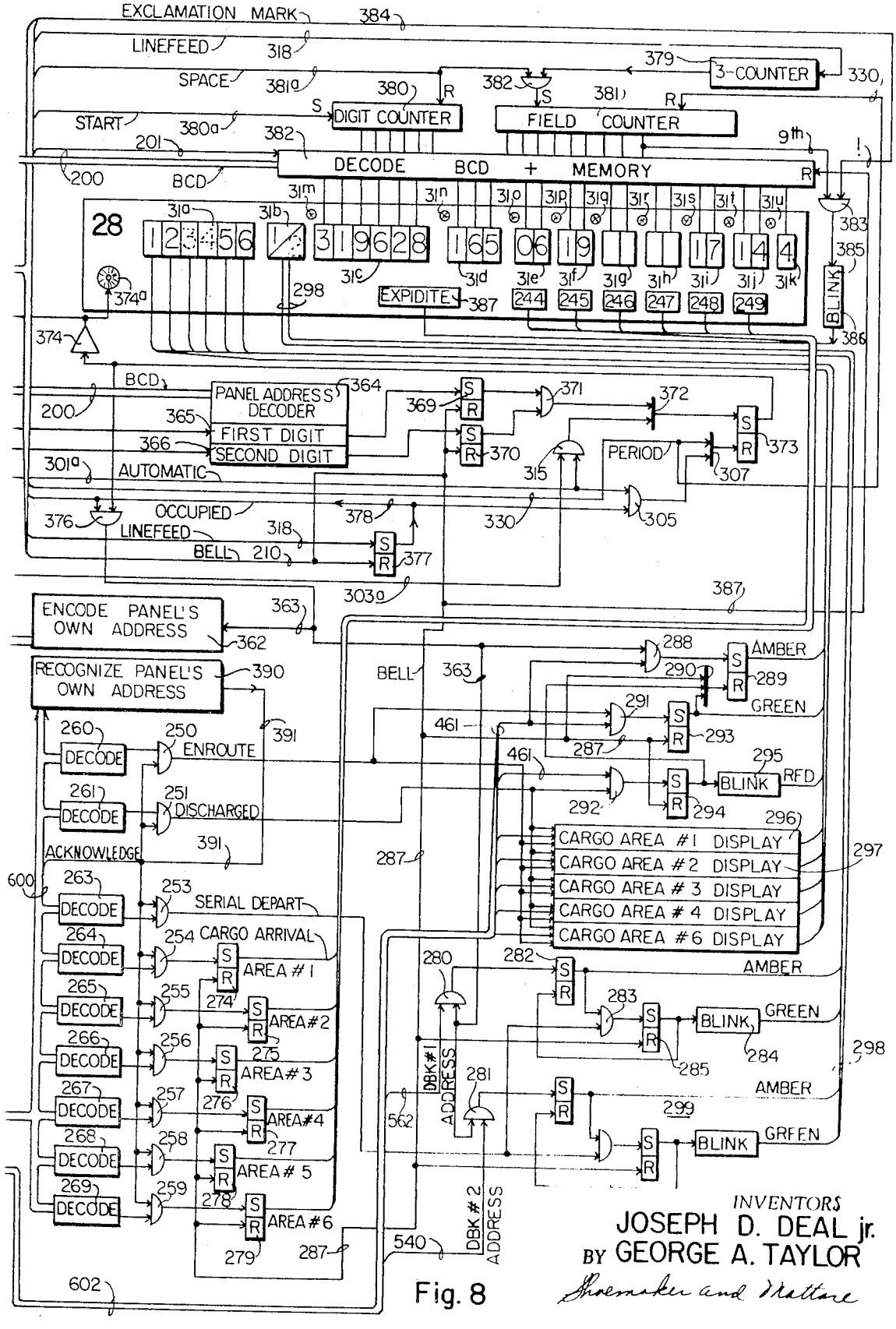


Fig. 8

INVENTORS
JOSEPH D. DEAL jr.
BY GEORGE A. TAYLOR
Shoemaker and Mattare
ATTORNEYS

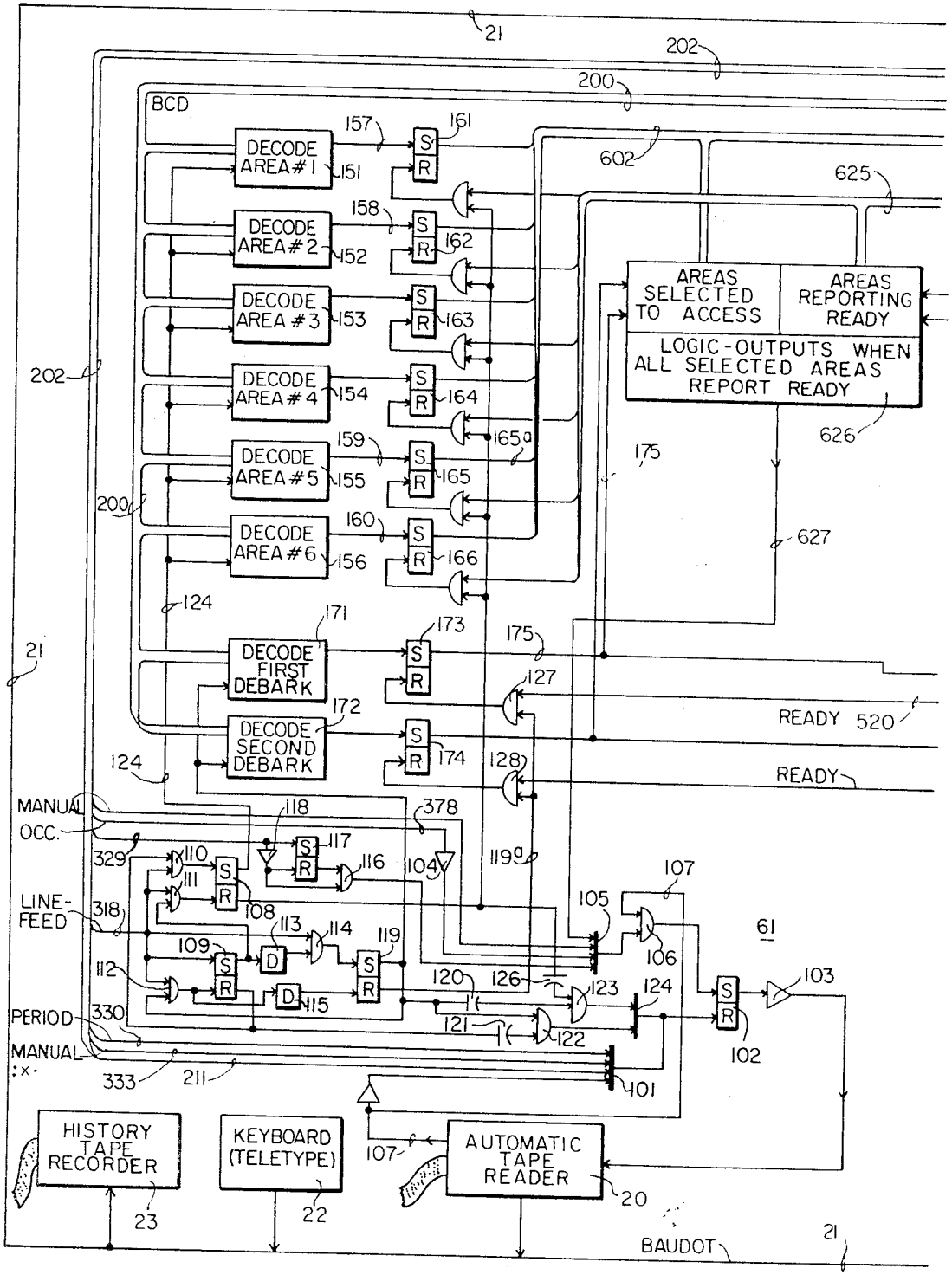


Fig. 9

INVENTORS
JOSEPH D. DEAL jr.
BY GEORGE A. TAYLOR
Shoemaker and Mattare
ATTORNEYS

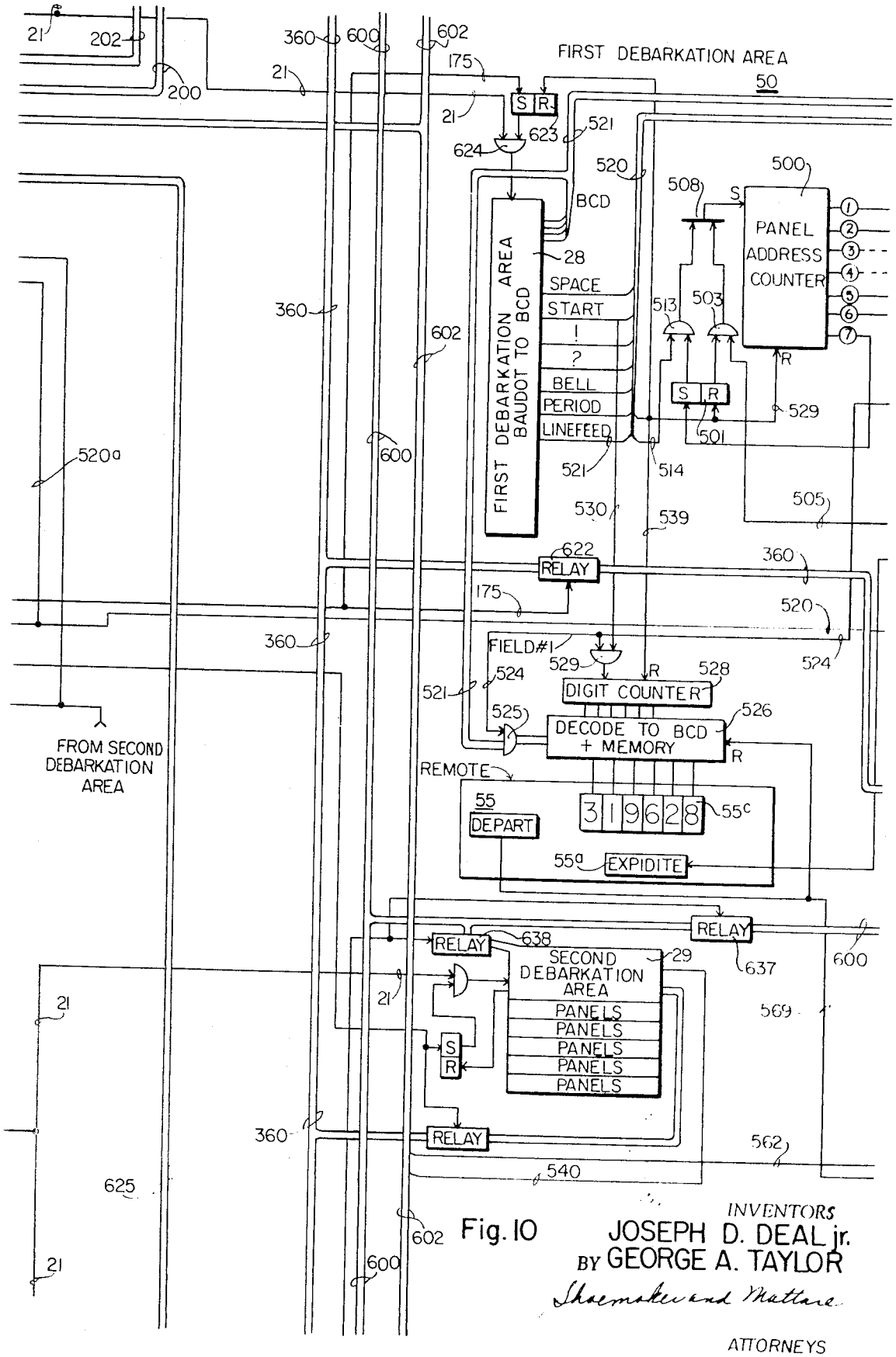


Fig. 10

INVENTORS
JOSEPH D. DEAL jr.
BY GEORGE A. TAYLOR
Shoemaker and Mattare
ATTORNEYS

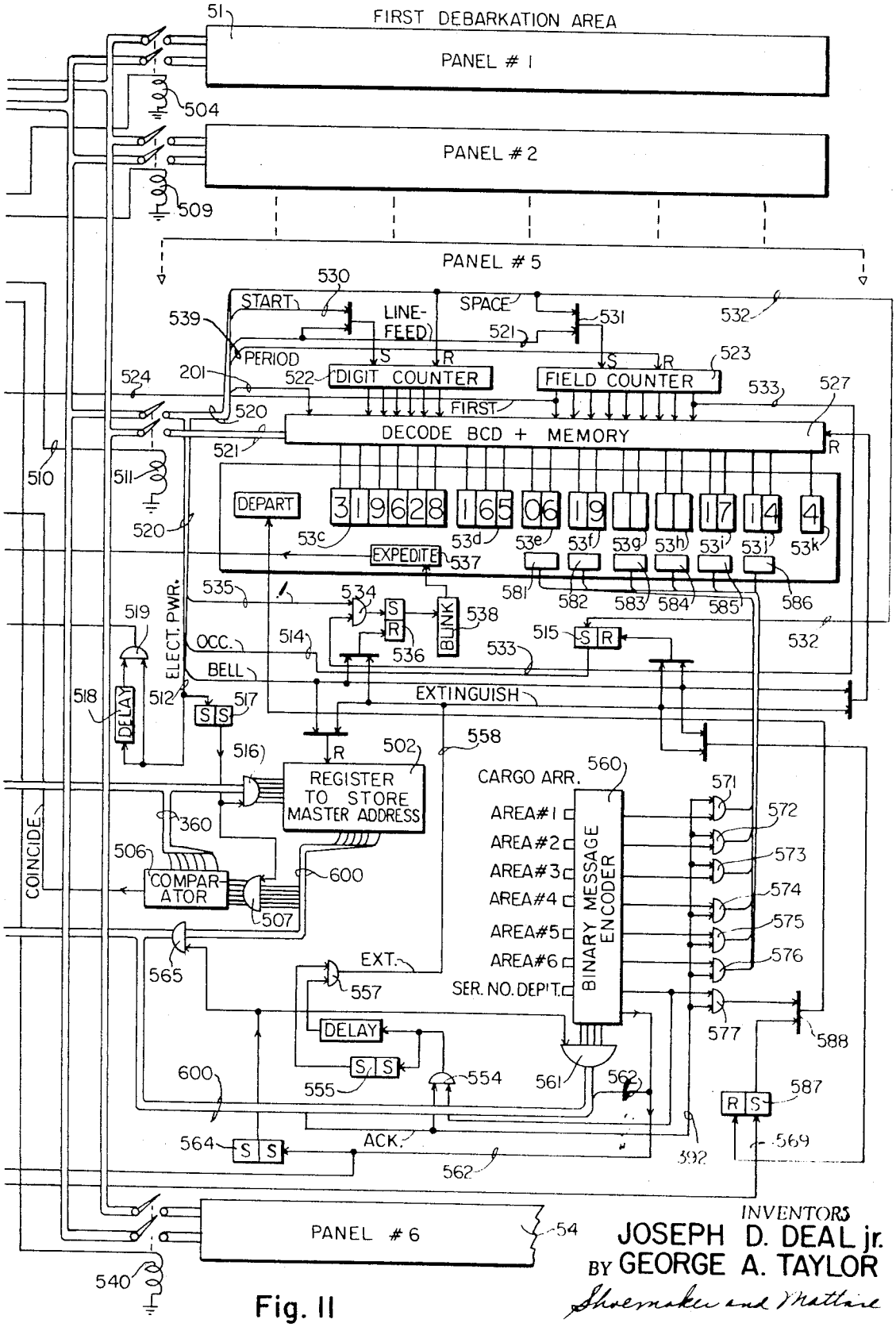


Fig. 11

INVENTORS
JOSEPH D. DEAL jr.
BY GEORGE A. TAYLOR
Shoemaker and Mattare
ATTORNEYS

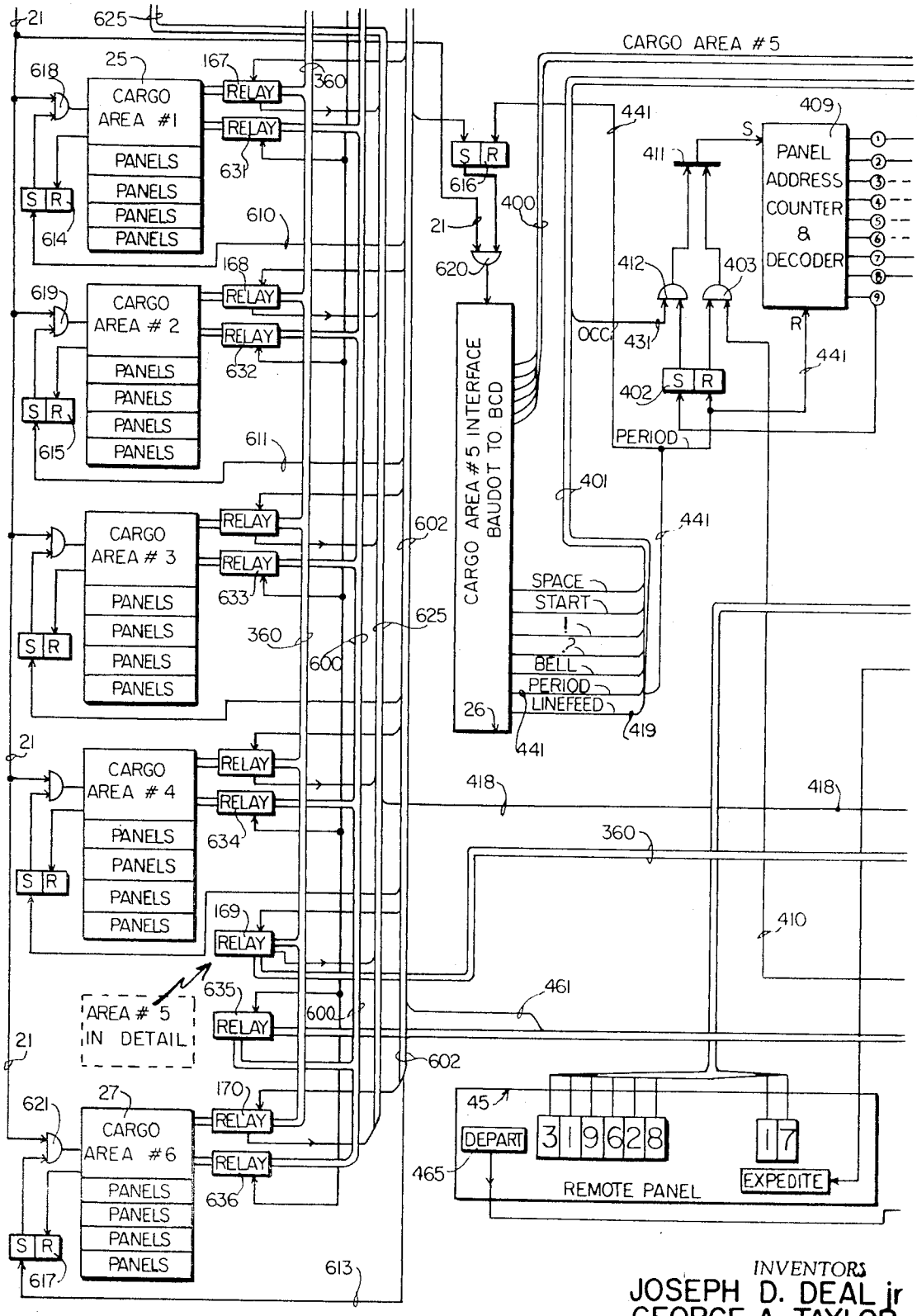


Fig. 12

INVENTORS
JOSEPH D. DEAL jr
BY GEORGE A. TAYLOR
Shoemaker and Mattare
ATTORNEYS

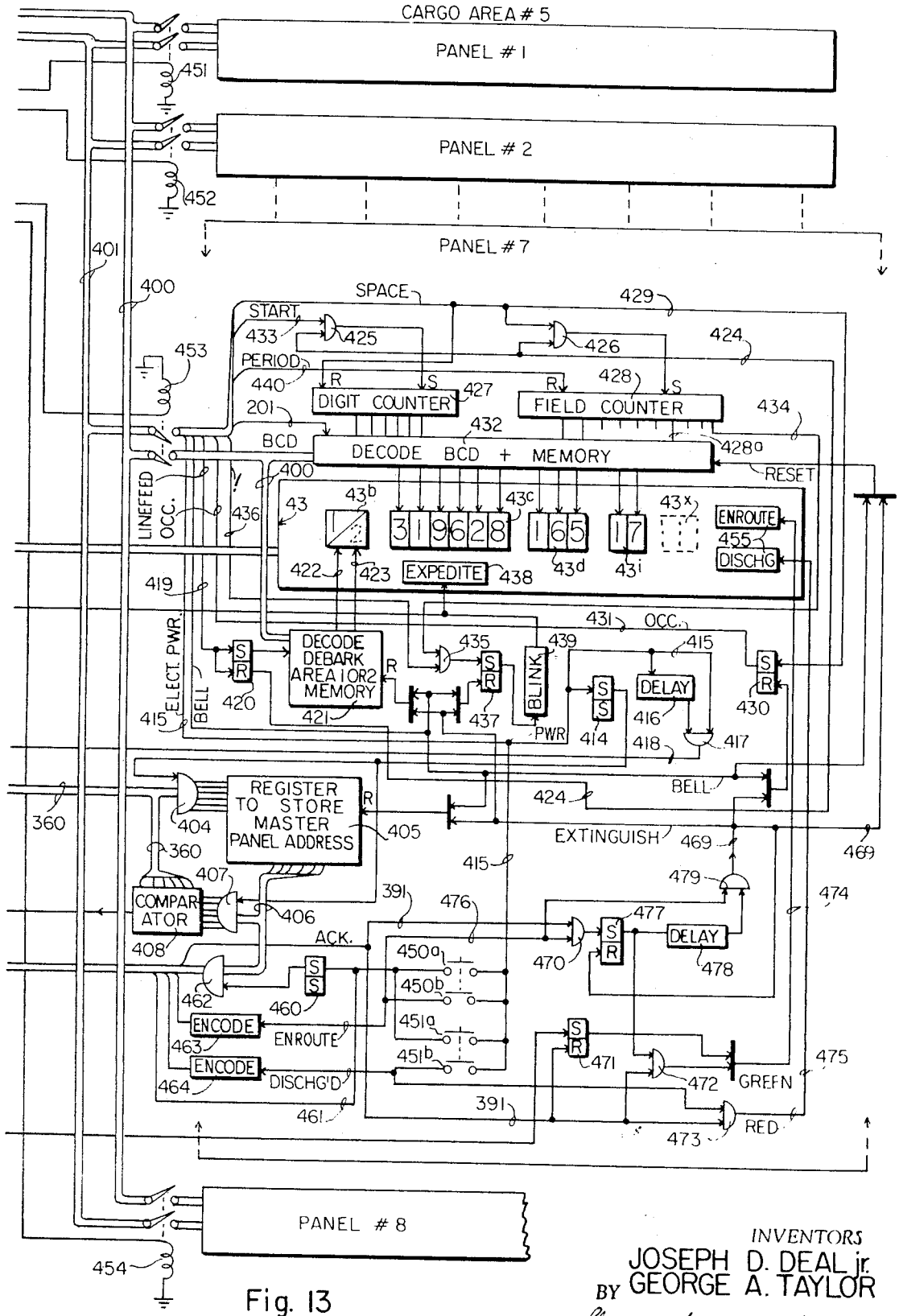


Fig. 13

INVENTORS
JOSEPH D. DEAL jr.
BY GEORGE A. TAYLOR
Shoemaker and Mattare
ATTORNEYS

DISPLAY SYSTEM FOR COMMUNICATING DATA AMONG UNITS IN DIVERSE AREAS

The invention herein described was made in the course of or under a contract, or subcontract thereunder, with the Department of the Navy.

This invention relates to a data communicating and display system of the type employing a trunkline network selectively connecting a master area with diverse slave areas on a time sharing noninterfering basis to display information from any encoded-format data source at selected display panels in the various areas and to communicate status among these panels, the same network being used in the display of data on different panels in the same areas so that the system can perform plural unrelated transactions programmed consecutively while displaying data relating to many of them simultaneously.

The invention will be described against a general environmental background wherein information programmed by a suitable source of data and command signals is coupled to a master area having multiple display panels within sight of system-operating personnel and wherein appropriate portions of said data are routed to plural slave areas where the data is displayed to personnel using selected ones of multiple slave panels available at each area. The panels in the master and slave areas when occupied by display data representing a particular programmed transaction can be disconnected from the data transferring lines in the network, leaving the occupied panels to continue their displays and permitting these network lines to be used in the performance of a new and unrelated transaction involving different display panels in the various slave and master areas. Although disconnected from the data transferring lines of the network, the panels are still interconnected by other network lines in a way permitting them to signal status of the related transaction among themselves without interfering with another transaction currently being programmed from said source. The input data and commands can be introduced into the system using a wide variety of sources coupled through suitable commercially available interface means to provide the system with fixed-format messages and commands. Examples of sources useful to initiate communication to the display system include punched or magnetic tape readers and punched card readers, the latter having the advantage of greater performance flexibility since the various transactions can be prepared on separate cards which can then be fed to the card reader in any desired sequence. Other sources include keyboard teletype devices, computer-initiated messages, etc. The display system illustrated in the practical embodiment set forth hereinafter employs punched tape and teletype machines delivering Baudot encoded data and commands to interface converter means which convert the serial Baudot code into parallel binary coded digital form which is then read out digit by digit to select, fill and control the various area display panels. The present display system is useful in a wide variety of applications such as warehousing, mail-order filling, ship or vehicle loading and unloading, debarkation of military supplies and weaponry from magazines of attack vessels or vehicles, collecting parts from storage areas to feed assembly lines in factories, displaying of weather conditions, instructions, and other vital information to initiate cooperation efforts by personnel assembled in diverse areas, for instance to pilots assembled in plural readyrooms preparing to fly assigned missions, etc.

It is an object of this invention to provide a system for the rapid transmission and display of information at selected mutually distant master and slave areas, together with the subsequent intercommunication of acknowledgements and/or status indications. The information is transmitted through a network of trunklines having a relatively small number of conductors in such a way that, within certain broad limits, any desired number of diverse display areas may participate. Units can be added to or deleted from the system in a building-block fashion since the various units are to a large extent accessed in parallel rather than serially.

Another object is to provide a system in which each area includes a large number of display panels, suitable for mass viewing, and capable of simultaneously displaying information concerning a number of unrelated transactions, whereby the system can perform many tasks at once, so long as mutually associated display panels are accessed one transaction at a time, to either insert data or to change previously inserted data.

It is a further object of the invention to provide a system in which each transaction commences by the selection of one of the unoccupied panels at the master area, which master panel has a unique binary encoded address, and this address is then used to identify all of the distant location panels involved in the same transaction, those panels having means for remembering that address and using it both to recognize master panel for locally initiated report-back purposes. This use of local address memory and recognition at each panel is one factor contributing to system flexibility permitting the same network to perform many data transfers with respect to plural different transactions all displayed at once.

A further object of the invention is to provide a multiple area system having plural display panels at each area, some of which are usually occupied by display data and some of which may be unoccupied, and wherein each area when addressed by the master conducts its own search for a local panel displaying data relating to the same transaction, or alternatively, conducts a search for any empty panel which can then enter into the transaction. In either case, the local area reports successful accomplishment of this task, and this report enables the system to proceed to the next programmed step in the transaction.

Another object of the invention is to provide an input source transmitting display data interspersed with command signals in a fixed-format message designed to cooperate with the structure of the display panels which include alphanumeric display devices, such as those which produce illuminated letters or numerals, and these devices being arranged on each display panel to form individual message fields having one or more digits. Typically, these include on the master display panels multiple digit fields identifying the transactions by order number or serial number, fields designating certain slave areas selected, type and/or quantity of items to be ordered from each area in a warehousing or debarkation application, destination and/or time of departure, mode of transportation, weather conditions, etc. In addition, associated with each designated slave field, the master panel may include one or more indicators for status reporting to the master panel from the various slave panels, as well as controls for delivering messages, such as "expedite" to associated slave panels. At the slave panels, there are alphanumeric display devices showing serial number, type and/or quantity of items ordered from that slave area, or information displays such as weather conditions, etc. In addition there are message indicators such as "expedite" lights, and report-back actuators for operating status indicators at the master panels. The slave areas may also include departure areas, such as ordered-item assembly areas or debarkation points on shipboard or warehouse shipping rooms. These departure areas display transaction serial numbers, designations of storage slave-areas from which items are expected to come and types and/or quantities thereof, "expedite" lights, and status report actuators referred to the master panels. Moreover any of the slave stations can include remote repeater panels carrying at least a part of the information locally displayed in that area. The slave areas also include means to extinguish their displays and return them to unoccupied conditions when they report completion of their assigned functions.

Still a further object of the invention is to provide source-controlled network routing of the outgoing data to the various panels, and the ability to disconnect and leave occupied panels to display the entered data. This outgoing routing is separate from slave panel controlled status report-back messages and addressing which uses separate network lines and logic so that status-reporting between panels never interferes with outgoing data to either the same panels or other panels.

A further object of the invention is to provide a system fed from a Baudot code message source, and including multiple slave and master panel areas, wherein each area has its own interface means to decode the Baudot messages connected to all the interface means. These decoded messages then select areas, select panels, occupy them with data, and extinguish them to return to unoccupied status when the transaction is completed. The illustrated system shows the use of teletype keyboard machines and automatic punched program machines feeding network lines with encoded messages including both display data and commands, the function and punctuation outputs of these machines are used as command readouts to the system, and the alphanumeric outputs thereof contain the display data.

It is an object of the invention to provide responses from the panels accessed to control pausing of the automatic program machine until the panels are ready for each next step, having completed the one previously commanded.

Another object of the invention is to provide a system in which previously occupied and disconnected panels can be again accessed and reconnected to the data display lines of the network in response to intervention by the keyboard source means, which interrupts the automatic source means at any one of multiple predetermined permissible points in the message format, and takes over control of the system until it again relinquishes it to the automatic source means. During manual mode operation, the keyboard source can be used to access any master panel and reconnect to the network any slave panel associated with that master. Once this access is gained, the keyboard source means can then select any field or digit of a field in these panels and extinguish the data contained therein and enter new data, without changing the other fields.

Another object of the invention is to provide the system with a recording unit which records chronologically all entries into the system from both the automatic mode and the manual mode sources to provide a precise history of all display data and commands relating to all transactions handled by the system.

Other objects and advantages of the invention will become apparent during the following description of one practical embodiment illustrated in the drawings, wherein:

FIG. 1 is a diagram showing the general layout of one practical embodiment of the system;

FIG. 2 is a front view of a master panel;

FIG. 3 is a front view of a debarkation area panel;

FIG. 4 is a front view of a cargo area panel;

FIG. 5 is a front view of a remote repeater panel;

FIG. 6 is a drawing showing how subsequent figures should be arranged to form a complete block diagram of the system;

FIGS. 7, 8, 9, 10, 11, 12 and 13 when placed relative to each other in the manner shown in FIG. 6, form one complete block diagram of the system.

The drawings illustrate a practical embodiment of the invention for use aboard a ship carrying cargo in different holds, each of the holds carrying cargo of one particular type. The present system is intended to off-load materials as well as personnel from the ship, for instance in preparation for an assault upon a beachhead.

The ship is assumed to have several different debarkation areas located in different parts of the ship to which the ordered material must be sent from the cargo holds in order to meet a certain time of arrival at the debarkation area selected. The ordering of the material from the cargo holds and its routing aboard the ship is controlled from a master panel area which includes means for accessing the various panels in the cargo and debarkation areas, this accessing being in the form either of an automatic prerecorded program tape, or in the form of manually inserted information which must be entered by the operator into the system on a selective-destination basis from a suitable keyboard instrument. Thus, the system includes a master area, mutually distant cargo areas and debarkation areas, and means for routing the information among these areas as desired.

Referring now to FIG. 1, this figure shows a suitable overall system including input equipment serving as the source of information necessary either for display purposes or for command signal purposes. These source devices comprise an automatic tape reader 20 connected to a input Baudot code line 21, and in addition includes a manual mode input keyboard in the form of a teletype writer 22 also connected to the input line 21. In addition, the input line is advantageously connected to a history tape recorder 23 which prepares a chronological recording of all display and command signals appearing on the input line 21 so as to provide a history of all information carried by the system. In the present example, the teletype equipment 22, tape reader 20 and tape punch 23 referred to are of standard type and comprise purchased items which operate in response to various display and command signals in Baudot code appearing on the input line 21. This is a serial code, and must, therefore, be converted by suitable interface converters 24, 25, 26, 27, 28 and 29, into a parallel format that the illustrative embodiment of the present system can accept. In the present system this format is parallel binary-coded-decimal (B C D), and The B C D output from each of these interface converters is fed into any one of the master unit, or into a cargo area unit or a debarkation area unit, as shown in FIG. 1. The precise nature of the signals going into the above-mentioned units will be discussed in greater detail in connection with FIGS. 7 through 13 of the drawings, but for present purposes it is sufficient to state that the B C D signals include both display data and command signals coming either from the automatic mode or the manual mode means 20 or 22.

In broad terms, the present system seeks to accomplish two purposes, firstly, to display information at panels of the master unit and at various cargo area units and at a debarkation area unit to thereby inform the personnel located at the various units as to which materials are to be assembled for departure from the ship, and when; and secondly, to report back from the various cargo areas and the debarkation area to inform the master area of the status of that particular transaction, and eventually of its completion so that the various display panels can be reset and made ready to participate in another transaction. In general, it is assumed that each of these transactions is essentially unrelated to other transactions in progress, each of which is identified by a unique serial number, these serial numbers being displayed at the various panels involved in carrying out the particular transaction. The transaction identified by a particular serial number can be either further defined in greater detail by a written bill of materials or goods to be supplied, copies of which may be in the hands of the various personnel located at the distant display units; or alternatively all information necessary at the cargo and debarkation areas may be displaced by the present system when expanded somewhat beyond the present illustration. For purposes of simplifying the present illustration, it will be assumed that each serial number which is displayed corresponds with a written bill of materials in the hands of the operating personnel located in the various cargo and debarkation areas so that the display of the serial number informs the personnel as to precisely the nature of the item or material being requested via the display panels. Therefore, at the cargo and debarkation areas in the present illustration only serial numbers and quantities of materials being ordered will be displayed.

As pointed out above, the system is capable of performing many different transactions by displaying the information relating to each at different display panels in the various areas effected. Therefore, as shown in FIG. 1, there will be a number of master panels coupled to a single master panel control unit 30 and comprising the panels 31, 32, 33, 34, and 35. The automatic and manual information sources 20 and 22 will access only one of these panels at a time and only one of these master panels for each different transaction as represented by a unique serial number. FIG. 2 shows a typical master area panel 31 which will be described hereinafter in more detail. Moreover, each cargo area unit, such as the unit 40 shown in cargo area number 5 will include plural cargo area panels of

the type shown in FIG. 4 at 43 and in FIG. 1 at 41, 42, 43 and 44. Each of these panels can become associated with a particular master panel 31, 32,...35, and while associated therewith will display information relating to a particular transaction as represented by a particular serial number. Likewise, each debarkation area unit such as the unit 50, FIG. 1, includes plural debarkation panels 51, 52, 53 and 54, a typical panel 53 being illustrated in FIG. 3. There will be as many debarkation area units as there are debarkation areas aboard the ship to which cargo can be sent. For instance, the debarkation area number 1 may comprise the well deck of a ship, and the debarkation area number 2 may comprise the flight deck of a ship so that in the latter case the ordered material will depart by aircraft, whereas in the former case the material will debark aboard smaller vessels. Thus, these several types of possible debarkation vehicles will also be displayed on the panels located in the master area and the debarkation area, it being understood that there may be a number of different types of transportation vehicles available, such as different types of landing barges or different types of aircraft. In view of the fact that each cargo area and each debarkation area may well comprise a plurality of different rooms or compartments, it may also be desirable to provide a plurality of remote repeater panels such as the panels 45 and 55 which can be viewed by personnel aside from the officers actually operating the various cargo and debarkation area units.

Since each master panel 31–35 handles only a single transaction, at any moment it is necessary that it be selectively coupled with a uniquely associated panel in each of the participating cargo or debarkation areas involved with that serial number. The routing means 60 performs this function and also controls the automatic feed of the tape through tape control circuitry 61 by which the tape is restarted when a required step of the program has been completed so as to read out an additional step and then have its forward motion halted while the readout step is being performed and until the command unit answers back that it has completed the function.

All cargo areas and all debarkation areas may not necessarily be involved in any particular transaction as represented by a certain serial number. Therefore the manual mode means 22 or the automatic mode means 20 must select which cargo holds are involved and which debarkation areas are involved. In general, the system operates to select an unoccupied master panel 31–35 whenever a new transaction has begun. Then the input means selects certain cargo holds storing the particular material to be ordered and selects one of the debarkation stations as a destination. Each cargo area selected through its cargo area control unit 40 scans the available panels 41–44 in search of an empty panel and when it finds such a panel it connects it through the routing means to the master panel involved with that transaction. This process is repeated again for the selection of a debarkation area 51–54. When all of these panels have been selected and are connected through the routing means to the master panel handling that transaction, the system begins to enter the required data, one display field at a time and one digit at a time, these entries being simultaneously made in all connected and associated panels.

Referring now to FIG. 2, suppose that at the beginning of the transaction the master panel control unit found that master panel 28 was unoccupied and therefore available. It would then connect to the network this master panel (as shown in FIG. 2) to receive data. Having selected a master panel, the tape control 61 then starts the tape reader again. The tape then reads out the numbers of particular cargo areas to be accessed and the master panels displays the areas selected in field 31*a*, while the routing means actuates the control units in these areas to find suitable display panels. Suppose the system selects cargo areas 1, 2, 5 and 6 and illuminates lamps behind ground glass plates bearing these numbers in field 31*a*. Next, the program reads out which of the debarkation areas is to be involved, number one in this particular example, which number is then made to appear in field 31*b*, and the routing means then actuates the first debarkation area unit to select a local panel. When all selected panels have been coupled to the network, the serial number of the transaction, for instance 319628 is then read into fields 31*c*, 53*c*, 43*c* and 45*c*. Next, the estimated time of departure will be entered into the panels of fields 31*d* and 53*d*, but displayed only at the master area panel, FIG. 2, and at the debarkation area panel, FIG. 3, namely, 16.5 hours. Next, the system reads out the quantity of items required from the various cargo areas designated, namely cargo holds 1, 2, 5 and 6, and these quantities will appear in fields 31*e*, 31*f*, 31*i* and 31*j*, each of which has two digits. The other fields, 31*g* and 31*h*, relating to cargo holds 3 and 4 remain vacant since nothing is ordered from those holds according to this serial number. These quantity numbers are also repeated at the debarkation area in six similar display fields, 53*e* through 53*j* respectively, but at the individual cargo area panels only the quantity affecting that particular cargo area is displayed. Since the cargo area panel 43 represents cargo hold number 5 it will display the numeral 17 as the quantity in its frame 43*i*. The repeater panel 45 which is connected in parallel with the cargo hold panel 43 will display the serial number in field 45*c* and quantity in field 45*i*. The remote repeater panel 55, however, will be similar to the panel 53 and will display the serial number of the transaction, and possible the six different cargo area quantities to be supplied.

Thus, in effect all of the panels associated with that particular serial number transaction are connected in parallel with each other through the routing means and through the converter interfaces 24 through 29 inclusive to receive data from the automatic or manual sources. Having once received that data, the incoming data lines are then disconnected, and the panels are left to continue the display of their information. However, they are still able to communicate with each other for the limited purpose of answering back the status of the orders called for by their common transaction. The answer-back uses a different network of lines through the routing means than the data entry used, and the manner of its performance will be discussed in connection with FIGS. 7 through 13.

Finally, in the last field 31*k* the system can enter the designation of a particular type of transportation to be used in transporting the materials from the debarkation area panel, such as a small boat, ship, aircraft, fighter plane, etc., and a coded designation will be displayed in this field to indicate which type of vehicle. For instance, the numeral 4 could be used to indicate a certain class of aircraft, or even a certain flight. This number will be shown only at the master area panel in field 31*k* and at the debarkation area panel in field 53*k* in view of the fact that the type of transportation of the goods is of no interest to the personnel in the cargo areas.

The precise sequence of events and the means by which the various panels are selected and coupled to the network to receive data or to return the information will be discussed in connection with FIGS. 7 through 13 in which the means to perform these functions is illustrated in more detail.

The operation of the present system can be understood with reference to FIGS. 7, 8, 9, 10, 11, 12 and 13 when assembled in the manner shown in FIG. 6 to form a simplified circuit diagram. However, it is also necessary to understand the message format which is used by the system. As stated above, access may be had either in an automatic mode of operation, for instance using tape reader 20 as shown in FIGS. 1 and 9, or else in the manual mode using the teletype keyboard machine 22. The system is either in one mode or the other. The automatic mode will be described first, and assumes that a preprogrammed tape has been made and is presently being read out through the tape reader 20. Its message comprises display data readout in increments by the tape reader interspersed with command signals necessary to instruct the system as what to do with the data being read. The command signals and the data do not flow continuously from the tape reader 20, but are started and stopped by a tape control 61 located in FIG. 9 also. The tape control 61 is necessary to cause the readout by the tape reader 20 to pause at times and await confirmation

from the system that the latest command has been carried out, in view of the fact that certain commands may not be capable of execution immediately. For example, when all panels are occupied the system has to await the release of a panel before it can proceed with a new transaction to be entered.

FIG. 9, and parts of FIG. 10 and 12 show the routing means 60 which includes the tape control 61, and in addition serves to route the wires in the network among the various units which are shown in the portions of the drawings surrounding the routing means. FIG. 7 shows the master panel control unit 30, and to the right of it FIG. 8 shows a typical master display panel No. 28, only one being shown. The groups of wires extending downwardly from FIG. 7 into FIGS. 10, 9 and 12 comprise the network joining the various units together, usually through the routing means. To the right in FIG. 10 is located debarkation area control unit 50, and to the right in FIG. 11 are illustrated several debarkation display panels, No. 53 of which is shown in some detail. Below FIG. 10, FIG. 12 shows the various six cargo areas, with cargo area number 5 being shown in greater detail. Still further to the right in FIG. 13 are shown a series of cargo display panels which are all associated with cargo area No. 5, and one of these display panels No. 43 is shown in some detail.

The leftmost line extending downwardly through FIGS. 7, 9, and 12 is the Baudot code line 21 providing input to the system from the teletype 22 and tape reader 20 this line extending to the various interface converters 24, 25, 26, 27, 28 and 29. These interface decoders are purchased items which accept the serial Baudot code from the teletype and tape reader machines and convert this code, using logic including gates and flip-flops, into binary encoded output signals, which comprise the B C D data display and address signals appearing in the second group of network wires labeled 200, and comprise a plurality of hard-wired command signals which appear on the lines 202 which are also located in the network. These latter wires comprise the command signals which control the actual functioning of this system these functions having been arbitrarily assigned to certain standard teletype symbols and can be defined as the following functions:

Carriage Return	Indicates start of panel entry of a new transaction
Dash	Indicates automatic entry mode, in which the master panel assembly is directed to find an empty. master panel
Line Feed	Commences, the later ends, the intervals during which slave panels such as cargo panels and debarkation panels are addressed.
Space	Steps panels to the next information field.
Exclamation Mark	When used causes an expedite lamp to blink on accessed panels..
Period	Indicates end of message entry to the panels and decouples the panels from their control units.
Colon	Indicates a request for manual mode operation
Stop	Indicates a request to disconnect the manual teletype from the display portion of the system.
Figures	Places the teletype in upper-case mode of operation.
Letters	Places the teletype in lowercase mode of operation in which mode it can only address the history tape recorder 23.
Question Mark	Extinguishes a presently addressed field on the master and slave panels.
Bell	Extinguishes the addressed slave panel.

AUTOMATIC MODE ENTRY

Commencing now with a description of the manner of entering data on to panels, the first function of the system is to determine whether manual or automatic mode entry will be made. The system for performing this function is shown near the center of FIG. 7. As pointed out above, a carriage return signal applied to line 21 by a tape reader 20, decoded by the interface 24 and appearing on wire 300 is the first signal in the entry of a new transaction. This signal sets the flip-flop 302 to provide an output which enables respective inputs to the AND-gates 304 and 306. As the tape reader 20 progresses, if this carriage return signal on wire 300 is followed by a dash on wire 308, the flip-flop 310 is then set which enables one input to the AND-gate 312. The dash signal on wire 308 also resets the flip-flop 302. However, during the brief instant when both flip-flops 302 and 310 are set, the gate 100 becomes enabled and places a pulse on wire 211 which travels through cable 202 to the bottom of FIG. 9, passes through OR-gate 101 and resets flip-flop 102 to stop the drive through driver 103 and halt the tape reader 20. The lower input 378 to the AND-gate 312 in FIG. 7 is energized whenever a panel, as shown in FIG. 8 and described later, is occupied, so that when the wire 311 becomes energized to the AND-gate 312 an output signal appears on the wire 313 if the panel being interrogated at that moment is already occupied. A panel step counter 314 is used to address the panels one at a time to determine whether or not they are occupied. Assuming for example that there are 40 panels at the master station, anyone of which can be accessed for data entry, the step counter 314 steps through these panels one at a time in an effort to determine whether or not they are occupied. For example, panel 28 is shown in FIG. 8. Therefore, when the panel counter 314 counts "28" and the decoder 303 recognizes this count, it puts out a signal on wire 303*a* to enable one input to the gate 315. The other input to gate 315 also enabled by output from amplifier 301 on wire 301*a*, and therefore an output passes from gate 315, through OR-gate 372 to turn on flip-flop 373 and close the relay 375 through the driver 374, thereby connecting the "occupied" line 378 to the gate 312 to step the panel counter 314 to the next panel. If panel No. 28 is occupied, the signal on wire 378 will pass through enabled gate 305 and OR-gate 307 and reset flip-flop 373 to open relay 375 and immediately release panel No. 28. Moreover when the panel being interrogated is occupied, the signal appearing briefly on the wire 378 in the vicinity of gate 312 in FIG. 7, and present only until the relay 375 can physically open, will pass through the AND-gate 312 and provide a pulse on the wire 313, which pulse will pass through the OR-gate 316 to step the panel counter 314 to the next panel, in search of an unoccupied panel. The process will be repeated if the next panel is occupied, but if it is unoccupied no signal will appear on the wire 378 and therefore the step counter 314 will cease stepping, and an empty master unit panel will have been found.

In the present illustrative example, assume that the panel 28 shown in FIG. 8 is unoccupied and that therefore the panel counter 314 stops stepping from panel to panel when it addresses No. 28. Thus, in the automatic mode an empty master panel No. 28 has been selected automatically by a carriage return followed by a dash, but the tape reader 20 is still stopped. Panel No. 28 has now had its relay 375 closed placing it "online" with the network 200 and 202, but its occupied line 378 is still indicating "unoccupied" status. This unoccupied status signal passes downwardly on wire 378 through the cable 202 and through an inverter 104 and an OR-gate 105 to enable one input to AND-gate 106. The other input is continuously enabled via the wire 107 which is a wire coupled to the tape reader to indicate it is not disconnected. Therefore, the inverted "unoccupied" signal on wire 378 sets the flip-flop 102 and again starts the tape reader 20.

The tape reader reads out a first linefeed signal which is decoded on wire 318 by the interface converter 24. The digit counter 317 is reset by the pulse from the linefeed 318 which also returns the flip-flop 310 to reset condition and blocks further counting by the panel counter 314.

The manual mode of operation will be described hereinafter the end of this specification.

ADDRESS LOGIC

As pointed out above, the master panel unit **30** has a larger number of individual panels, for instance 40. Each one of these panels has its own binary encoded address, requiring six wires to conduct the address since there are more than 32 such panels. The six wires carrying the address of whichever master panel is "online" at any particular moment are grouped together to form the network group **360**, and this binary address is generated by a hard-wired series of gates forming the encoder **362**. It will be recalled that the relay **375** is energized by the set flip-flop 373, and that the tape reader **20** has just read out its first linefeed signal on wire **318**. This signal reset the flip-flop 310, and now sets the flip-flop 377 to generate an "occupied" signal on wire 378. This signal together with the output from flip-flop 373 enables the gate **376** and places an "entry in progress" signal continuously on wire **363**, which actuates the address encoder **362** to continuously apply the master panel address on wires **360**. This address also appears in the cable 360 at the routing means in FIG. **10** and 12 to be used in the manner hereinafter described. The binary encoded number delivered by the present encoder 362, FIG. 8, is the number "28" corresponding with the particular panel illustrated in FIG. 8. The other panels will, of course, have differently wired encoders to provide different individual master panel address numbers.

The first linefeed signal on wire 318 travels downwardly in network cable 202 into FIG. 9 and to the tape feed logic **61**. Assuming that both flip-flops 108 and 109 are initially reset, the linefeed signal on wire 318 will set the flip-flop **108** through the gate 110 whose upper input is enabled because the flip-flop **109** is still reset, a condition which occurs only during the first linefeed. The latter also directly sets flip-flop **109**, but it does not set flip-flop 119 through gate **114** because of the delay 113. The setting of the flip-flop 108 energizes wire **124** and thereby enables all six of the cargo area address decoders **151**, **152**, **153**, **154**, **155** and **156** to recognize the B C D encoded cargo hold addresses when they appear on network cable **200**. The tape reader 20 does not stop after reading out the first linefeed, but proceeds to read out addresses of cargo areas to be affected by the present transaction. In the present example, it is assumed for illustrative purposes that cargo areas **1**, **2**, **5** and **6** are to be addressed, and the tape reader **20** proceeds directly to read out these four encoded addresses. The addresses are recognized from the B C D lines **200** by the decoders **151**, **152**, **155** and **156**, which respectively put out signals on the wires **157**, **158**, **159** and **160** as the decoders respond to their addresses. These signals set the flip-flops **161**, **162**, **165** and **166**, whose outputs into network cable **602** travel downwardly into FIG. 12 and close the relays **167**, **168**, **169**, and **170**, thereby coupling the master panel No. **28** address from lines **360** into cargo area control units **1**, **2**, **5** and **6**, area unit No. **5** being shown in detail in FIGS. **12** and **13**. The relays **167**, **168**, 169 and 170 remain closed until flip-flops **161**, **162**, **165** and **166** in FIG. 9 are reset as explained hereinafter. The other nonaddressed cargo areas 3 and 4 are not supplied with the master panel address appearing on wires 360 because their flip flops 163 and **164** were not set.

The second linefeed is supplied right after the last cargo hold address without stopping the tape a the reader **20**, and this second linefeed appearing on wire 318 near the lower left corner of FIG. 9 resets flip-flop 108 through the enabled AND-gate 111, thereby removing the signal from wire **124** and disabling the cargo address decoders 151 through **156**, leaving the flip-flops **161**, **162**, **165** and **166** still set. Moreover, the second linefeed sets the flip-flop **119** through the enabled gate 114. The setting of flip-flop **119**, and the simultaneous resetting of flip-flop 108, operates to pass pulses through capacitors **120** and **126** and through the AND-gate **123** and the OR-gate **124** to reset the flip-flop **102** and halt the tape reader **20**. The output from the set flip-flop **119** also travels upwardly to enable the debarkation area decoders **171** and **172**, and downwardly to enable the AND-gate **112**, for purposes that will be explained when the tape reader **20** is again started up.

With the tape reader 20 stopped, but the relays **167**, **168**, 169 and 170 still energized and connecting the master panel address lines 360 to the slave panel control units in cargo areas 1, 2, 5, and 6, it becomes necessary for each of these control units to select a slave panel and connect it through the routing means to master panel No. 28. It will be noted that there are a number of different available slave panels at each cargo area. And therefore each area must sweep through the available panels searching for a panel which is either already storing the address of master panel No. 28 or which is unoccupied, and then return a signal to the routing means indicating that it has found and connected an appropriate panel. This takes time, and during this interval of time the tape feed **20** stops and waits until it receives word from each selected cargo area that it has located and connected an empty panel.

In order to understand the manner in which each cargo area selects and connects its panel, cargo area No. 5 is shown in greater detail in FIGS. 12 and 13, and will now be described. The interface converter 26 shown in the middle of FIG. **12** is substantially the same as that shown for the master panels in FIG. 7, and is a purchased item available from a number of different companies. It takes in the Baudot code appearing on line 21 when gate 620 is energized and delivers B C D signals including display data on the B C D lines labeled **400**, and delivers decoded command signals appearing on the network wires 401. The signals decoded and delivered for command purposes are labeled as they come out of the lower portion of interface 26 in FIG. 12.

Recalling that the flip-flop 165 in FIG. 9 is still set and selecting cargo area number 5, its output on wire **165***a* will enter the cable 602 and travel downwardly into FIG. **12** and set the flip-flop 616 to enable inputs to the gate 620 from the Baudot line 21 during subsequent readouts by the tape reader **20**, which is at the present time stopped, however.

Referring to FIG. 12, assume as an initial condition that the flip-flop 402 is reset so that the gate 403 has its left input energized and is conductive for signals appearing at its right input. The panel address counter 409 is caused to begin stepping through the local slave panels one at a time by the structure of the command message. It will first energize its No. 1 output to close relay 451, then 452..., 453..., 454 and soon until it has tried all eight available slave panels or been stopped by one. The counter 409 searches twice through the panels, first for a panel having the master's own address in its register **405**, and failing that, it searches a second time for an available unoccupied panel. Suppose the counter 409 has searched through the first six panels without being stopped. As it reaches the seventh panel, FIG. 13, if this No. 7 panel has been previously occupied, it will have received through wires **360** and gate **404** an address of a master panel which will have been stored in its register **405**. This register 405, as well as register **502** in FIG. **11**, is a parallel fed and accessed, nondestructive memory device which is cleared only by actuating its reset terminal R once it has been filled. The gate 404 will at the present time be blocked, however, and the register 405 will be reading out its stored address of a master panel, if it has stored such an address into the bus 406. When the counter 409 closes the relay **453**, electric power will appear on wire 413 and trigger the one shot 414 to enable the gate 407 and deliver the stored address to the comparator 408, which comprises a exclusive OR-gate At this time, during the initial search through the panels, the master panel will also be coupling its address to the comparator **408** through the bus 360, but not through the blocked gate 404.

The comparator 408 compares these addresses and delivers an output if they are the same, but if they differ, then it delivers no output on the coincidency wire 410. This output travels through the enabled gate 403 and steps the counter 409 to the next position through the OR-gate 411. If no match

occurs in the coincidence comparator in panel No. 8 when relay 454 is closed, then the counter is stepped to its number 9 position in which an output on wire 409*a* sets the flip-flop 402, thereby blocking gate 403 and enabling gate 412 at its left-hand input to receive signals from a line 413 indicating whether a particular panel is occupied or unoccupied, as will be discussed hereinafter.

Each time a panel is found which is occupied, a pulse will be passed from the line 431 through the gate 412 and the OR-gate 411 to step the panel address counter 409 to the next available panel. When an empty panel is located, however, there will be no pulse on the occupied line 431, and therefore the address counter will stop at that unoccupied panel, and the search for an unoccupied panel will have been completed.

In this example, it is assumed that panels No. 1–6 are occupied, but that panel 7 is unoccupied, and therefore the relay 453 will become energized and will close the contacts at the input to cargo panel No. 7. The relay 453, which can in fact also be electronic logic means, connects the B C D network 400 and the command network 401 into the cargo panel No. 7 so that it can receive both commands and display data.

As soon as the relay 453 is closed, electric power connected by it to the wire 415 passes through a delay 416 sufficient to exceed any contact bounce, and then is ANDed in the gate 417 to provide an output on wire 418 to start the tape readout by the automatic tape reader 20. The output via wire 418 goes into the cable 625 and up to a logic circuit 626 together with a wire from each of the other slave panel areas, all arriving on the cable 625. The logic circuit 626 has other inputs arriving via the cable 602. These tell the logic 626 which of the cargo areas have been selected by the decoders 151 through 156, and the wires arriving via cable 625 tell the logic circuit 626 which of these cargo areas have selected a panel and connected it on line. When the reporting areas match the selected areas, the logic circuit 626 delivers an output on wire 627 to start the tape reader 20. The closing of relay 453 also sends a linefeed through the interface 26 and on the wire 419 which sets the flip-flop 420, this constituting the first linefeed to the panel, although it is really the second linefeed to the system. The output from the flip-flop 420 in the set position enables the decoder 421 which later decodes which of the debarkation areas, number 1 or number 2 is to be illuminated.

In FIG. 9 the output wire 427 from the logic circuit 426 indicates that all designated cargo areas have found a suitable panel, and this signal passes through OR-gate 105, through the enabled AND-gate 106 and sets the flip-flop 102 to start the tape moving again. The tape now reads out an encoded designation of one debarkation area on the Baudot line 21 which is then translated by a converter 26 to a B C D encoded address on line 400 to the decoder 421. An output on the wires 422 or 423 determines which debarkation hold is called for by decoding the four-bit binary code entering the decoder 421. This decoding will illuminate either the numeral 1 or the numeral 2 in the debarkation field 43*b*. After the B C D signal has been sent by the tape readout on lines 400 to the decoder 421, a second linefeed is sent on wire 419 which resets the flip-flop 420 and disables the decoder 421 from changing its selection of a debarkation area. The wires 422 and 423 are connected to memories located within the decoder 421 so that the correct debarkation station remains illuminated in field 43*b* after the flip-flop 420 is reset by the second linefeed. The resetting places a signal on wire 424 which travels upwardly to enable the AND-gates 425 and 426 which serve to step the digit counter and field counters 427 and 42 respectively. Thus, it will be noted that the first locally received linefeed selected the debarkation field 43 *b* and that subsequent linefeeds select the other fields 43*c*, 43*d* and 43*e* which are individually stepped by the digit counter and field counter in the manner about to be described.

Having now selected a debarkation station, it is necessary for the circuitry shown in FIG. 10 to select an empty debarkation panel, and the manner in which this is accomplished will be described in connection with the discussion of FIGS. 10 and 11. Going back to FIG. 9, when the tape reader 20 reads out the debarkation area No. 1 address, for example, this B C D address appeared on lines 200 and was decoded by decoder 171 which then sets the flip-flop 173. If it had selected debarkation area No. 2, flip-flop 174 would have been set through decoder 172. The output from flip-flop 173 on wire 175 informs the logic circuit 626 of the selection and closes the relay 622 to place the master panel address No. 28 from the cable 360 into the debarkation address panel address comparator 506. The output on wire 175 also sets the flip-flop 623 at the first debarkation area and enables data on the Baudot line 21 to enter the converter 28 through the gates 624.

As in the case of the cargo area panel search, the debarkation area panel address counter 500 commences stepping through the panels available at that area one at a time. It steps through the panels one at a time enabling their relays, 504, 509,...511, and 540 seeking to match the master panel address on cable 360 with a possible address stored in its local address register 502, and each failure to match in the comparator 506 puts a pulse on line 505 to step the counter 500 on via the enabled gate 503 and the OR-gate 508. When a panel, such as panel No. 5 in FIG. 11 is momentarily connected by its relay 511, electric power appears on wire 512 to trigger one-shot 517 to enable gate 507 to couple the address register 502 to the comparator 506. If the counter 500 gets through the whole six panels without finding coincidence, the on its seventh count it sets the flip-flop 501 to disable the gate 503 and enable the gate 513, to commence a new search through the available panels for one which is unoccupied.

Assume only panel 5 is unoccupied. The first four panels searched or returned "occupied" signals on wire 514 coming from their own set flip-flop 515, and these "occupied" signals on wire 514 stepped the panel address counter 500 past panels 1, 2, 3 and 4. However, when the counter searched panel five, being unoccupied, no signal appeared on wire 514 and therefore the panel address counter stopped searching. Had there been no unoccupied panel available, the search would have continued until a panel became available later on.

The tape reader 20, it will be recalled, transmitted the address of the first debarkation area, but it also followed that address with the third linefeed into the system, this linefeed appearing on wire 318 in FIG. 9 reset the flip-flop 109 through the still enabled gate 112 and at the same time set the flip-flop 119. This is the only time that flip-flop 109 is resetting while flip-flop 119 is setting, and this fact is used to provide outputs through the AND-gate 122 and the OR-gate 124 to stop the tape by resetting the relay 102. When the No. 5 panel in the first debarkation area is connected online, electric power appears on wire 512, FIG. 11, and enables the gate 519 through the delay 518 which exceeds contact-bounce time of the relay 511. A signal appears on wire 520 and travels into FIG. 9 on wire 520*a* to the logic circuit 626. This circuit compares a signal on wire 175, indicating that a debarkation panel has been designated, with a signal on wire 520*a* indicating that a panel has been selected at that debarkation area, and when the signals match, it issues a pulse on wire 627 to start the tape reader 20 again through gates 105 and 107 and the flip-flop 102. Meanwhile, the signal issuing from gate 112 has passed through delay 115 and reset flip-flop 119, thereby placing a signal on wire 119*a*. The combination of this signal with the one on wire 520 passes through AND-gate 127 and resets the flip-flop 173, and the process of selecting a panel in the debarkation area is completed leaving panel No. 5 in FIG. 11 online with relay 511 energized.

The tape reader 20 now moves on to read out the serial number "319628" into master panel No. 28, slave panels in cargo storage areas 1, 2, 5 and 6, and slave panel No. 5 in the first debarkation area. The tape reader 20 now reads out the first digit, a "3" into the Baudot line 24, and the converters 24, 26, 28,... convert it into B C D appearing on the data lines 200, 400, 521..., respectively. Referring to FIG. 8, assume that the digit counter 380 and field counter 381 are initially reset to select the first field. It will be recalled that so far in the en-

tire procedure, three linefeeds have been translated from the tape reader **20**. The counter **379** near the top of FIG. **8** has counted these three and sent a signal on the third linefeed on wire **379***a* to enable one input of the gate **382**. The tape reader **20** then proceeds to readout a "start" signal on wire **380***a* which advances the digit counter to select the first digit in field **31***c*. It then reads out a "3" which enters the decoder **382** as a B C D signal and is decoded and entered into the first digit of field **31***c*. The tape reader then reads out a "start" signal appearing on wire **380***a* which advances the digit counter to select the second digit. At this point, the tape reader **20** reads out the encoded numeral 1 which enters decoder **382** on the B C D lines **200** and enters the numeral 1 into the second digit of the field. This entry is followed by another 'start" signal on wire **380***a* which advances the digit counter **380** to the third digit and tape reader reads out the encoded numeral "9" which then passes through the decoder **382** and is recorded in the third digit of the field **31***c*. The subsequent digits of the serial number 319628 are entered in this way, and when the last digit, "8," has been read out the tape reader **20** follows it by a "space" signal on wire **381***a* which resets the digit counter **380** and advances the field counter **381** to the next field, **31***d*.

Meanwhile at the slave panel for cargo area No. **5**, FIG. **13**, a similar function has been underway, entering the serial number "319628" into the field **43***c*. It will be recalled that the second linefeed set the flip-flop **420** and that the third linefeed reset it, thereby energizing wire **424** and enabling gates **425** and **426**. As the serial number is read out, interspaced with "start" signals, the digit counter **427** is advanced through the gate **425**. The digits entering the decoder **432** through the cable **400** are decoded and entered in the frame **43***c* until the last digit is entered. Then the tape reader sends a "space" signal on wire **429** which resets the digit counter **427**, advances the field counter **428** to the next field **43***d* through the gate **426**, and sets the flip-flop **430** to enable the "occupied" line **431**, continuously until the whole panel is reset after its function is completed.

Similarly in panel **5** at the first debarkation area in FIG. **11**, the third linefeed signal on wire **521** set the digit counter **522** and field counter **523** to select the field **53***c* into which the serial number "319628" is entered digit by digit, the digit counter being advanced to each "start" pulse preceding a numeral, the numerals being decoded by the decoder **527**. When the last numeral has been sent in the serial number, the tape reader reads out a "space" signal on wire **521** to advance the field counter **523** to select the field **53***d*. The first "space" signal on wire **532** also sets the flip-flop **515** to enter a signal continuously on "occupied" line **514**, which signal is reset only when the whole panel is later extinguished. At this point all panels are displaying the serial number "319628" and the tape reader is still running.

The tape reader then reads out a series of three digits preceded by "start" signals and comprising the estimated time of departure "16.5" hours. These numerals are entered in the respective panels at fields **31***d*, **43***d*and **53***d*, their digit counters being advanced by the "start" pulses. When the third digit has been entered, the tape reader sends a "space" signal to advance the field counters to select the fields **31***e*, **53***e*, and the corresponding field in the first cargo storage area (not shown). The next six fields corresponding with **31***e*, **31***f*, **31***g*, **31***h*, **31***i* and **31***j*, and with **43***e*, **53***f*, **53***g*, **53***h*, **53***i* and **53***j* are all fully displayed only at the master panel **28** and the debarkation panel **53**, but only one of these fields is displayed at each cargo slave panel, namely the field relating to that cargo area.

The tape reader **20**, continuing to run, reads out two digits for fields **31***e* and **53***e*, preceded by "start" pulses and followed by a "space" signal to move the field counters to the next field. In FIG. **13** showing cargo area No. **5**, the third, fourth, fifth, sixth and eighth outputs are blank, whereas the seventh output on wire **428***a* enables the field **43***i* which corresponds with the fifth cargo area. Thus the panel **43** will display the number **17** in its field **43***i* indicating that the order corresponding with serial number 319628 requires **17** pallets of the item being stored in this cargo area. This order is displayed in fields **31***i* and **53***i* at the master and debarkation panels along with the quantities to be ordered from other storage areas.

The panel **45**, shown near the bottom of FIG. **12** is merely a remote repeater panel duplicating what is shown on its associated storage area panel **43**. Another more complex type of remote panel is shown in FIG. **10** and will be described thereinafter in greater detail.

The last field **31***k* and **53***k* appears only at the master panel and at the selected debarkation panel and is provided so that a type of transportation can be indicated, i.e., aircraft, ship, small boat, truck, etc. A single number can be entered in this field arbitrarily designating this transportation. As in the case of previous entries, the number is preceded by a "start" signal, but when the number has been decoded and entered in the panel, the entries are complete, and the panels are now ready to be separated from the network data entry lines and left to display their data until further intervention takes place by the operating personnel. However, if the present serial number is urgently needed, the tape reader **20** can send a space signal to advance the field counters to their highest number output, and then send an "exclamation mark" on wire **384**. The output of the counter **381** is used in FIG. **8** to enable a gate **383** which when receiving the "exclamation mark" signal on wire **384** provides an output on wire **385** to a blinker **386** to illuminate the expedite light **387** on the panel of this unit. Similarly on the last count of field counter **428**, FIG. **13**, the wire **434** enables the gate **435** so that the "exclamation mark" signal on wire **436** can set the flip-flop **437** to light the "expedite light" **438** through blinker **439**. In FIG. **11** the "exclamation mark" signal on wire **535** sets the flip-flop **536** through the gate **534** which is enabled by the last count of field counter **523**, appearing on wire **533**, to light to "expedite" lamp **537** through the blinker **538**.

The display units actually used in the present illustrative embodiment are commonly known in the art as IEE's, and are digital displays which project a numeral on a ground glass face from one of 10 projectors located behind the glass. These IEE's are purchased units and are driven by drivers manufactured by the same company, namely the Industrial Electrical Engineers. For instance, the decoder **382** is merely a series of AND-gate and inverters each one of which recognizes one particular binary encoded signal on the four wires entering the decoder **382** from the network lines labeled **200** near the top of FIG. **8**. Since this is a very well-known type of decoding and display technique, no further explanation of it is deemed necessary at this point.

All entries, including "expedite" have now been made in the panel, and therefore the tape reader **20** proceeds to so indicate by reading out a "period." In FIG. **8**, the "period" signal arrives on the wire **330** and resets the field counter **381**. The 'period" on wire **330** also passes through the OR-gate **307** and resets the flip-flop **373** to disable the driver **374** and open the relay **375**, leaving the master panel No. **28** occupied but disconnected from the network lines **200** and **202**. In FIGS. **10** and **11**, the Baudot coded "period" is converted by the converter **28** to a signal on wires **539** which resets the flip-flop **623** blocking the gate **624** from further Baudot input from line **21**. It also resets the flip-flop **501**, resets the panel counter **500** to remove the signal from output No. **5** and open the relay **511**, the field counter **523** being reset prior to mechanical opening of the relay **511**. In cases where there is a remote panel such as the panel **55** in FIG. **10**, to be explained hereinafter, the period on wire **539** also resets its field counter **528**. In FIGS. **12** and **13**, the period on the Baudot line **21** is converted to an output on the wire **441** from the converter **26** and this output resets the flip-flop **616** to block further input to the converter **26** via the gate **620**. It also resets the flip-flop **402**, resets the panel counter **409** to remove the signal from its No. **7** output and open the relay **453**. Before the relays contacts mechanically open, the "period" signal on wire **441** also resets the field

counter 428. Finally, the "period" signal on wire 330 in FIG. 7 travels downwardly in cable 202 and passes through the OR-gate 101 to reset the flip-flop 102 and stop the tape reader 20.

At this point, automatic entry has been made into all accessed panels; these panels have been disconnected from the network, and the slave panels are each storing in their own address registers the address of the master panel with which they have been associated.

MANUAL MODE ENTRY

Recalling for the moment that a "carriage return" signal on wire 300 in FIG. 7 signifies the start of a new transaction entry, this entry is by the automatic mode if the "carriage return" signal 300 is followed by a "dash" on wire 308, which sets the flip-flop 310. However, when seeking to enter the manual mode, the operator first sends a "colon" signal on wire 326 which sets the flip-flop 328 and enables one input to the AND-gate 332. Since it is not desirable to permit the operator to break in on the automatic tape reader 20 at just any random position in its cycle, the system awaits the sending of a "period" by the tape reader 20, which "period" on wire 333 enables the other input of gate 332 which then delivers a signal on wire 333, which passes through OR-gate 101, FIG. 9, and resets the flip-flop 102 to stop the tape reader 20.

The operator at the keyboard, however, must not be operating his teletype 22 in the lowercase mode. A warning means is provided to warn this contingency, and includes the flip-flop 322 which is reset by an output on wire 320 indicating lowercase operation. This energizes wire 323 which, together with wire 351 which is energized by reset flip-flop 336, passes a signal through gate 324 to light the warning lamp 350 through the driver 349. The warned operator then shifts to uppercase thereby energizing wire 321 and setting flip-flop 322 to extinguish the lamp 350 and enable gate 352 to reset flip-flop 342. In this condition of the flip-flop, the data live gates 346 are conductive, as will be explained hereinafter, so that data can flow into the master panel from the keyboard machine 22.

Next, the operator sends a carriage return signal indicating a new data entry cycle via wire 300, and this sets the flip-flop 302 to enable one input to each of the gates 304 and 306. The gate 304, however, remains blocked at its other input because the flip-flop remains reset since the operator has not manually sent a "dash" signal. The reset condition of flip-flop 310, however, enables a second input to the gate 306 so that when the operator sends the first numeral of the address of the master panel which he desires to access, the "start" signal on wire 348 preceding that character will enable the third input to gate 306 and provide an output on wire 306*a* to step the address digit counter 317 to provide an output on wire D1 to enable the first digit 365 of the panel address decoder 364.

Assume that the operator seeks to access master panel No. 28 and all of the slave panels storing its address. The operator therefore types in a "2" followed by an "8." The panel address decoder 364 is hard-wired in its two digits to recognize only its own address. With its first digit 365 energized it recognizes a "2" and delivers an output on wire 367 to set the flip-flop 369. The "start" pulse on wire 348 preceding the "8" numeral, which the operator sends next, advances the address counter 317 to enable its output D2 and thereby energize decoder digit 366. Since this decoder will recognize the transmittal "8," it will energize wire 368 and set the flip-flop 370. The outputs from both the flip-flop 369 and 370 will enable the gate 371 to pass a signal through OR-gate 372 and set the flip-flop 373, thereby energizing the driver 374 to light the lamp 374*a* on panel No. 28 and close the relay 375 connecting this panel online with the network lines 200 and 202.

The operator then sends linefeed signal on wire 318 which resets the address digit counter 317, and at the bottom of FIG. 9 sets the flip-flop 108 in the manner set forth above in detail under automatic entry. The wire 124 becomes energized so that when the operator types in the addresses of storage area panels 1, 2, 5 and 6, the decoders 151, 152, 155, and 156 set the flip-flops 161, 162, 165 and 166 to energize the relays 167, 168, 169 and 170, FIG. 12, to introduce the address of master panel No. 28 from lines 360 into storage areas 1, 2, 5, and 6. Of course, if the operator so desires, he may omit any of these slave panels which he does not desire to correct, such as panels not containing the data to be changed. The set flip-flops, such as 165, FIG. 9, put out enabling signals into cable 602, for instance on wire 165*a*, to set the flip-flops enabling the addressed cargo areas, i.e. flip-flop 616 in FIG. 12. The local panel counter 409 in each accessed cargo area begins searching through its panels by closing relays 451, 452...453...454 one at a time, thereby pulsing the flip-flop 414 to enable the gates 407 and feed into the comparator 408 the address previously stored in the address register 405. When the stored address matches the address now appearing on wires 360, the output disappears from wire 410 which results in failure to the address counter 409 to step any further. In this way, the panels storing an address matching that of the presently accessed master panel have now been connected online the precise details of this connection having already been explained previously in this specification.

The operator now sends a second linefeed on wire 318 which resets the flip-flop 108 and sets the flip-flop 119 to enable the debarkation area decoders 171 and 172, FIG. 9. The operator the sends the address of which ever debarkation area is to be accessed, for instance area No. 1 in the present example, and the decoder 171 recognizes this address, sets the flip-flop 173, and thereby energizes the relay 622 through the wire 175. This wire also sets the flip-flop 623 and places debarkation area No. 1 into operation. The panel address counter begins stepping through its outputs, sequentially closing the relays 504, 509...511...540 while the address comparator 506 in each panel in turn compares the address of panel No. 28 on lines 360 with the stored address, if any, in the logical register 502. As described above in detail, each failure to find coincidence puts a signal on wire 505 to step the address counter 500 to the next panel. When panel No. 5 is reached, coincidence of the addresses occurs, and the counter 500 steps no further, leaving panel No. 5 connected online

As described hereinbefore, when the designated slave panels are selected and online, their signals from the gates 418 in FIG. 13 and 519 in FIG. 11 reset the flip-flops 161 through 166 and 173 and 174, located in FIG. 9. The operator can look at the master panel, FIG. 8, and tell that the selection of the associated slave panels has been successfully accomplished because the illumination of the digits in fields 31*a* and 31*b* changes color in response to successful selections as will be described hereinafter in detail under the general heading devoted to Status Reporting to the master panels from the slave panels. The operator sends the third linefeed signal on wire 318 after the address of the debarkation area to be accessed, and this linefeed resets flip-flops 109 and 119 in FIG. 9, enabling the gates 127 and 128 so that the flip-flops 173 and 174 can be reset. All panels in all areas have now been selected and are online awaiting the operator's next move.

Assuming that the operator wants to change the data only in certain fields, and not all data displayed, he addresses the various fields one at a time. Note that in FIG. 8, there is a row of lamps across the top of the master display panel No. 28, one above each of the fields 31*c*, 31*d*, 31*e*, 31*f*, 31*g*, 31*h*, 31*i*, 31*j*, and 31*k*. These lamps light in response to the various outputs from the field counter 381, only one of which outputs is energized at a time. Thus, the lamp which is lighted indicates which field is momentarily being accessed. It will be recalled that each "space" signal on wire 381*a*, FIG. 8 or on wire 532 in fig. 11. or on wire 429 in FIG. 13, advances the local field counter to the next field. Therefore, when the operator sends the first "space," he advances the counters to the first field selected in this manner, which is field 31*c*, and thereby illuminates the lamp 31*m*, FIG. 8. If he does not wish to change this field, 31*c* which shows the serial number, he sends another "space" signal which advances to the next field, 31*d* which shows the estimated time of departure and lights the lamp 31*m*

when selected. The sending of additional "space" signal would similarly advance the field counters in all online master and slave panels sequentially and in step with each other to select the fields associated with lamps 31*o*, 31*p*, 31*q*, 31*r*, 31*s*, 31*t* and 31*u*, the last-lighted lamp being extinguished each time a new one is lighted by a subsequent "space" signal.

Assume that the operator wishes to change the estimated time of departure field 31*d*. He sends a total of two "space" signals to light the lamp 31*m*, and then sends a question mark to extinguish the associated field 31*d*. Each of the IEE numeral displays in a field and digit, as stated above, is a ground glass screen with the small projectors behind it, selectable one at a time to cast an image on the screen. The projectors are selected by memory and driver means such as flip-flops (not shown) which are ANDed together for reset purposes. When a local field counter selects a field, it enables the associated AND gates (not shown) to reset those flip-flops. The "question mark" signal on wire **201** feeds into the decoder **382** which contains those flip-flops, serving as the memory, and extinguishes the fields by resetting the flip-flop memories whose reset gates have been selected by the field counter. The operator then types in a new first digit, preceded by a "start" signal on wire **380***a*, FIG. **8**, to actuate the digit counter **380** to select the first digit. The operator then sends the second digit, preceded by a "start" signal to again actuate the digit counter **380**, and so on until the correction of the field 31*d* is completed.

The aforementioned "start" signals are not specifically selected and sent by the teletype operator, but are automatically sent by the teletype each time another message character key is depressed by the operator. Standard teletypewriters using a standard code, such as the Baudot code, maintain a certain condition of the output line when they are in nontransmitting condition. Depending upon the particular machine, the line may be normally minus, normally plus, or normally zero, etc. However, when a character is to be sent, an indication of this fact is signalled by the transmission of a "start" pulse, sometimes known as a stepping signal, which amounts for example to a reversal of the line polarity actuated by a clutch within the teletypewriter at the beginning of each encoded character.

In the online slave panels, the procedure for changing the digits of the displays is the same. As a further illustration, if the Estimated Time of Departure has been made earlier, the operator may wish to send additional "space" signals until he reaches the 9th output of the field counters and then send an exclamation mark on wire **384** to start the "expedite" lamps blinking on all of the panels selected.

When the operator has completed the desired changes and/or entries, he then sends a "period" on wire **330** to withdraw from the selected panels. The "period" in FIG. **8** resets the field counter **381** and passes through the gate **307** and resets the flip-flop **373**, thereby opening the relay **375** and disconnecting the master panel No. **28**. In FIGS. **10** and **11**, the "period" resets the field counter **523** and resets the panel address counter **500**, thereby opening the relay **511** and disconnecting the panel **53** from the network. In FIGS. **12** and **13**, the "period" resets the field counter **428**, and resets the panel counter **409** to open the relay **453** and disconnect the panel **43** from the network.

If the operator wishes to address the history tape machine **23** to make a notation thereon without changing the panel entries, he sends a "stop" signal on wire **334** to set the flip-flop **336**, whose output enables one input to AND-gate **338** on wire **337**. The set flip-flop **328** will have enabled the middle input **329** to this gate, and the "period" on wire **330** will have enabled the upper input to the gate **338**. The output from this gate will set the flip-flop **342** through the OR-gate **340**, whose upper input is likewise enabled to set the flip-flop **342** whenever the teletype is in lower case mode and the flip-flop **322** is reset. The effect of setting the flip-flop **342** is to remove the enable signal on wire **344** placed there by inverter **343**, thereby blocking the B C D data to the panel No. **28** on network lines **200**. The operator then shifts to lower case and addresses the history tape **23**. When finished, he shifts again to upper case and sends another "stop" signal which resets the flip-flop **336** and resets the flip-flop **342** through the now enabled AND-gate **352**, thereby again enabling the AND-gate **346**.

Finally, when the operator is through, he relinquishes control by the keyboard machine **22** by sending a "colon" on wire **326**. This second "colon" resets the flip-flop **328** and thereby removes the signal from wire **329** which had previously set the flip-flop **117** near the bottom of FIG. **9**. When the wire **329** goes false, the inverter **118** rests the flip-flop **117** and enables the gate **116** to send a signal through the OR-gate **105** and the AND-gate **106** to set the flip-flop **102** and commence the tape-reader **20** running again to resume automatic mode entry.

STATUS REPORTING

In the lower half of FIG. **8**, are illustrated a number of means by which slave units report back to a master panel such as panel No. **28** to indicate the status of their assigned tasks. It will be recalled that on network lines **360** the master panel No. **28** sent out its own encoded address to associated slave panels through the routing means, which address is available at all times on the lines **360** whenever an entry is in progress, meaning that in FIG. **8** an output from gate **376** enables the wire **363** entering the encoder **362**. The associated slaves then retain this address in their address registers **405** and **502**, etc. On the other hand, at the bottom of FIG. **7** is another cable of wires labeled **600** and returning from the slave units through the routing means, FIGS. **9** and **10**. This bundle of wires includes six B C D wires serving to carry the stored address of whichever master panel is being reported to by a slave panel. This address, placed on the wires **600** from its register by a slave unit in a manner to be described hereinafter, enters the decoder **390**, which recognizes its own address, and in response thereto applies an "acknowledge" signal to the wire **391** to enable a series of gates **250** through **259** inclusive. Each one of these gates has another input driven by a wire from a decoder located to the left of it and operative to decode one of a number of different possible status messages available to the personnel at the slave units.

From the various cargo storage areas there are two possible messages, one is that the cargo ordered is "en route" to the designated debarkation area, and the other is that the order is "discharged" meaning that the items ordered can not be supplied and may previously have been dispatched as a result of an out of sequence manual mode directive. The top decoder labeled **260** receives from other lines in the network cable **600** a binary signal, which if it bears the correct coding will enable the output from the decoder **260** to indicate that the cargo is "en route." The decoder **261** is sensitive to the other possible message in binary encoded from which indicates that the ordered cargo is "discharged."

The binary signals on the cable **600** report either from the debarkation areas or from the cargo storage areas and are routed by the routing means in a manner to be explained hereinafter. The six cargo storage areas and the two debarkation areas are connected to the network cable **600** for status report purposes by eight relays labeled **631**, **632**, **633**, **634**, **635**, **636**, **637** and **638**, and comprising part of the routing means shown in FIGS. **10** and **12**. These relays are interconnected by a wire **639** in such a way that only one relay of the eight can be closed at any particular moment. This is not a hardship in view of the fact that report-back from any area requires only a few milliseconds, and therefore if two areas attempt to report almost simultaneously, the first report will go through and the other will have to wait for a short interval. However, all reports are acknowledged by the master unit addresses, and therefore personnel at a slave unit are not left in doubt. The manner. The manner of acknowledgement will be described hereinafter.

Since the present discussion relates to status reporting from a storage area, referring to FIGS. 12 and 13, assume that no other slave unit is reporting status at the moment and that the personnel at cargo area No. 5, panel No. 7, wishes to report. He can do so by depressing either the ganged switches 450*a* and 450*b* to indicate "en route," or by depressing the ganged switches 451*a* and 451*b* to indicate "discharged." In FIG. 8, there are three colored lights located behind each of the digits 1 through 6 combining to form the field 31*a*, these digits corresponding with each of the six selectable cargo areas. Whenever a cargo area reports back to the master panel, the pressing of either switch triggers the single shot 460 which puts out a pulse signal on wire 461 to close the Report Relay 365. The output from the single shot 460 also enables the gate 462 thereby placing the address of the master unit panel No. 28 on the network lines 600 from the register 405 via the lines 406. The master panel recognizes its own address using its decoder 390, FIG. 8, and puts out a signal on wire 391 enabling one of the gates 250 or 251 to pass a signal from the associated decoder 260 or 261. The wire 461, indicating that a status report is being carried from No. 5 cargo area passes into network group 602 and upwardly into FIG. 8, and when it is energized, it enables the gates 288, 291, and 292 in the No. 5 cargo area display. If the panel is occupied, the wire 363 will also be energized and therefore the gate 288 will set the flip-flop 289 and light the amber lamp behind the digit No. 5 in field 31*a*. The flip-flop 289 remains set and therefore the amber light remains on until one of the other lights is illuminated or until a signal is applied to the OR-gate 290 to extinguish it from the extinguished line 287. The hard-wired address wire 461 from cargo area No. 5 has also enabled one input to the gates 291 and 292 as mentioned above. If the cargo area officer signals that the required inventory is "en route" he passes the switches 450*a* and 450*b* in FIGS. 13, and this signal enables the encoder 463 to send an "en route" signal through the network lines 600 to the decoder 260 in FIG. 8. This decoder then energizes the gates 291 through the gate 250 and sets the flip-flop 293, thereby lighting the green lamp behind digit No. 5 in field 31*a* when the flip-flop 293 sets, it resets the flip-flop 289 via the OR gate 290, thereby extinguishing the amber light. Conversely, if the cargo area officer had depressed the switches 451*a* and 451*b* to indicate "discharged," the encoder 464 would have sent an encoded signal to the decoder 261 in FIG. 8 which would have passed a signal through gate 251 to enable the other input to the gate 292 and thereby set the flip-flop 294 to light the blinker 295 and show a blinking red light on the panel No. 28 behind the fifth digit of the field 31*a*. The other boxes located adjacent to the circuitry just described and labeled 296, 297 ... are identical, only they relate to the other five cargo areas and to amber, green and red lights located behind the other digits in the cargo area field 31*a*.

The debarkation areas have more available reports to make than the cargo areas, but the operation is similar. In FIG. 7, an encoder 560 is shown having seven different report messages. Six relate to the arrival of the cargo from the six cargo storage areas, and the seventh relates to departure from the debarkation area of the entire inventory called for by the serial number of the present transaction. Each of these seven messages is encoded differently by the encoder 560 and is delivered to the network lines 600 through the gate 561 when enabled.

The two debarkation areas are connected to the network cable 600 for status report purposes by the respective relays labeled 637 and 638, and comprising part of the routing means shown in FIG. 12. These relays are also connected to wire 639 in such a way that only one relay of the eight connected thereto can be closed at any particular moment. However, all reports are acknowledged by the master unit addressed, and therefore personnel at a slave unit are not left in doubt. The manner of acknowledgement will be described hereinafter.

Since the present discussion relates to status reporting from a debarkation area, referring to FIGS. 10 and 11, assume that no other slave unit is reporting status at the moment and that the personnel at debarkation area No. 1 wishes to report. He can do so by depressing any of the push buttons on the left side of the decoder 560 to indicate an encode one of the above-listed messages. In FIG. 8 the decoder 263 can decode a message from the debarkation area that the entire serial number has been filled and "departed" the ship. The decoder 264 decodes a message showing that the required inventory of items ordered from cargo hold area No. 1 under the serial number has "arrived" at the debarkation area. Decoder 265 can decode a message indicating that certain specific cargo required from cargo hold No. 2 has arrived. Decoder 266 indicates that the cargo ordered from cargo hold No. 3 has arrived. Decoder 267 indicates that the cargo ordered from hold No. 4 has arrived, and decoders 268 and 269 decode similar messages indicating that the specific inventory ordered from cargo areas 5 and 6 has arrived. Thus, on the wires 600 there can appear a series of specific messages indicating the status of the serial number relative to the various slave units.

Each of these messages, when decoded and passed through the appropriate gate 254 to 259 lights a light on the master panel to indicate the status of cargo ordered from the particular cargo area whose field is located above the lamp. The lamps lighted by these respective outputs are maintained lighted by flip-flops 274, 275, 276, 277, 278 and 279 which in turn illuminate lamps 244 through 249, respectively appearing beneath the associated cargo area fields 31*e*, 31*f*, 31*g*, 31*h*, 31*i*, and 31*j* on the panel 28, thereby informing the operator that the cargo ordered from those particular holds has in fact arrived at the debarkation station designated.

In field 31*b*, FIG. 8, the two possible debarkation area designations "1" and "2" are etched on ground glass and illuminated from behind by lamps showing either an amber light or a green light to further indicate status of the serial number considered as a whole transaction. When the debarkation station officer pushes one of the buttons on the encoder 560, he enables the wire 562 which travels in network bundle 600 and closes the report relay 637. This signal on wire 562 travels upwardly also in bundle 602 into FIG. 8 to the gate 280, which being also enabled by the entry in progress signal on wire 363, sets the flip-flop 282 and energizes wire 282*a* to light the amber light under the ground glass bearing the numeral "1" in debarkation field 31*b*.

On the other hand, if the status report seeks to indicate that the entire order bearing that serial number has departed from that debarkation area an output from the decoder 263 will enable the gate 283 and cause the blinker 284 to blink a green light under the numeral "1" of the field 31*b* to indicate that the departure is accomplished. The green light will be turned on by setting the flip-flop 285 through the gate 286, which will leave the green light blinking until the panel is extinguished. The cable 298 joins these wires to the lamps (not shown) located behind field 31*b*. An "extinguish" signal on the wire 287, as described hereinafter, will reset the flip-flop 285 and cause extinguishing of the green light. Moreover, setting of the flip-flop 285 resets the flip-flop 282 thereby extinguishing the amber light.

The amber and green light circuitry, generally labeled 299 and located directly beneath the circuits just described, are identical and operate in the same way except that they are activated by an enabling signal on wire 540 and gate 281 whenever the reply signal is coming from the second debarkation area instead of the first one.

Referring again to FIG. 11, when the debarkation officer depresses any of the buttons on encoder 560, thereby energizing wire 562, this wire triggers the singleshot 564 which then enables the gates 565 and 561. The gate 561 places the stored master panel address on the wire in the network cable 600 from the storage register 502, which address passes through the relay 637, is recognized in the address decoder 390, which then enables the decoder gates 250, 251 and 253 through 259

in FIG. 8, as stated above. The encoded messages from the encoder 560 pass through the gate 561 on to other wires in the network bundle 600.

Furthermore, when one of the first six report buttons is pressed in encoder 560, it enables the associated one of the gates 571 through 576, and lights a lamp under the associated field 53*e*, 53*f*, 53*g*, 53*h*, 53*i* or 53*j*, these lamps being labeled 581 through 586 and reminding the debarkation officer that the associated cargo area has completed its function in that transaction.

When the whole transaction relating to that serial number has been completed and the officer has illuminated appropriate lights 581 through 586, thereby having shown the required performance by each involved cargo hold and having placed an acknowledge signal from the associated master panel on wire 392 to enable one side each of the gates 554 and 557, he then presses the serial number depart button of the encoder 560. The output from this button passes through the enabled gate 557 and the OR-gate 588 to illuminate the DEPART Light on the debarkation panel 53. This same output from the serial number depart button of the encoder 560 also passes through the enabled gate 554 and actuates the DELAY and the single-shot 555. Because of the DELAY, the gate 557 is not enabled at both of its inputs when the serial number depart button is pressed the first time. However, if the officer depresses the serial number depart button again before the DELAY runs out, the gate 557 will be enabled through the single-shot 555 and will deliver an output on the extinguish wire 558, which will extinguish the entire debarkation panel 53 in FIG. 11 although it will not affect the associated master panel. Thus, the debarkation panel can be extinguished in either of two ways, i.e., as just described by twice depressing the serial number depart button, or when the system operator extinguishes the master panel by sending a "bell."

The remote panel 55 shown in FIG. 10 operates similarly to the panel 53 in FIG. 11, but it has its own decoder 526 which received B C D data from lines 521 through gates 525 which are conductive only when the field counter 523 in FIG. 11 is selecting the first field which it can select, namely the serial number field 53*c*. This corresponds with field 55*c* in panel 55 which is then enabled. The "start" pulse on wire 530 preceding the first numeral "3" advances the digit counter 528 through enabled gate 529, and subsequent "start" pulses do the same for the remaining digits of the serial number. When the linefeed advances the field counter 523 to the next field the wire 524 goes false and entries at the remote panel are completed. The "expedite" light 55*a* at the panel 55 can be driven by the blinker 538 in parallel with the lamp 537. A "-period" resets the counter 528 when the wire 539 becomes energized. When the personnel at the remote panel 55 have completed their function, for instance loaded their cargo on to the departure vehicle, they press the depart switch 55*b*, FIG. 10, and thereby energize the line 569 to extinguish the panel 55 and set the flip-flop 587 in FIG. 11. This flip-flop then passes a signal through the OR-gate 588 to light the "Depart" lamp 590 on the panel 53. This lamp can also be lighted through the OR-gate 588 and the AND-gate 577 when the "-Serial Departed" button is pushed on the encoder 560. The wire 392 comes from FIG. 8 and is the output of the decoder 390 when it recognizes its own address. The wire 392 enables the gates 571 through 577 so that if the lamps 581 through 586 light, the debarkation officer will know that his status report is being received. This is an acknowledgement from the master area panel No. 28. "The acknowledge" signal on wire 392 also enables the gate 554 so that when the operator depresses the "Serial Departed" button on encoder 560, the resulting output will pass a signal through the singleshot 555 and the delay 556 and enable the gate 557 to deliver an extinguish signal on wire 558. This signal extinguishes the entire panel by resetting the flip-flops 515, 536, and 587 also resetting the memories in the decode and memory unit 527, and by resetting the address memory register 502. In this condition, the debarkation panel No. 53 becomes available to start all over again with a new transaction.

Referring to FIG. 13, a storage area panel, such as the panel No. 43, can be extinguished by the local operator thereat by depressing the "en route" switches 450*a* and 450*b* twice in succession. The first actuation closes the report relay 635, and an "acknowledge" signal returns from FIG. 8 on wire 391 to enable the gates 470, 472 and 473, and to reset the flip-flop 471. Now, if the cargo man at remote panel 45 depresses the "Depart" button 465, he will set the flip-flop 471 and light and green lamp in housing 455 via the wire 474. On the other hand, if the operator depresses the "Discharged" switches 451*a* and 451*b* in FIG. 13, he will enable the gate 473 and light the red lamp in housing 455 via the wire 475. Returning to the gate 470 which was also enabled by the "acknowledge" signal on wire 391. If the operator presses the "en route" switches 450*a* and 450*b* for the second time, the output on wire 476 will set flip-flop 477, light the green light through wire 474 and gate 472, pass through the delay 478 and enable the other side of gate 479 to deliver on wire 469 an "extinguish" signal, which will reset flip-flops 477, 430, 437, the numeral decoder and memory 432, the debarkation area decoder 421, and the address register 405. The panel 43 becomes unoccupied and available for a new transaction.

Finally, at the master area, the system operator can extinguish the master panel by using the teletype keyboard 22 to end a transaction. It will be recalled that when the debarkation officer provides a status report to the master panel No. 28 that the entire serial number inventory has departed the ship, his report resulted in a green blinking light driven by the blinker 284 near the lower right-hand corner of FIG. 8 and showing through field 31*b* on panel No. 28. Observing this indication that the transaction is concluded, the system operator types in a "colon," then a "stop" and await the sending of a "period" by the automatic tape reader 20, FIG. 9, and the relinquishing of automatic mode, all as described above under MANUAL MODE. The operator then goes to lowercase mode and enters the serial number and the time of actual departure on the memory tape 23, together with any other comments he may desire to enter. He then returns to uppercase mode, sends a "-stop" signal, and a "carriage return," and two digits comprising the address of the master panel serving that transaction. If he desires, he can also address selected slave panels in the manner described above. Having online all panels he has addressed, the operator then types in a "bell" which resets in the master panel in FIG. 8 via wire 387 the numeral decoder and memory 382, the flip-flops 377, 285, 289, 293, and the lamp driven flip-flops 274 through 279 inclusive. The master panel 28 is now unoccupied and available for use in a new transaction.

The embodiment of this invention is only illustrative of the concepts involved and can be varied in a great variety of respects. Having provided an illustrative embodiment, we now proceed to set forth the following claims.

We claim:

1. A system for selectively transferring data to and displaying data at diverse mutually distant stations joined by a trunkline network, one of the stations being a master station and the other stations being slave stations, comprising:

a. source means for applying to the network a sequential program including display data and designations of certain slave stations to display said data and including control means to deliver system commands;

b. a plurality of separate display panels at each station, each panel having means for selectively connecting it to the network for data transfer therethrough and each panel having means for indicating whether it is presently occupied by data or unoccupied;

c. uniquely encoded address means at each master panel for identifying it among the other master panels, said address means including means operative to encode its address and enter it into said network;

d. search means at each station for sequentially scanning through the panels associated with that station;

e. means at the master station responsive to said control means to actuate its search means to select an unoccu-

pied master panel and connect its address means to the network to enter its encoded address thereinto;

f. memory means at each slave panel for storing and encoded address;

g. means responsive to the source means to select slave stations designated by the source means and to actuate their search means to find at each selected station an unoccupied local panel and introduce the encoded and entered address into its memory means and couple those panels to the network; and

h. means in the source means for transferring data for display to the selected master panel and to all selected slave panels which are coupled to the network and storing that encoded address.

2. In a system as set forth in claim 1, said source means being capable of a series of unrelated transactions each represented by one sequential program, and said control means including means for disconnecting the selected master panel and associated slave panels from the source means at the end of the related program sequence and leaving those panels storing the applied data and the encoded address of the related master panel; and said control means including means for actuating the search means in the master station and particular slave stations designated by the new sequential program of the next transaction to select unoccupied master and slave panels to display the data in the new sequential program.

3. In a system as set forth in claim 2, said master panels each storing data relating to one of said transactions, and the master panels having different slave panels associated therewith and storing data requiring action on the part of personnel located at the slave stations, and each slave panel having means for applying to said network the address of the associated master panel and data for displaying at the addressed master panel to provide an indication of the status of the required action; status display means at each master panel; and means at each master panel to actuate this display means in response to status data arriving together with that panel's encoded address.

4. In a system as set forth in claim 1, said network including function control signal lines, and display data lines, and each station including interface means coupled to receive said display data lines and some of said control signal lines; said means to select slave stations comprising routing means coupled to receive some of said control signals together with display data identifying designated slave stations and responsive thereto to select said slave stations; means operative in response to signals indicating that a master panel and the designated slave station panels are coupled to the network to actuate said source to transfer display data through the interface means into the coupled panels and then disconnect them from the network.

5. In a system as set forth in claim 4, said network including answer-back lines coupled from the slave station panels directly to the master panels, and including report-data lines indicating status of the display data program entered into a particular slave panel and including address lines for carrying the address of the associated master panel; indicator means at the master panels and selectively actuated by the appearance on the answer-back lines of both status data and the address of the associated master panel; and means to exclude answer-back by other slave panels when one slave panel is applying data to the answer-back lines.

6. In a system as set forth in claim 1, said source means comprising means for reading out to data entry lines of said network sequential programs representing recorded display data interspersed with system command signals, said source means including means to start and stop its readout; said master station search means including means responsive to selection of an unoccupied master panel to start readout by said source means of data designating specific slave stations; means in said source means to stop the readout thereafter; means responsive to selection of unoccupied panels in the slave stations to start readout to the network by said source means of display data to all panels thus selected; and means at the selected panels to display said data.

7. In a system as set forth in claim 6, means in the source means and responsive to completion of the readout of the display data for disconnecting the associated master and slave display panels from the data entry lines of said network and leaving them containing the stored data and addresses.

8. In a system as set forth in claim 6, said source means including means for reading out designations of slave stations one at a time, each designation being displayed on the selected master panel; said means responsive to the source means to select slave stations comprising routing means responsive to the readout of a designation to connect the designated slave station to the data entry lines of said network and actuate its search means; and means responsive to the finding of a slave panel by the search means for starting the readout of another slave station designation, until all of the slave stations designated in that sequential program have been connected to said data entry lines.

9. In a system as set forth in claim 6, said means for reading out the sequential programs comprising means for reading out a serially encoded message; interface means at each station connected in parallel to receive said message and operative to convert it into command signals and into binary coded digital data; each station having switching means for selectively coupling said binary data into any one of its display panels as selected by said search means when that station has been selected by the converted command signals of said source means.

10. In a system as set forth in claim 1, the search means in each station having means for sensing said means for indicating whether a panel is occupied or unoccupied and for skipping occupied panels until an unoccupied panel is sensed.

11. In a system as set forth in claim 1, said source means comprising means for reading out to data entry lines of said network, and into display panels presently selected and connected to it, binary information in a message format including plural message fields each having at least one digit, and the panels at the stations including corresponding display fields and digits; said source means including preprogrammed data interspersed with command signals demarcating the various fields and digits; and each display panel having counter means responsive to said command signals to apply the display data to corresponding fields and digits of the various panels.

12. In a system as set forth in claim 11, the display panels at some slave stations having fields for displaying only some of the fields displayed at the master panels, and the field counter means at these slave stations including means for omitting the counts of fields which are not to be locally displayed.

13. In a system as set forth in claim 11, said source means including both automatic means for reading out said programmed data having said message format and manual keyboard means having the capability of reading out both display data and command signals, said manual means having a command key for interrupting the automatic means to change over the manual entry; and the system including means responsive to the latter command key to prevent interruption of the automatic means until it reaches the end of a complete message field.

14. In a system as set forth in claim 13, said manual means comprising a teletypewriter wherein nonalphanumeric keys provide encoded command signals to the system including interruption of the automatic means to substitute manual means entry; and said system including apparatus coupled to both the automatic and the manual means and operative to record a continuous history of all readouts from either means.

15. In a system as set forth in claim 14, said teletypewriter having both upper case and lower case modes of operation, and the system having control means operative to permit the manual means to access the system only in the uppercase mode; and to access only the recorded-history apparatus in the lower case mode.

16. In a system as set forth in claim 11, said source means including both automatic means for reading out said message format and manual keyboard means for reading out said message format and manual keyboard means having the capability of reading out both display data and command signals, said manual means including command signal means for substituting it in place of the automatic means, means for changing the data displayed in a certain field of the display panels when the source means has been shifted to the manual means, comprising keyboard means for entering into the network data entry lines the address of the master station panel and the designations of the slave panel stations containing the data field to be changed and for actuating the means for searching the panels at these stations for panels storing the entered address and connecting these panels to the network; command means on the keyboard for stepping the field counters in the accessed panels to the field to be changed; keyboard command means for extinguishing the data appearing in that field; data entry means on the keyboard for entering the new data to appear in that field; and command means on the keyboard for disconnecting the changed panels from the network data entry lines and for returning the network to the control of the automatic means.

17. In a system as set forth in claim 11, at least some of the display digits being grouped together on the master panels to form fields representing function to be carried out at particular corresponding slave stations; means at the associated slave station panels to answer back and signal the status of their particular functions; means at the master panels to indicate the answering status relative to each such field; answer-back wiring in the network and connected continuously from all slave panels to all master panels, said wiring including master panel address wires and status report wires; means at each slave panel and operative when actuated to apply the address of an associated master panel and the status to be reported to said wires, said address means at each master panel including means responsive to decode its own address on said wires; and means to apply said status signal to the master panel's status indicator means.

18. In a system as set forth in claim 17, said answer-back wiring including wiring extending to all slave panels having answer-back capability; means at each such panel for signalling via this wiring whenever the local answer back means is activated; and means at each slave panel for preventing activation of the local answer-back means whenever another panel is signalling its own activation in this wiring.

19. In a system as set forth in claim 18, said answer-back means including means to signal completion of the function to be carried out at the slave panel; and the slave panel including means responsive to activating a completion signal to clear its display and address memory and to return it to unoccupied condition.

20. A display system for selectively displaying information at diverse mutually distant areas including means at a master area where orders for items are initiated joined by a trunkline network to means located at other areas which are storage areas each storing items of a type distinct from those stored in other areas, the display system comprising,

a. source means for applying to the network various orders each comprising a sequential program including display data and designations of certain storage areas to display such data and including control means to deliver system commands;

b. multiple master display panels included in said means at the master area to receive and display different ones of said orders, the panels including display fields for displaying identifications of the orders and further including fields associated with each of the storage areas, and each such field having digits for displaying the quantity of the item to be ordered from that storage area, and each master panel having encoded address means for uniquely identifying it among the other master panels;

c. multiple display panels at each storage area and having memory means for storing an encoded address, and having display fields for displaying order identifications and having fields including digits for displaying the ordered quantity of the item stored at that area;

d. means at each panel for indicating whether it is presently occupied by data or unoccupied;

e. routing means in the network for selectively coupling certain storage areas to the network in response to designation thereof by the source means to receive data;

f. means at the master area responsive to said control means to select an unoccupied master panel and connect it to the network to enter its address thereinto;

g. means at each designated storage area responsive to said source means to select an unoccupied local panel and connect it to the routing means to receive and enter in its memory means the address of the selected master panel; and

h. means in the source means for transferring data into the fields of the selected panels including said address, said data showing identification of the particular order and the ordered quantity of items stored at the associated storage areas.

21. In a system as set forth in claim 20, said panel selecting means in each area comprising step-by-step means responsive to a command from said control means to search through the panels available at the area for a panel whose indicating means shows it to be presently unoccupied; means in the control means to pause in its sequential program during the search; means operative to indicate the successful selection of a panel to the control means to terminate its pause.

22. In a system as set forth in claim 20, each order comprising a separate transaction program having an identifying order number displayed in associated panel fields as the order identification, and said control means including means for disconnecting the selected master and storage area panels from the source means at the end of the related program sequence and leaving these panels storing the applied data and the encoded address relating to that order number; and said control means including means for selecting unoccupied panels in response to a new sequential program representing a different transaction.

23. In a system as set forth in claim 20, said source means comprising means for reading out to date entry lines of said network sequential programs representing recorded display data interspersed with system command signals, and said source means including means to start and stop such readout; said master panel selecting means including means responsive to selection of an unoccupied master panel to start readout of data designating specific storage areas; means in said source means to stop the readout after each designation during selection of unoccupied storage area panels and thereafter to restart said readout until panels have been selected in all designated storage areas; and means for commencing readout of display data to the selected panels.

24. In a system as set forth in claim 20, said diverse areas also including assembly areas to which the ordered items are sent, said master panels and storage area panels including fields for entering designation of a particular assembly area to which the ordered items are to be sent; multiple display panels at each assembly area and having memory means for storing an encoded address and having fields for displaying identification of an order, and having fields corresponding with the storage areas and including digits for displaying the quantity of items to be sent from each storage area, and each assembly panel having means for indicating whether it is presently occupied by data or unoccupied, the assembly areas being connected to the routing means to be coupled to the network when selected by said source means; and means at each designated assembly area responsive to said source means to select an unoccupied assembly panel and connect it to the routing means to receive and enter in its memory means the address of the associated master panel and the quantities ordered from the selected storage areas.

25. In a system as set forth in claim 24, said diverse areas including substorage areas having subpanels connected in parallel with the storage area panels and repeating their displays, and said diverse areas including departure areas having subpanels connected in parallel with the assembly area panels and repeating their displays. —

26. In a system as set forth in claim 24, each sequential program comprising a separate transaction, and different ones of said panels storing data relating to different ones of said transactions and the master panels having selected storage and assembly area panels associated therewith and storing data ordering the supplying of items; each storage area panel having means for indicating that the items ordered are en route, and each assembly area panel having means for indicating that a transaction is completed; each master panel means having means referred to the individual fields associated with particular storage areas and assembly area for confirming that the items are en route and that the transaction is completed, said confirming means being responsive to said indicating means.

27. In a system as set forth in claim 26, the storage area panels and the assembly area panels having means for resetting them to unoccupied condition, and these resetting means being responsive to actuation of the local indicating means.

28. In a system as set forth in claim 24, said network including function-control signal lines and display data lines, and each area including interface means connecting said source means to said display data lines and to some of said control lines, and said routing means being coupled to said display data lines and to certain ones of said control lines; and means responsive to the selection of panels in designated areas and to signals on said control lines to transfer display data into the panels from the source means and then disconnect them from the routing means.

29. In a system as set forth in claim 28, said network including answer-back lines extending directly from the storage area panels and the assembly area panels to the master panels and including report data lines and address lines; status indicator means at the master panels and associated with particular display fields thereon; means at each storage area panel and at each assembly area panel for reporting back the status of the items ordered at those areas by a message applied to said report data lines and for applying to said address lines the address of the associated master panel; said address means in each master panel including means responsive to its own address on said address lines and operative to apply the accompanying message on the report data lines to its status indicator means; and means to exclude answer-back by other storage area and assembly area panels when another one thereof is applying data to the report-data lines.

30. In a system as set forth in claim 28, said source means reading out programs in serially encoded form to said interface means and said interface means converting the programs into command signals and into binary coded digital data; each area having switching means for selectively coupling said data into any of its selected panels when that area has been designated by a command signal and coupled by the routing means.

31. In a system as set forth in claim 24, said source means comprising means for reading out to data entry lines of the network and to display panels presently coupled to it binary information in a message format including plural message fields each having as least one digit, and the area panels including corresponding display fields and digits, said source means including preprogrammed data interspersed with command signals demarcating the various fields and digits; and each display panel having counter means responsive to said command signals to apply the display data to corresponding fields and digits of the various panels.

32. In a system as set forth in claim 31, the display panels at some of the storage and assembly areas having fields for displaying only some of the fields displayed at the master panels, and the field counter means at these storage and assembly areas including means for omitting the counts of fields which are not to be locally displayed.

33. In a system as set forth in claim 31, said source means including both automatic means for reading out said programmed data having said message format, and manual keyboard means having the capability of reading out both display data and command signals, said manual means having a command key for interrupting the automatic means to change over for manual entry; and the system including means responsive to the latter command key to prevent interruption of the automatic means until it reaches the end of a complete message field.

34. In a system as set forth in claim 33, said manual means comprising a teletypewriter wherein nonalphanumeric keys provide encoded command signals to the system including interruption of the automatic means to substitute manual means entry; and said system including apparatus coupled to both the automatic and the manual means and operative to record a continuous history of all readouts from either means.

35. In a system as set forth in claim 34, said teletypewriter having both uppercase and lowercase modes of operation, and the system having control means operative to permit the manual means to access the system only in the uppercase mode; and to access only the recorded-history apparatus in the lowercase mode.

36. In a system as set forth in claim 31, said source means including both automatic means for reading out said message format and manual keyboard means having the capability of reading out both display data and command signals, said manual means including command signal means for substituting it in place of the automatic means, means for changing the data displayed in a certain field of the display panels when the source means has been shifted to the manual means, comprising keyboard means for entering into the network data entry lines the address of the master panel, and the designations of the associated panels containing the data field to be changed and for actuating the routing means and the selecting means for selecting the panels to be corrected and connecting them to the network; keyboard command means for stepping the field counters in the connected panels to the field to be changed; keyboard command means for extinguishing the data appearing in that field; data entry means on the keyboard for entering the new data to appear in that field; and command means on the keyboard for disconnecting the changed panels from the date entry lines and for returning the network to the control of the automatic means.

37. In a system as set forth in claim 36, control means responsive to a command signal substituting the manual means for the automatic means to prevent interruption of the automatic means until it reaches the end of a complete message field.

38. In a system as set forth in claim 36, said manual means and said automatic means each delivering messages to the same network lines; and said system including apparatus coupled to these lines and operative to record a chronological history of the readouts from both said message delivering means.

39. In a system as set forth in claim 29, said display panels comprising fields of digits having illuminated alphanumeric visual displays, said status indicator means at the master panels comprising lights located adjacent to the fields relating to particular selected storage area panels and assembly area panels; and said means at said storage and assembly area panels for reporting-back comprising switches for illuminating corresponding lights at master panels responding to the address appearing on said address lines.

40. In a system as set forth in claim 39, said source means including means for applying to the network and connected panels a command signal to expedite the order; and said panels including expedite lights thereon responsive to said command signals.

41. In a system as set forth in claim 39, said reporting-back means including switch means respectively operative for extinguishing each storage area panel and assembly area panel when its function is completed and returning its indicating means to unoccupied condition.

42. In a system as set forth in claim 39, said source means including means for delivering a command signal to the network for extinguishing all panels then connected to it and returning their respective indicating means to unoccupied condition.

* * * * *