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Hillhouse et al.

[11] **3,739,339**

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[54] **WAREHOUSE INDICATOR SYSTEM**

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[52] **U.S. Cl.** ..... **340/147 A**, 186/1 B, 340/339

[51] **Int. Cl.** **G08b 5/36**, H04q 1/30

[58] **Field of Search** ..... 340/147 A, 152, 286; 235/61.6 C, 61.7 B; 186/1 R, 1 B, 1 D

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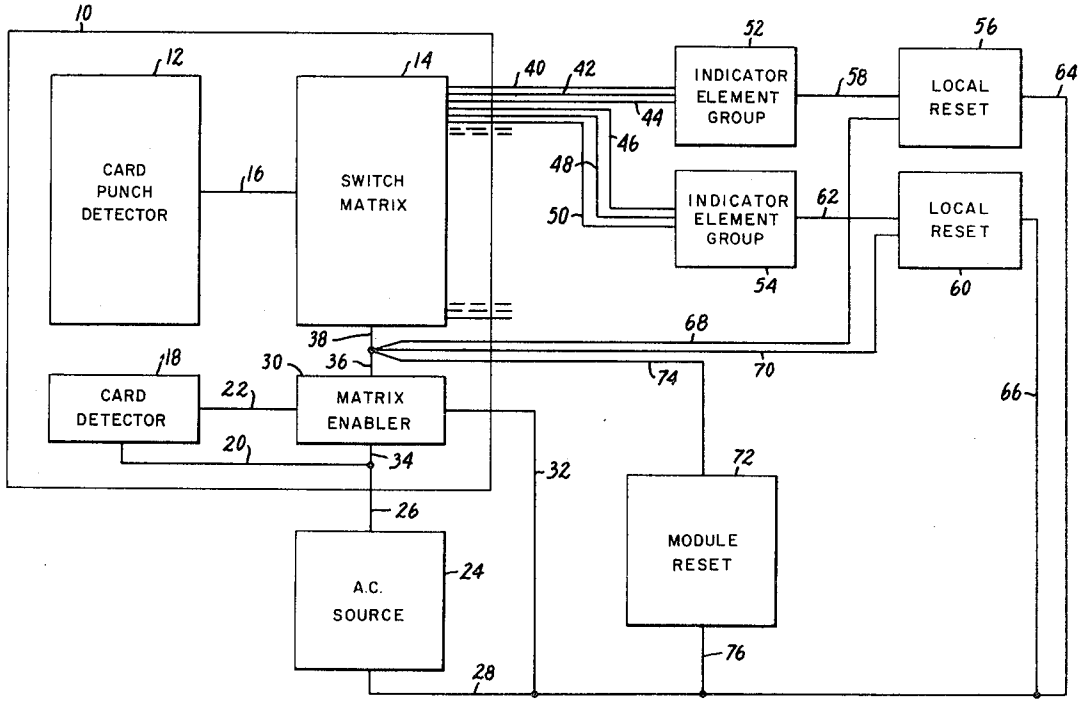
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[57] **ABSTRACT**

A system responsive to a punched card defining ordered items in ordered quantity is disclosed for providing quantity indication at warehouse locations containing the items. A group of indicator elements is disposed at each item location and, where the punched card defines ordered quantity by a binary number, each indicator group provides a binary indication of ordered quantity.

10 Claims, 4 Drawing Figures



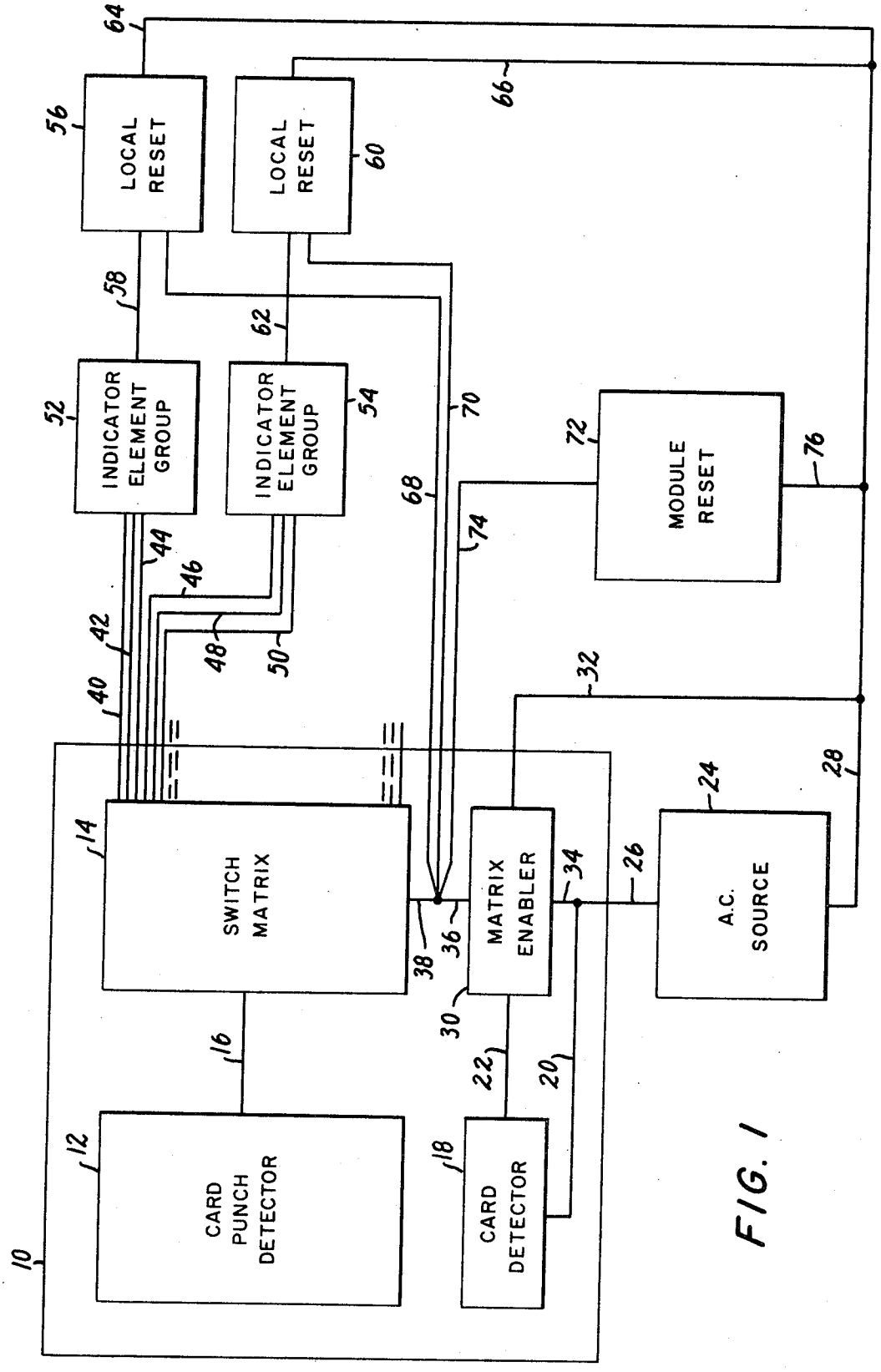

64
66
56
LOCAL RESET
60
LOCAL RESET
58
62
52
INDICATOR ELEMENT GROUP
54
INDICATOR ELEMENT GROUP
70
72
MODULE RESET
76
68
74
44
46
42
48
50
40
32
28
24
14
SWITCH MATRIX
MATRIX ENABLER
34
26
A.C. SOURCE
38
36
30
16
22
20
12
CARD PUNCH DETECTOR
18
CARD DETECTOR
10

FIG. 1

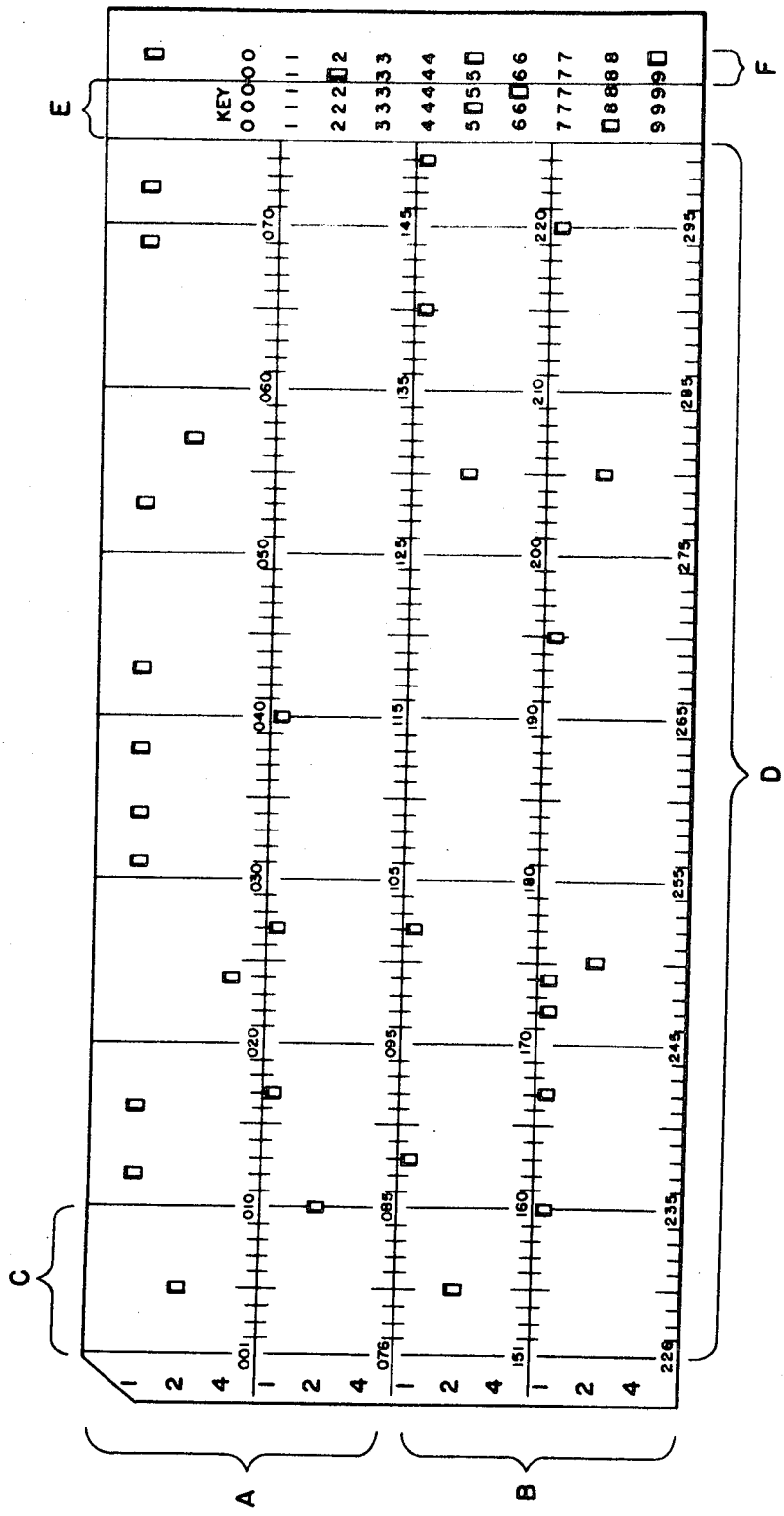

KEY
00000
11111
22222
33333
44444
55555
66666
77777
88888
99999
A
B
C
D
E
F

FIG. 2

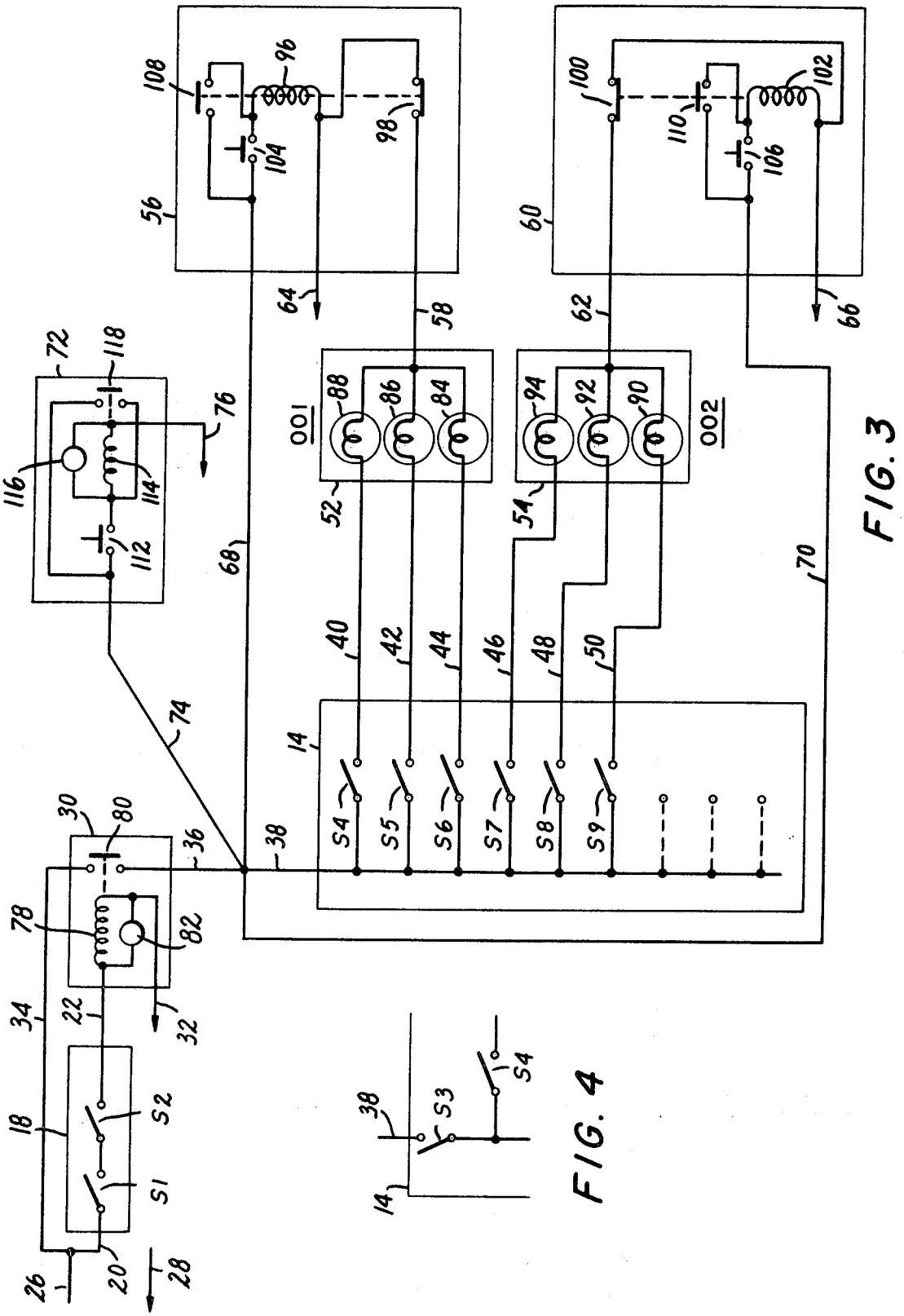


FIG. 3

FIG. 4

WAREHOUSE INDICATOR SYSTEM

FIELD OF THE INVENTION

This invention relates to indicating systems for facilitating the manual collection in a warehouse of selective items in ordered quantity and, more particularly, to systems of this type which are responsive to punched cards defining items in ordered quantity.

BACKGROUND OF THE INVENTION

The inefficiency generally involved in unaided manual collection of ordered items from storage locations in a warehouse has given rise to numerous efforts of introducing automation into warehousing operations. For various reasons, such efforts have apparently not met with widespread practical acceptance and present warehousing operations generally remain at a level of efficiency less than is desired. A primary reason for such non-acceptance of automation is the complexity of item dispensing and collection apparatus attributable in large part to the extensive versatility required thereof in handling items of vastly non-uniform physical dimensions. The purchase and maintenance costs and the space requirements of such apparatus also persuade against the automation of warehousing operations.

Apart from efforts at automation, various efforts have been directed to assisting the manual collection of items in the interests of improving efficiency in warehousing operations. These efforts, which typically require warehouse key-punching of orders and look toward the provision of visible indications of ordered items in a storage area or warehouse, have various operational shortcomings, e.g., requiring that the warehouse assistant determine ordered quantity by the flicker rate of a single indicator element, as in Chodziesner U.S. Pat. No. 2,570,918. Such efforts are evidently ineffective to elevate efficiency in warehousing operations to the desired level.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an improved system for assisting manual warehousing operations.

It is a more particular object of this invention to provide a system of the foregoing type which is operatively responsive to punched cards defining ordered items and ordered quantities thereof.

In the efficient attainment of the foregoing and other objects, the invention provides a system incorporating a punched card reader and indicator circuit means for selectively displaying information respecting ordered item quantities by use of a group of indicator elements disposed at the warehouse location of each orderable item. Means are included for selectively deenergizing all indicator elements at each location. The display of quantity information may be enhanced by the binary weighting of the indicator elements of each group in accordance with binary definition in the punched card.

The foregoing and other objects and features of the invention will be evident from the following detailed description of systems in accordance with the invention depicted in the drawings wherein like reference numerals are employed throughout for identification of like parts.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagrammatic illustration of a system in accordance with the invention.

FIG. 2 depicts a type of punched card adapted for processing by the system of the invention.

FIG. 3 is a schematic diagram of circuitry employable in the FIG. 1 system.

FIG. 4 illustrates further circuitry employable in the FIG. 1 system.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, unit 10 comprises a punched card reader, e.g., Model 2981A Card Reader, a commercially available unit produced by American Pamcor Inc. Typically, these units may be considered as including a card punch detector 12 and a switch matrix 14 incorporating a plurality of switches arranged in spatial correlation with the columns and rows of the punched card. For example, where a punched card includes p equals 80 columns and q equals 12 rows, matrix 14 includes 960 switches arranged individually at the intersections of the 80 card columns and the 12 card rows. As indicated by reference numeral 16, matrix 14 is operated by detector 12 such that the matrix switches are selectively closed in accordance with punches present in the card. Generally, the detector includes a matrix switch operator, comprising a plurality of pins, which is applied to the card in residence in the reader. Where a card punch coincides spatially with a pin, the pin extends through the card and operates the switch therebelow.

A further element incorporated in unit 10 is card detector 18, adapted to provide indication that a card is in residence in unit 10 and that a reading of the information content thereof is desired. In providing such indication, detector 18 typically provides continuity between input line 20 and output line 22 thereof.

A source of current, e.g., A.C. source 24, having first and second terminals, respectively connected to supply line 26 and return line 28, provides the FIG. 1 system with operating power. Matrix enabler 30 is connected to line 22 and is further connected by line 32 to return line 28. Where detector 18 provides continuity between lines 20 and 22, enabler 30 is connected across the terminals of supply 24 and thereupon provides continuity between enabler lines 34 and 36, thereby connecting supply line 26 to switch matrix line 38. On this occurrence, first terminals of all switches in matrix 14 are connected to supply line 26 and, in accordance with selective operation of matrix 14 switches by detector 12, certain switch second terminals are connected to supply line 26 as are the output lines of matrix 14 connected to such operated switches. For brevity, in explaining the FIG. 1 system, a limited number of output lines of switch matrix 14 are considered, e.g., lines 40–50.

The output lines of matrix 14 are connected in selective groupings of m each to distinct indicator element groups. As illustrated, m is equal to three and a first indicator element group 52 is connected to matrix output lines 40, 42 and 44 and a second indicator element group 54 is connected to matrix output lines 46, 48 and 50. Each indicator element group includes m individual indicator elements and a first terminal of each indicator element thereof is connected to supply line 26 where

the matrix output line connected thereto is connected to a matrix switch operated by detector **12.** All second terminals of the indicator elements are connected, through means discussed below, to return line **28** and indicator elements are thus selectively energized in the card reading operation.

Each indicator element group is disposed in a warehouse storage location adjacent a single stored item and the *m* indicator elements at such location have the capability of indicating a maximum of 2^m characteristics of such item. Where *m* is 3, as preferred, each indicator element group may indicate 2^3 or eight quantities, i.e., zero through seven. At each such item storage location manual input means are provided for selectively resetting, i.e., deenergizing, the indicator element group at such location in response to input thereto by a warehouse assistant. For this purpose, local reset **56** is connected by line **58** to indicator group **52** and local reset **60** is connected by line **62** to indicator group **54.** Local resets **56** and **60** are connected, by lines **64** and **66** respectively, to supply return line **28.** Local resets **56** and **60** are also connected, by lines **68** and **70** respectively, to matrix enabler line **36** and thus derive operating power for performing their indicator element group reset functions.

In a particularly convenient warehouse arrangement for use with the invention, a plurality of such warehouse locations are disposed in succession adjacent a conveyor to provide a warehouse module. The number of individual items in such module is preselected to be definable by one card such that a single card reader **10** may be associated with the module and such that permanent connections may be provided for such module card reader, the module indicator element groups and the module local resets.

In collecting ordered items from such module, the warehouse assistant inserts the punched order card in the module card reader, operates the same, and selects items from the individual item storage locations of the module in accordance with binary indications of quantity provided by the module indicator element groups. On his reading of the binary number represented by each indicator group and his placing the equivalent decimal number of the ordered item on the conveyor, he operates the local reset associated with that indicator element group, thereby extinguishing the indicator elements thereof. The assistant proceeds in this manner throughout the extent of the module and may then, if desired, operate module reset **72.** This unit is connected by line **74** to module enabler line **36** and is connected by line **76** to return line **28.** On manual input to module reset **70** by the assistant, this unit provides indication that the module is inactive.

FIG. **2** illustrates a preferred form of punched card whose information contents are to be indicated by the system of the invention. The card includes *p* equals 80 vertical columns and *q* equals 12 horizontal rows. In providing information in respect of items numbering in excess of *p*, the card is divided into an upper field A and a lower field B and each such field is subdivided into two sections. Each card section per column embraces *m* or three horizontal rows for providing characteristic information respecting the item defined therein up to 2^m units, or eight (2^3) units, where *m* is three. As above discussed, where the item characteristic is quantity, zero through seven units may be defined. In this arrangement, the card may evidently identify (*p*) times (*q*/*m*) items.

In portion C of the FIG. **2** card a single punch is shown as residing in the uppermost section of field A. This punch is indicative of an order for warehoused item 005, the order quantity being two (2^1) units. As shown, a typical card may contain numerous such punches and, in instances where no punch is entered, e.g., for columns 001–004 and 006–010, no order is placed for the warehoused items defined thereby. A predetermined discipline is employed as between the card locations indicating particular warehoused items and the warehouse locations containing the same. Accordingly, when the card is in its readable position, i.e., is resident, in card reader **10,** the card warehoused item 005 is disposed intermediate punch detector **12** and the *m* matrix **14** switches which are connected with the indicator group positioned at the warehouse location for item 005. In the preferred arrangement of the card, the first 75 card columns, indicated as D, are employed to provide selective punch card locations for 300 warehoused items. The next three card columns, identified as E, are employed to provide decimal indication of the retail store placing the order, i.e., store No. 856 as shown. The last two card columns, indicated as F, are employed for providing auxiliary information and specifically, in the case of field A of the last card column, for module identification. Evidently, those matrix **14** switches associated with the reading of punches in the last five columns, except for the module identification punch, are not used in this instance.

The card of FIG. **2** may of course be prepared by keypunching undertaken at the warehouse and based on written orders physically received from retail establishments. Preferably, the card is prepared by a warehouse card punch machine which receives telephone-line transmitted digital signals indicative of ordered items and ordered quantities thereof. A digital signal transmission system for this purpose is described in copending application Ser. No. 183,183, entitled "Data Transmission System," filed concurrently herewith.

Preferred circuitry for use in the FIG. **1** system is shown in FIG. **3.** Card detector **18** may comprise a series circuit of two switches, **S1** and **S2. S1** is a limit switch which is closed when a punched card is in residence in card reader **10. S2** is closed upon operation of the card reader handle by the warehouse assistant.

Upon closure of **S1** and **S2,** card detector output line **22** is connected to input line **20** thereof. Thereupon, relay **78** of matrix enabler **30** is energized, and relay contact arm **80** provides continuity between matrix enabler lines **34** and **36.** Lamp **82** is energized at this time, indicating that card reading is in progress. Line **38** of matrix **14** is connected to supply line **26** through lines **34** and **36** and thereby all first terminals of the individual switches of matrix **14** are connected to supply line **26.** Upon the selective closure of ones of switches **S4–S9** of the matrix, those of lines **40–50** which are connected to the closed matrix switches will be connected to supply line **26.** Selective ones of indicator elements **84–94,** whose first terminals are connected through lines **40–50** to supply line **26,** will accordingly be energized. As shown, the indicator elements are lamps whose filament ends provide indicator element terminals. Such energization occurs for the indicator elements of indicator group **52** since output line **58** thereof, connected in common to the second terminals

of indicator elements **84, 86** and **88,** is connected to output line **54** of local reset **56** through the normally closed contacts of relay **96** and hence to return line **28,** i.e., contact arm **98** connects line **58** to line **64** and line **64** is connected to return line **28.** In similar manner, line **62** of indicator group **54** is connected through contact arm **100** of relay **102** to line **66** and hence to return line **28.** At this time, input line **68** of local reset **56** is connected to supply line **26.** However, since push-button **104** is unoperated, relay **96** is not energized. Similarly, for local reset **60,** input line **70** thereof is connected to supply line **26** but relay **102** is unenergized, push-button **106** being unoperated.

By way of example of the operation of the FIG. **3** circuitry, let us assume that switches **S5, S6, S7** and **S9** are closed by card punch detector **12.** Lamps **84, 86** and **88** are assigned the binary weights 2^0, 2^1 and 2^2, respectively, as are lamps **90, 92** and **94,** respectively. Lamps **84** and **86** of indicator element group **52** are energized and lamp **88** remains unenergized. Thus, at location 001 in the storage area, a binary three is indicated, i.e., lamp **84** (2^0) calling for one unit of item 001 and lamp **86** (2^1) calling for two additional units of item 001. At location 002, lamps **90** and **94** are energized and lamp **92** is unenergized, providing an indication of binary five, i.e., lamp **90** (2^0) calling for one unit of item 002 and lamp **94** (2^2) calling for four units of item 002.

The warehouse assistant notes the binary display provided by indicator element group **52** and removes three units of item 001 from the storage location therefor and places them on the conveyor. He then operates push-button **104.** Relay **96** is thereby energized and remains energized after operation of the push-button, being self-latched by contact arm **108.** Upon the energization of relay **96,** continuity between lines **58** and **64** is interrupted by displacement of contact arm **98** and lamps **84** and **86** are deenergized. The warehouse assistant proceeds to place five units of item 002 on the conveyor and thereafter operates push-button **106.** Relay **102** is thereby energized and self-latched by contact arm **110.** Contact arm **100** is displaced, interrupting continuity between lines **62** and **66** and lamps **90** and **94** are deenergized.

The operations described in connection with indicator groups **52** and **54** are repeated for all remaining indicator element groups in the module. Thereafter, the assistant may operate push-button **112** and thereby energize relay **114** and module inactive indicator element **116.** Relay **114** is self-latched by contact arm **118.**

Upon removal of the order card from the card reader, **S1** and **S2** are opened, thereby deenergizing matrix enabler relay **78,** module reset relay **114** and each of the local reset relays, e.g., relays **96** and **102.** At this point the system of FIG. **3** is entirely reset and is prepared for the processing of a further punched card.

Where the number of warehoused items exceeds the number of items which are definable by a single punched card, and hence is not assignable to locations in a single warehouse module, multiple modules are evidently required. In this instance, each module incorporates a system in accordance with FIG. **1,** and provision may be made for insuring that a punched card intended to define items in one module is not processed by the card reader of another module. FIG. **4** illustrates circuitry for appropriate modification of the FIG. **3** circuitry for this purpose.

Referring to FIG. **4,** a matrix **14** switch, **S3,** is connected in a series circuit with line **38** and each of the remaining matrix switches of FIG. **3,** e.g., **S4.** The matrix cannot operate to energize the indicator elements unless **S3** is closed. By reason of its position relative to punched cards inserted in reader **10, S3** is closed exclusively where such inserted card contains a punch in registry with **S3,** preferably a punch in a preselected row of the uppermost section of the last column of the card (FIG. **2**). An effective interlock between the card reader and cards intended to be read thereby is thus provided by **S3.** Three such interlocks may evidently be provided by single punches entered in different rows of the uppermost section of the last card column. Seven interlocks may be readily provided by the use of three matrix switches in place of one **S3.**

Various modifications to the foregoing particularly described systems of the invention will be evident to those skilled in the art. For example, the punched card may be subdivided into six sections per column, i.e., m may be two. In this instance, each indicator element group includes two indicator elements for providing quantity indication of from zero to three units. The extending pin card punch detector may of course be replaced by photoelectric or like means. Accordingly, the particularly described system are intended in a descriptive and not in a limiting sense. The true spirit and scope of the invention will be evident from the following claims.

What is claimed is:

1. A system for use in providing indications, at item storage locations in a warehouse, of ordered items and ordered quantity thereof in unit or greater quantity, each said item being identified in a selective location of a punched card, said ordered quantity thereof being defined by the punches in said punched card location, said system comprising:

a. a punched card reader having a plurality of output lines and selectively energizing said output lines in accordance with said card punches;

b. a plurality of indicator elements, each indicator element being connected to a distinct one of said card reader output lines and being energized on the energization of said one output line, a group of said indicator elements being disposed at each said storage location for providing indication of said ordered quantity for a one of said ordered items in said unit or greater quantity; and

c. a plurality of circuit means, each circuit means being connected to a one of said indicator element groups and operatively responsive to manual input to deenergize the energized indicator elements in said one group.

2. The system claimed in claim **1** wherein said card punches provide binary definition of said ordered quantities and wherein each said indicator group provides binary indication of the ordered quantity of the item contained in the storage location at which said indicator group is disposed.

3. The system claimed in claim **2** wherein said card punches are contained in p columns and q rows of said card, each column defining q/m different orderable items in quantity ranging from zero to 2^m-1, m being a number greater than unity, each said indicator element group including m indicator elements.

4. A system for use in providing indications, at item storage locations in a warehouse, of ordered items and

ordered quantity thereof in unit or greater quantity defined in p columns and q rows of a punched card, each ordered item being identified in a predetermined q/m rows of one of said columns, m being a number greater than unity, said ordered quantity thereof being defined by the punches in said predetermined column rows, said system comprising:

a. a plurality of p times q switches;

b. first means selectively operating said switches in accordance with said card punches;

c. a plurality of p times q indicator elements, each indicator element being connected to a distinct one of said switches and energized upon operation thereof by said first means, a different group of m of said indicator elements being disposed at each said item storage location for providing indication of said ordered quantity for a one of said ordered items in said unit or greater quantity; and

d. a plurality of second means, each second means being connected to a one of said indicator element groups and operatively responsive to manual input to deenergize the energized indicator elements in said one group.

5. The system claimed in claim **4** wherein said card punches provide binary definition of said ordered quantities and wherein each said indicator group provides binary indication of the ordered quantity of the item contained in the storage location at which said indicator group is disposed.

6. The system claimed in claim **4** wherein each of said switches includes first and second terminals interconnected on operation of said switch, each said switch second terminal being connected to a one of said indicator elements.

7. The system claimed in claim **6** further including a source of current having first and second terminals, third means connecting each of said second means to said source second terminal and fourth means connecting all of said switch first terminals to said source first terminal, said fourth means including first normally-open switch means connected in series circuit with said switch first terminals and said source first terminal.

8. The system claimed in claim **7** wherein said first means comprises a card punch detector operative to close said first switch means on the residence of a punched card in said detector.

9. The system claimed in claim **8** wherein said groups of indicator elements are disposed at the storage locations of a predetermined group of items, said fourth means including second normally open switch means connected in series circuit with said first switch means, said first means closing said second switch means exclusively where said punched card includes a punch indicating that all ordered items defined by said card are items within said predetermined group of items.

10. An indicator system comprising:

a. a plurality of p times q switches, each switch having first and second terminals interconnected on operation of said switch;

b. first means selectively operating said switches in accordance with punches contained in p columns and q rows of a punched card, each item to be indicated being identified in a predetermined q/m rows of one of said columns, m being a number greater than unity, the quantity of said item to be indicated being defined by the punches in said predetermined column rows;

c. a plurality of p times q indicator elements, each indicator element having first and second terminals;

d. a current source having first and second terminals;

e. first circuit means connecting said switch first terminals to said source first terminal;

f. second circuit means connecting each said indicator element first terminal to a distinct one of said switch second terminals; and

g. a plurality of third circuit means each connecting a distinct q/m of said indicator element second terminals to said source second terminal for providing indication of unit or greater item quantity, each said third circuit means being operatively responsive to a manual input to disconnect said distinct q/m indicator element second terminals from said source second terminal.

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