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Weichselbaum et al.

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[45] **Nov. 12, 1974**

[54] **IDENTIFICATION SYSTEM**

[75] Inventors: **Theodore E. Weichselbaum,** St. Louis; **Jack L. Wilhelmson,** Fenton, both of Mo.

[73] Assignee: **Sherwood Medical Industries Inc.,** St. Louis, Mo.

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[21] Appl. No.: **287,925**

Related U.S. Application Data

[62] Division of Ser. No. 94,452, Dec. 2, 1970.

[52] **U.S. Cl.** .... **235/61.7 R,** 235/61.11 D

[51] **Int. Cl.** **G06k 5/00,** G06k 7/08

[58] **Field of Search** .... 235/61.11 D, 61.12 M, 235/61.7 B, 61.7 R, 61.11 A, 61.11 C; 340/149 A

[56] **References Cited**

UNITED STATES PATENTS

2,939,110	5/1960	Beattie et al.	340/149 A
3,009,636	11/1961	Rumble	340/149 A
3,481,195	12/1969	Hendrickson et al.	235/61.7 B
3,513,441	5/1970	Schwend	235/61.7 B
3,593,291	7/1971	Carter	235/61.7 B
3,671,717	6/1972	Bieser	235/61.7 B
3,673,389	6/1972	Kapsambelis et al.	235/61.7 B

OTHER PUBLICATIONS

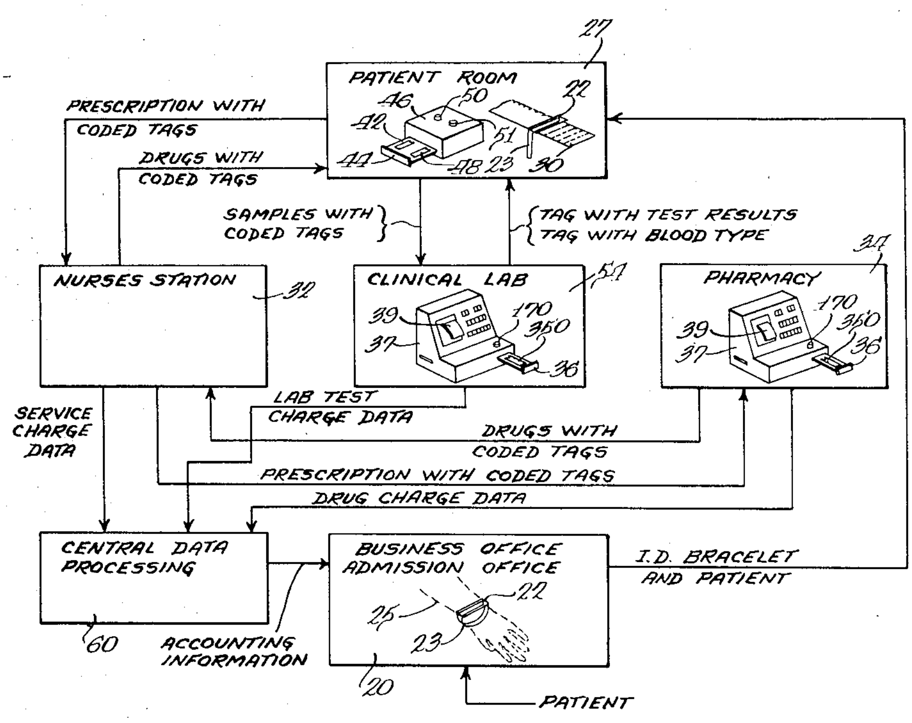
Kuntzleman et al., Automated Blood Typing, IBM Technical Bulletin, Vol. 10, No. 10, Mar. 1968, pp. 1,450–1,451.

Primary Examiner—Daryl W. Cook
Attorney, Agent, or Firm—Stanley N. Garber; William R. O'Meara

[57] **ABSTRACT**

An identification bracelet attached to the arm of each patient entering a hospital dispenses a plurality of magnetically coded tags having an adhesive backing for attachment to samples, prescriptions and the like to uniquely identify the source individual. Tag readers located throughout the hospital decode the magnetic tags in order to correlate an analysis with the proper patient. In the patient's room, a portable battery operated cross-check reader compares a magnetically coded treatment tag with an identification tag from the patient's bracelet to prevent a treatment from being given to the wrong patient.

2 Claims, 11 Drawing Figures



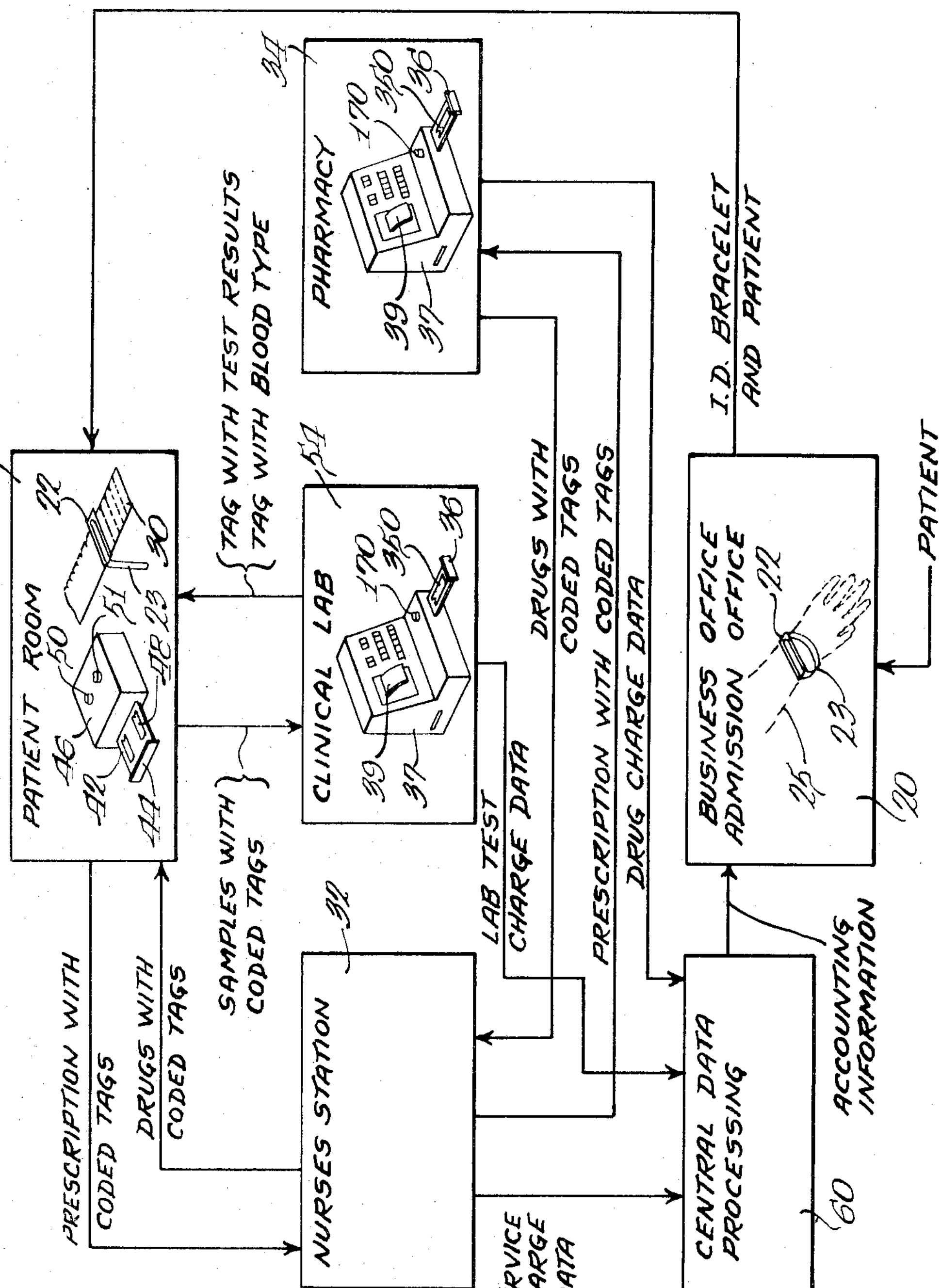

PATIENT ROOM
CLINICAL LAB
PHARMACY
NURSES STATION
CENTRAL DATA PROCESSING
BUSINESS OFFICE ADMISSION OFFICE
PATIENT
I.D. BRACELET AND PATIENT
TAG WITH TEST RESULTS
TAG WITH BLOOD TYPE
SAMPLES WITH CODED TAGS
PRESCRIPTION WITH CODED TAGS
DRUGS WITH CODED TAGS
LAB TEST CHARGE DATA
DRUG CHARGE DATA
SERVICE CHARGE DATA
ACCOUNTING INFORMATION

Fig. 1.

Fig. 2.

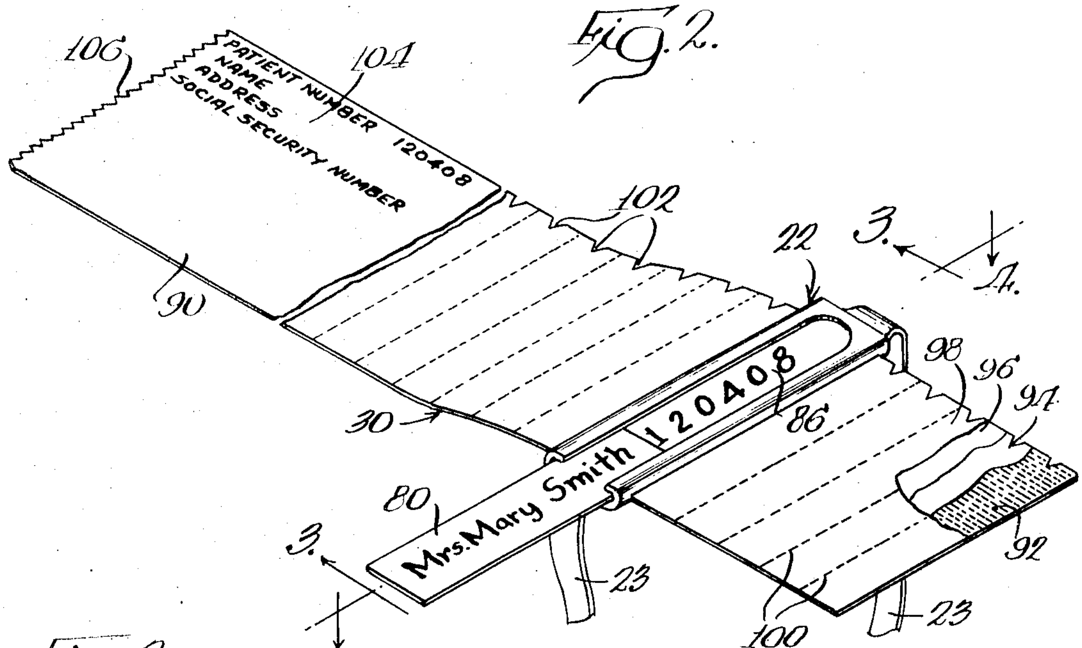


Fig. 3.

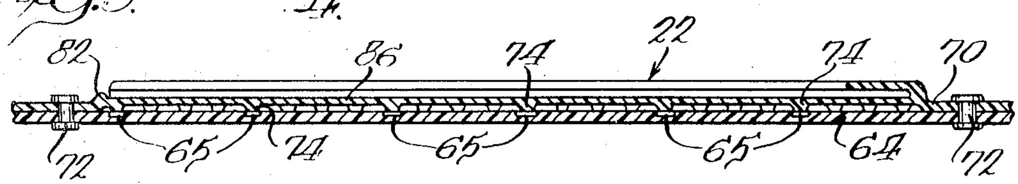


Fig. 4.

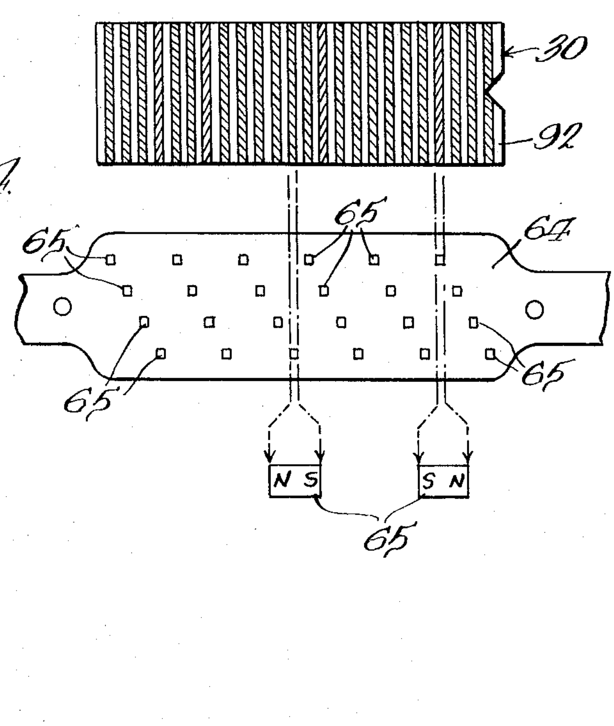


Fig. 5.

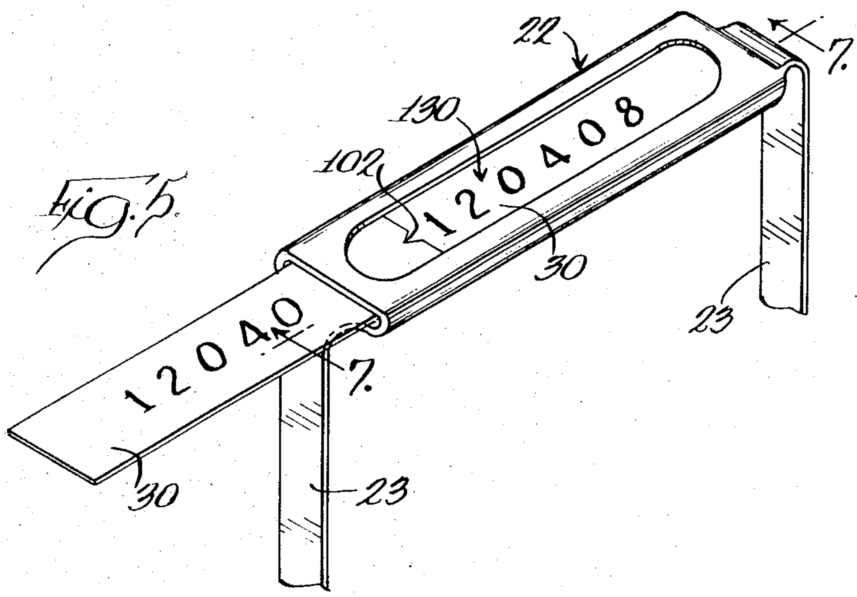


Fig. 6.

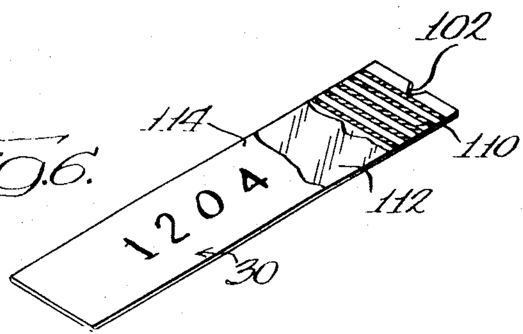
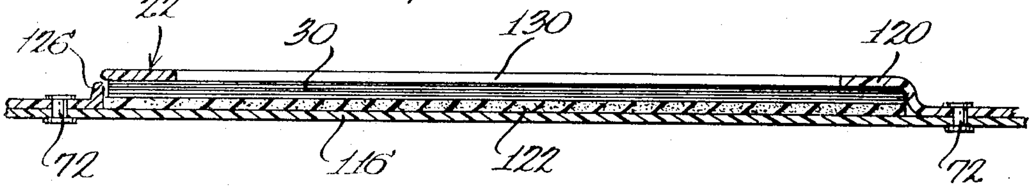


Fig. 7.



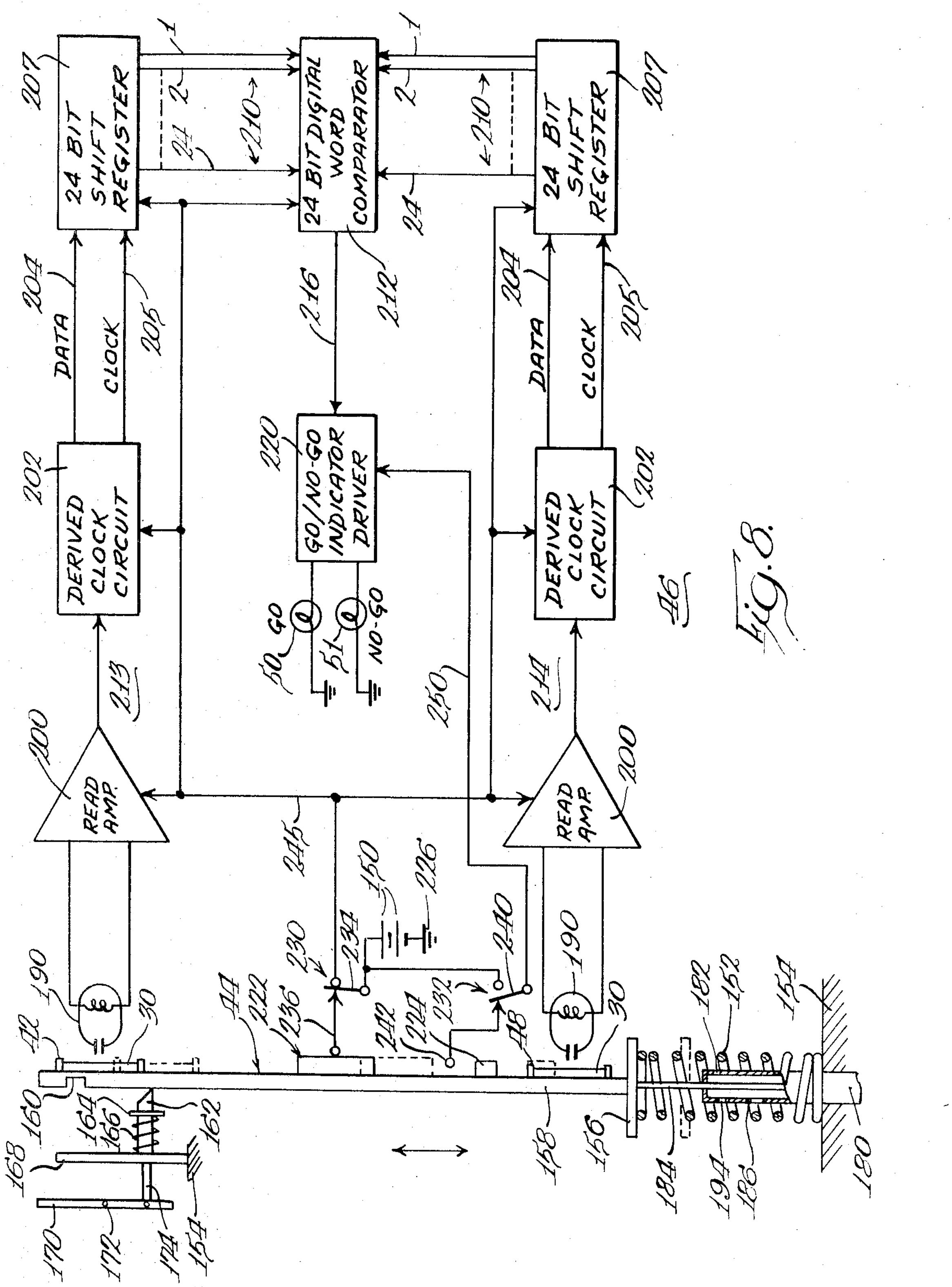

24 BIT SHIFT REGISTER
24 BIT DIGITAL WORD COMPARATOR
24 BIT SHIFT REGISTER
DATA
CLOCK
DERIVED CLOCK CIRCUIT
GO/NO-GO INDICATOR DRIVER
DERIVED CLOCK CIRCUIT
READ AMP.
READ AMP.
GO
NO-GO

Fig. 8

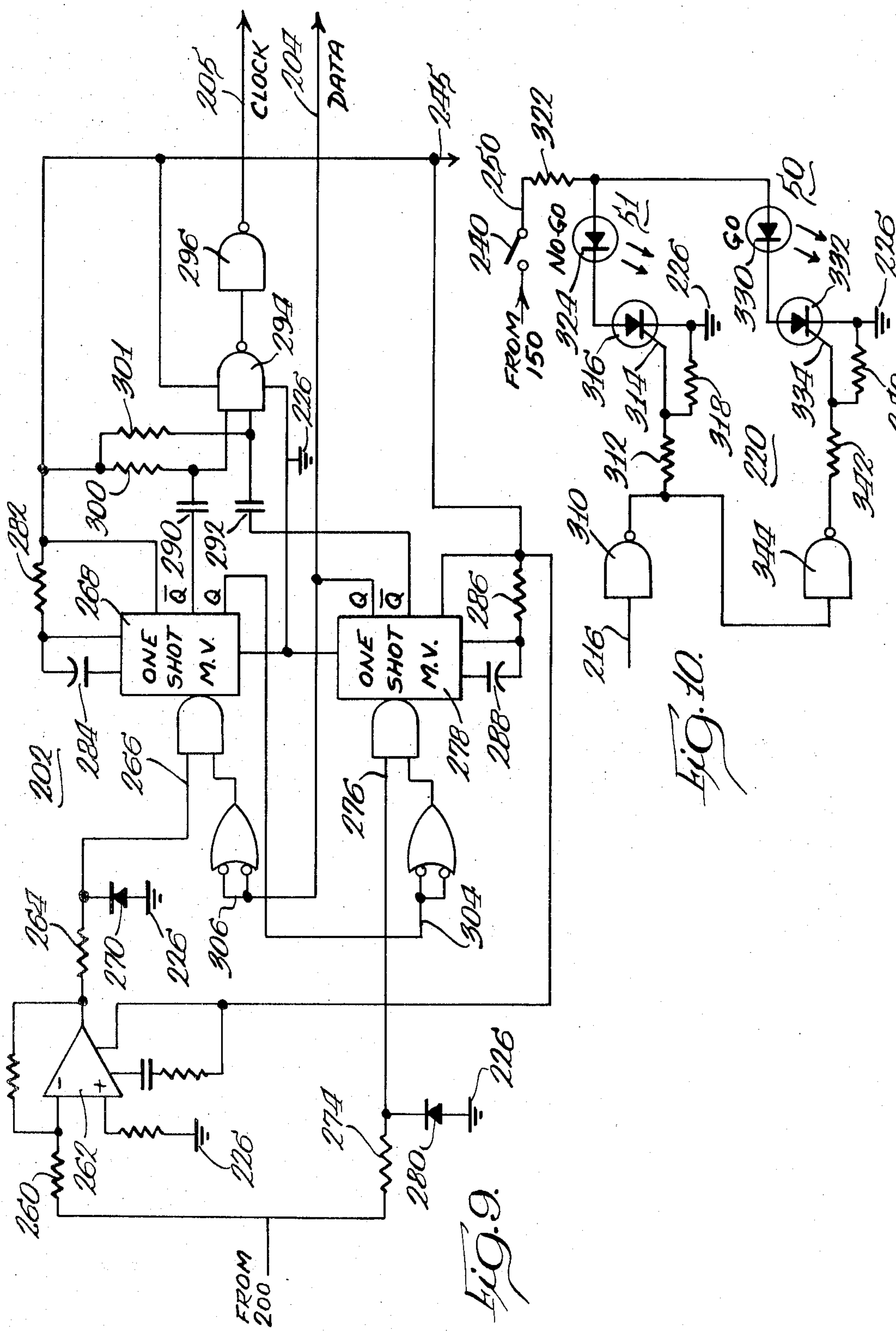


Fig. 9.

Fig. 10.

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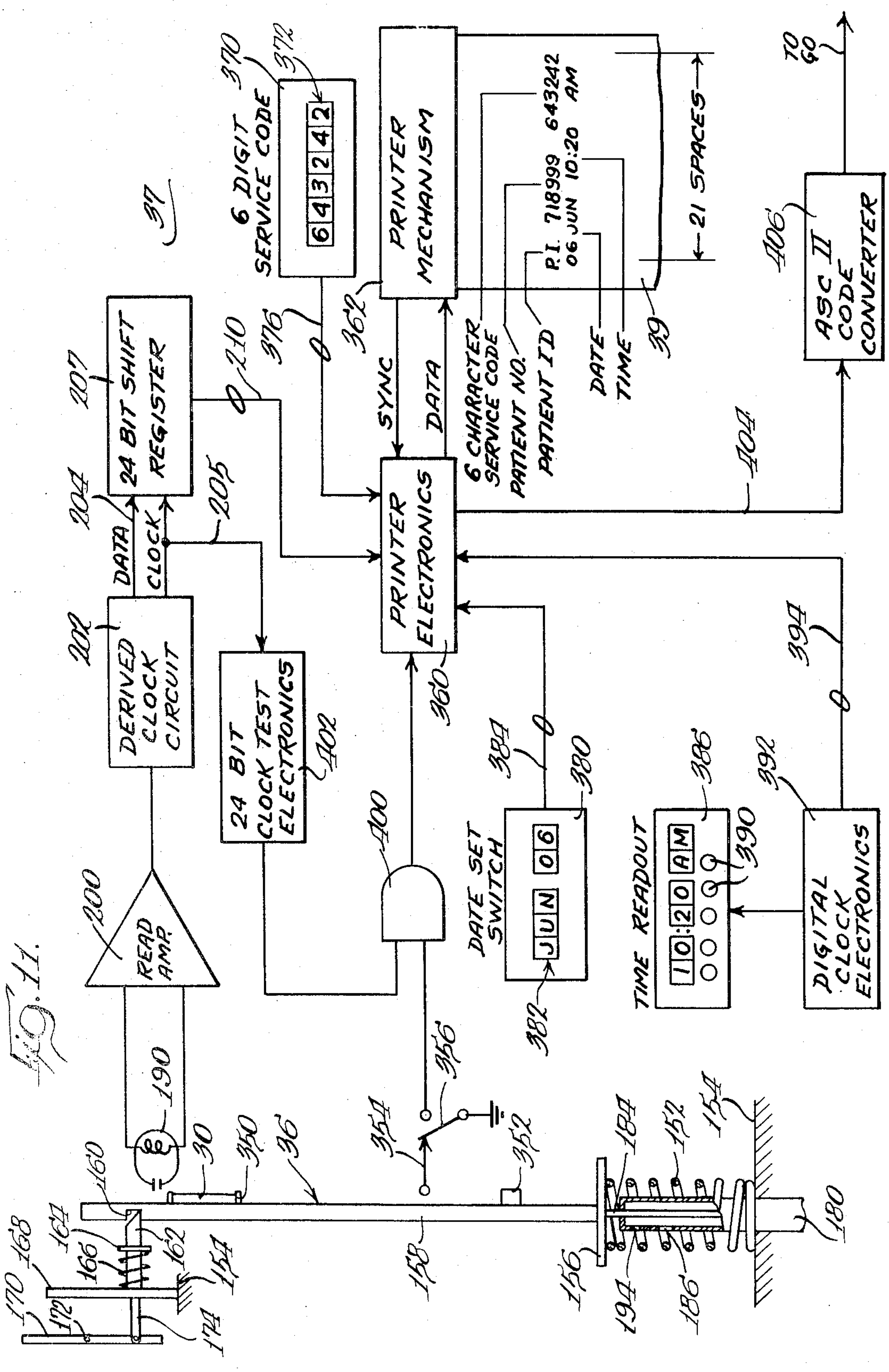

Fig. 11.

IDENTIFICATION SYSTEM

This is a division, of application Ser. No. 94,452, filed Dec. 2, 1970.

This invention relates to an improved identification system particularly adapted for preventing errors in identification of individual patients in medical centers treating a large number of patients.

In most hospitals and clinical laboratories, a bracelet containing a patient identification number is permanently affixed around the arm of an incoming patient in order to identify the patient during his entire stay. Upon discharge, the bracelet is removed by severing flexible straps which affix the bracelet to the patient's arm. Despite this numerous situations arise which result in errors in patient identification. When a sample is taken from a patient, the sample must be identified by the the identification (ID) number on the patient's bracelet. In transferring the patient's ID number, a nurse or a technician may miscopy the number, or may relay on memory or a different data source rather than actually reading the patient's bracelet. In an attempt to overcome this problem, it has been proposed to attach a notched token to the patient's arm, which can be read by an electromechanical reader in order to control a punch which reproduces the notched identification scheme in a card attached to a sample. Such a system is extremely costly, and not readily adapted for use in many practical situations which occur in a medical center.

An even more serious problem previously unresolved, occurs when an individual patient is to receive a treatment. Many prescription drugs and injections are identified merely by slips of paper on which the pateint's name and ID number has been handwritten by a nurse or technician who is to administer the treatment. For a variety of reasons, such as the transfer of patients to different beds, and errors in marking the slip of paper, the wrong patient may be given a treatment. While apparatus has been proposed for correlating the results of a sample analysis with the source sample such as a blood supply container, it has not previously been suggested that such a correlation could be applied to a patient about to receive a treatment. Furthermore, the equipment used in correlating a sample analysis with a container is not readily adapted nor practical for the latter purpose.

In accordance with the present invention, an improved and unique identification system is disclosed which both initially identifies the patient, and subsequently provides a crosscheck that a particular patient is to receive a particular treatment. A patient identification bracelet of simple design is disclosed which can dispense a plurality of magnetically coded tags for attachment to samples, prescriptions and the like, to properly identify the source individual. When a patient is to receive a treatment, one tag from his bracelet is placed in a portable cross-check reader which also receives a similar tag identifying the treatment and the patient to whom the treatment is to be administered. Only when the tags are identical is a nurse or technician authorized to administer the treatment.

One object of the invention is the provision of a patient identification system in which an ID bracelet attached to a patient dispenses a plurality of magnetically coded tages which identify the patient.

Another object of this invention is the provision of a patient identification system in which a cross-check reader compares treatment identification data with patient identification data taken from the patient immediately before administration of a treatment in order to authorize the administration of the treatment.

Further advantages and features of the invention will be apparent from the following description, and from the drawings, in which:

FIG. **1** is a block diagram illustrating the identification system used in a medical center such as a hospital;

FIG. **2** is a perspective view of one embodiment of an identification braclet for dispensing a plurality of magnetically coded identificaion tags;

FIG. **3** is a cross-section of the identification bracelet, taken along lines **3—3** of FIG. **2**;

FIG. **4** is a plan view illustrating the magnetic orientation of a tag produced by the identification bracelet, and taken along lines **4—4** of FIG. **2**;

FIG. **5** is a perspective view of another embodiment of an identification bracelet for dispensing a plurality of magnetically coded identification tags;

FIG. **6** is a perspective view, partly in section, of one tag from the bracelet of FIG. **5**;

FIG. **7** is a cross-section of the identification bracelet, taken along lines **7—7** of FIG. **5**;

FIG. **8** is a diagrammatic illustration of the cross-check reader illustrated in perspective view in FIG. **1**;

FIG. **9** is a schematic diagram of the derived clock circuit used in both the cross-check reader of FIG. **8** and the tag reader of FIG. **11**;

FIG. **10** is a schematic diagram of the indicator driver used in the cross-check reader of FIG. **8**; and

FIG. **11** is a diagrammatic illustration of the tag reader illustrated in perspective view in FIG. **1.**

While illustrative embodiments of the invention are shown in the drawings and will be described in detail herein, the invention is susceptible of embodiment in many different forms and it should be understood that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiments illustrated. Throughout the specification, values and type designations will be given for certain of the components in order to disclose a complete, operative embodiment of the invention. However, it should be understood that such values and type designations are merely representative and are not critical unless specifically so stated.

Turning to FIG. **1**, an identification system is illustrated for use in a hospital or other medical treatment center. A patient is first admitted in a business and admission office **20**, where he or she receives an identification bracelet **22** constructed in accordance with the present invention. The bracelet **22** has a conventional strap **23** which is affixed around the arm **25** of the patient in order to retain the bracelet during the patient's entire stay in the hospital. The patient, wearing the attached bracelet, is then transferred to one of a large number of patient rooms **27** for diagnosis and/or treatment.

In accordance with the present invention, any media concerning the patient, including prescriptions, samples of the patient's fluids, and the like are identified by magnetically coded carriers or tags **30** which are dispensed by the bracelet 22. For example, one magnetically coded tag 30 is attached to a prescription before it is transmitted via a nurse's station 32 to a pharmacy 34 where the prescription is to be filled. The tag 30 accompanying the prescription is placed in a receptacle in a tray 36 of a tag reader 37, and the tray 36 is manually closed. A lever is then moved which actuates circuitry, to be described, which decodes the magnetic information on the tag 30 and produces decoded output indications, including a print-out on a paper strip or web 39.

After the prescription is filled, a tag similar to tag 30 is attached to the prescription drug bottle or container before being transmitted to the nurse's station 32. The tag accompanying the treatment includes markings or handwriting which is read by a nurse in order to provide an initial determination of the patient who is to receive the treatment. The prescription drug is taken by the nurse to the patient's room 27 containing the patient who is to receive the treatment. The tag accompanying the prescription drug is then placed in a receptacle 42 in a sliding tray 44 of a cross-check reader 46. At this time, a new tag 30 is dispensed from the bracelet 22 and placed in another receptacle 48 in the tray 44. The tray is then manually closed and a lever is moved to activate the cross-check reader 46. If the magnetically coded tag accompanying the drug matches the magnetically coded tag from the pateint's bracelet 22, a GO indicator 50 is energized. This authorizes the nurse to apply the treatment to the patient. If a NO GO indicator 51 should be energized, an error is indicated, and the nurse is not authorized to administer the treatment. The cause of the error can then be traced and corrected.

In a clinical laboratory 54 which analyzes samples from patients, another tag reader 37 is located in order to decode coded tags 30 accompanying samples. After analysis, the test results, blood type, or the like, are identified by a tag similar to that provided by the pharmacy 34. Certain data may be transmitted to the patient's room 27, and in such instances, the identification tag accompanying the analysis is compared with a tag 30 taken from the bracelet 22 before posting or otherwise entering the data on a patient's record. If desired, the nurse's station 32, or other stations in the hospital, can also be provided with tag readers 37.

The information from the magnetically coded tags 30 is also used to supplement information which is transmitted to a central data processing station 60 which provides accounting information for the business office 20. Each tag reader 37 includes keys for manually entering data concerning the operation being performed, as analysis, drug perscription and the like, which information is automatically printed on paper strips 39 along with the patient's number from a tag being decoded. At the same time, the decoded ID number and the manually entered information produces computer coded data which is transmitted to the center data processing station 60 in order to update the patient's personal record and his billing record.

In FIGS. 2–4, one embodiment of the patient bracelet 22 is illustrated in detail. Bracelet 22 consists of a bottom plate 64 of flexible material such as low density polyethylene, which carries a plurality of magnetized areas 65 arranged to form a unique binary code for identifying one patient. By way of example, each magnetized area 65 may be formed by an embedded permanent magnet formed of a ferrous material, such as alnico blanks 0.030 inches in diameter, which are magnetized during manufacture with a north-south orientation transverse to the direction of movement of the tags 30 through the bracelet 22, see FIG. 4.

Bracelet 22 includes an upper section 70 spaced from plate 64 to form a channel or slot for passage of tags 30 therethrough. The upper section 70, formed of a flexible material such as low density polyethylene, similar to the material used for the lower plate 64 is permanently attached at its ends to the lower plate 64 by a pair of rivets 72. Section 70 includes a plurality of downwardly extending fingers 74, each finger 74 being located closely adjacent a different one of the permanent magnets 65, so that as the tags 30 are drawn between the fingers 74 and the plate 64, the fingers 74 insure good contact between the tags and the permanent magnets 65.

In order to provide an initial determination of patient identity, the patient's name may be entered by any suitable means on a name card 80, and the card slid between current channel members in section 70 and over a locking tab 82, see FIG. 3, for retention within a channel. The upper, central section of the channel is open, as seen in FIG. 2, to expose the name on the name card 80. For permanent identification, the digital equivalent of the binary coding of the permanent magnets 65 may be prestamped in a lower surface 86 of the channel for the name tag.

A plurality of separable tags 30 are dispensed at one time by placing a magnetizable card or form 90 into the slit opening between the teeth 74 and the lower plate 64, and manually pushing and then pulling the form 90 through the bracelet, as seen in FIG. 2. Form 90 is composed of a layer 92 of magnetizable material, as a ferrite coating, uniformly applied over one side of a flexible carrier layer 94. The opposite side of layer 94 is coated with an adhesive backing 96 for attaching individual tags, i.e., sections of the form 90, to prescriptions, sample bottles, and the like. A thin layer of paper 98 covers the adhesive backing 96, and can be peeled away to expose the adhesive backing when an individual tag 30 is to be attached to an item.

For convenience, the form 90 contains perforations 100 between each separable section, so that an individual tag 30 may be separated from the form 90. Desirably, an orientation key 102 is notched in the center of each tag 30 to provide a reference for orienting the tag in the cross-check reader and the tag reader to be described. At the end of form 90, a space 104 is provided for noting the patient's name and number, but such identification is for purposes of convenience only, and is not used for actual identification purposes since it is subject to the same types of errors as presently occur in identification systems. Space 104 may also contain instructions for passing the form 90 through a bracelet 22, and may include other means for insuring that all forms are passes through the bracelets in the same manner, as for example, by color coding the area around the orientation notches 102 and similarly color coding one end of the bracelet 22. In addition, an edge 106 of form 90 is scalloped to prevent wrong end insertion of the form.

As the form 90 is drawn through the bracelet, the ferrite coating 92 becomes magnetized in longitudinal strips extending the length of the form. These strips have a magnetic orientation corresponding to the north-south orientation of the permanent magnets **65** embedded in the plate **64.** By way of illustration, the tag **30** illustrated in FIG. **4** has been magnetized in binary coded decimal (BCD) to form the 24 bit word 0001 0010 0000 0100 0000 1000, corresponding to the digital ID number 120408.

In FIGS. **5–7,** another embodiment of the bracelet **22** is illustrated in detail. This bracelet is more economical and of simpler construction than the bracelet of FIGS. **2–4,** but requires manual refilling at periodic intervals. The bracelet serves as a storage unit and dispenser of individual, precoded tags **30** which are magnetized before loading into the bracelet. Except for being precoded, each tag **30,** FIG. **6,** is similar to the tag **30** in FIG. **2.** A flexible layer **110** has deposited thereon a ferrite coating, permanently magnetized during manufacture of the tag to create **24** magnetically oriented tracks. The magnetic tracks are similar to the magnetic tracks illustrated for the tag **30** in FIG. **4,** and thus the tags **30** dispensed from the bracelet in FIGS. **5–7** are magnetically compatible with tags **30** produced by the bracelet of FIGS. **2–4.**

The tags are also mechanically and physically compatible, so that both type of bracelets could be used in the same hospital identification system. Similar to tag **30** in FIG. **2,** the tag **30** of FIG. **6** has an adhesive layer **112** placed over the magnetized layer **110.** Finally, a thin paper backing **114** is placed over the adhesive layer **112** so that the layer **114** can be peeled away and removed in order to attach the tag **30** to an item which is to be identified. The paper backing **114** may contain a decimal number corresponding to the binary coding of the magnetically oriented tracks in layer **110.**

As seen in FIG. **7,** bracelet **22** consists of a flexible bottom plate **116,** formed of low density polyethylene, and an upper plate **120,** formed of similar material, and joined at its right hand end in the drawing to plate **116** by a rivet **72.** The space between the plates **120** and **116** defines a storage area which holds a plurality of stacked, premagnetized tags **30.** A layer of foam rubber **122** serves to urge the tags **30** upward against the plate **120.** A locking tab **126,** attached to plate **116** by a rivet **72,** serves to retain the tags within the storage compartment.

In order to dispense tags, plate **120** has a central opening **130** which exposes the topmost tag **30.** By placing a finger or thumb through the opening **130,** a person can urge the topmost tag aginst and over the locking tab **126,** thereby dispensing a single tab from the end of the braclet **22.** After movement of the finger or thumb urges a single tag part way out of the bracelet, the tag can be entirely removed by grasping it between the fingers and pulling.

The bracelet **22** of FIGS. **5–7** is intended to hold a number of tags sufficient for identification purposes during a single stay of a typical patient. The bracelet is refillable by inserting tags through the same opening which is used to dispense tags. If desired, the plate **120** can be pivotally mounted to plate **116** so as to snap open for a refill operation. Although a refill operation increases the possibility of error, the procedure for refilling bracelets would desirably include several cross-checks to prevent mistake. Furthermore, it is contemplated that bracelets of different heights to hold different numbers of stacked tags may be provided, with bracelets of greater storage capacity being attached to

patients expected to have a longer stay in the hospital.

In FIG. **8,** the cross-check reader **46** is diagrammatically illustrated. Since the cross-check reader is both portable and self-contained, a dual power system is provided to insure long life. The system consists of a mechanical energy source which stores operator supplied energy, and an electrical energy source consisting of a pair of batteries **150,** providing for example 4.5 volts DC. The batteries **150,** as will appear, are switched to power the circuitry only when necessary. This switching system, in conjunction with the mechanical storage system, produces a reader of low electrical energy consumption and hence long battery life.

The mechanical storage system consists of a coil spring **152** captured between a frame or base **154,** which mounts the mechanical and electrical devices within the housing for the reader, and a plate **156** attached to a platen **158.** Platen **158** includes a locking notch **160** into which a latch **162** is driven when the platen **158** is depressed during a reset operation by manual operator motion.

Platen **158** forms a part of the sliding tray **44** which has the tag receptacles **42** and **48** located thereon. After individual tags **30** are placed within the receptacles **42** and **48,** the sliding drawer **44** is closed, moving the platen **158** downwardly to the position illustrated by dashed lines, at which position the latch **162** is driven into the notch **160.** Latch **162** includes a coiled spring **166** trapped between a shoulder **164** and a post **168** affixed to the frame **154.** In order to activate the reader **46,** a trigger **170** extending through the housing for the reader is manually rotated clockwise about a pivot point **172.** This laterally moves a connecting link **174** which attaches through an opening in post **168** with latch **162,** causing spring **166** to be compressed while the latch **162** moves out of engagement with the notch **160.** Platen **158** is then driven upward by action of the compressed spring **152.**

The speed of movement of platen **158** is controlled by a pneumatic damper **180** which comprises a cylinder **182** enclosing a piston connected through a piston shaft **184** with plate **156.** A pair of air vents **186** and **194** allows air trapped within the cylinder **182** to be vented to the atmosphere as the spring **152** drives the plate **156** and attached piston shaft **154** upward. The size of the openings **186** and **194** are chosen to produce the desired speed of movement of the platen **158** for the period of time that the tag receptacles **42** and **48** are being driven passed magnetic read heads **190.** After passing the read heads, the piston is so located as to block the opening **186,** allowing air to vent through the remaining smaller opening **194.** This causes the speed of movement of the platen **158** to be substantially reduced, controlling the time that the indicator **50** or **51** is energized.

The movement of the platen **158** during the operate or read mode causes the sliding tray **44** to be driven out of the housing to its intial open position, allowing the operator to remove the tags **30** in preparation for a subsequent cross-check operation. When a new reading is to be taken, another pair of tags **30** are placed in the receptacles **42** and **48,** and the unit is reset by the operator closing the sliding drawer and thus moving the platen **158** downward until latch **162** is driven by spring **166** into the notch **160.** Any energization of the indicators is disregarded during a reset operation.

In order to read the pair of magnetically coded tags, a pair of channels 213 and 214 are provided for the receptacles 42 and 48, respectively. Each channel contains similar circuits, as follows. A magnetic read head 190 has a gap located adjacent the tag 30 being read thereby. Receptacles 42 and 48 orient the tags 30 so that the magnetized tracks are located transverse to the direction of movement of the platen 158. The first track in each tag 30 is located at the uppermost position in FIG. 8, such that when the trigger 170 is actuated, each of the 24 tracks is in turn driven passed its read head at the same time that the corresponding track on the opposite tag 30 is driven passed the other read head.

Each head 190 is connected to a read amplifier 200 of conventional construction, producing amplified pulses which are coupled to a derived clock circuit 292, illustrated in detail in FIG. 10. The output from the derived clock circuit 202 consists of data pulses, on a line 204, and clock pulses, on a line 205. The clock pulse cause the data to be entered into a 24 bit shift register 207 of conventional construction. Shift register 207 has 24 output lines 210, individually labeled 1 through 24 to correspond with the bits being stored in the corresponding shift register storage unit.

The output lines 210 of the shift registers 207 in both channels 213 and 214 are coupled to a pair of inputs of a comparator 212. When all bits on the lines 210 from both channels match, a logic 1 bit output is provided on an output line 216 of comparator 212. This logic bit is coupled to an indicator driver 220, shown in detail in FIG. 11, to energize one of the indicators 50 and 51. If a 1 output indicating a match is present, GO indicator 50 is energized; and correspondingly, if a 0 output indicating no match is present, NO GO indicator 51 is energized.

Energization of the circuit of FIG. 8 is controlled by a power cam 222 and an indicator cam 224, both affixed to platen 158. The battery 150 is connected between a source of reference potential or gound 226, and a positive line which leads to a pair of switches 230 and 232, each of the single-pole, single-throw type. Switch 230 has a movable contact 234 which closes when a link 236 abuts or engages the power cam 222. Similarly, the switch 232 has a movable contact 240 which closes when a link 242 engages the indicator cam 224.

When switch 230 closes, power is supplied via a positive potential line 245 to the read amplifiers 200, the derive clock circuits 202, the shift registers 207, and the comparator 212. Power cam 222 has a width approximately equal to the width of the receptacles 42 and 48, and is located so link 236 engages power cam 222 during the same period of time that the gaps in the read heads 190 are positioned adjacent the tags 30. Power is supplied to line 245 just prior to the time the first track on the tags 30 is driven past the read heads 190. Power is disconnected from line 245 shortly after the last track on the tags 30 has passed the corresponding read heads.

Indicator cam 224 is located so that it engages link 242 after the last rack on the tags 30 has been read, but before the disconnection of power on line 245. When switch 240 closes, a potential line 250 energizes the indicator driver 220. Depending on the signal on line 216, one of the indicators 50 or 51 is energized, and remains energized until the indicator cam 224 is driven beyond the link 242. During the time cam 224 is abutting link 242 and hence actuating switch 240, the piston speed is controlled by the singal air vent 194, causing the platen 158 to move slowly and hence energize the driver 220 for several seconds, sufficient to allow the operator time to read th indicators. When the piston rises further and blocks the air vent 194, further movement of the platen 158 is terminated, and the sliding tray 44 is located at its fully open position. In this position, both links 236 and 242 are located off of their corresponding cams 222 and 224, thus denergizing the circuit.

In FIG. 9, the derived clock circuit 202 is illustrated in detail. The signal from the magnetic read amplifier 200 is coupled through a 10 kilohm resistor 260 to an operational amplifier 262 connected to function as a DC coupled inverter. The output of the inverter is coupled through a 150 ohm resistor 264 to a trigger input 266 of a one shot multivibrator 268, such as a type SN74121, manufactured by Texas Instruments. A diode 270 shunts input 266 to ground 226 in order to clamp the input to a maximum negative potential of minus 0.6 volts.

The signal from the magnetic read amplifier 200 is also coupled through a 150 ohm resistor 274 to a trigger input 276 of a one shot multivibrator 278 of similar type to multivibrator 268. A diode 280 shunts the trigger input to ground 226 in order to clamp the input to a maxiumu netative potential of minus 0.6 volts. Each multivibrator has a 2 millisecond one shot period, determined by an RC network consisting of a 15 kilohm resistor 282 and a 0.47 microfarad capacitor 284, connected to multivibrator 268, and a 15 kilohm resistor 286 and a 0.47 microfarad capacitor 288 connected in multivibrator 278. The output of each multivibrator, on a line labled Q, is coupled through respective 0.1 microfarad capacitors 290 and 292 to a NAND gate 294 having an output coupled to a second NAND gate 296 to produce an output on line 205 corresponding to the clock or timing pulses. The capacitors 290 and 292 are chosen to have values which couple rather than differentiate the outputs of the one shot multivibrators.

NAND gate 294 is normally held at a logic 1 level or high by a pair of 10 kilohm resistors 300 and 301, connected between the inputs of the NAND gate 294 and the positive potential line 245. The pair of multivibrators are cross coupled by connecting the $\overline{Q}$ output of multivibrator 268 to an inhibit input 304 of multivibrator 278, and by coupling the $\overline{Q}$ output of multivibrator 278 to an inhibit input 306 of multivibrator 268. The $\overline{Q}$ output of multivibrator 278 corresponds to line 204 and produces the data output pulses.

Both one shot multivibrators 268 and 278 are of the type that are only susceptable to triggering when the inhibiting input is held low (0 volts or negative). The multivibrators trigger when the trigger input thereafter goes high (positive potential), producing a high or positive going pulse on the Q output and a low or negative going pulse on the complementary $\overline{Q}$ output.

The spring 152 and the pneumatic damper 180 of FIG. 8 are selected to have values which cause each channel of data on each tag 30 to be driven past the magnetic read heads once each 200 milliseconds, when the RC networks have the previously disclosed values which produce a 2 millisecond one shot period. The operation of the FIG. 9 circuit is as follows. When a 1 bit is detected, a positive going pulse from amplifier 200 occurs at the time the leading edge of a magnetic track passes a magnetic head **190.** This pulse is coupled to both resistors **260** and **274.** The positive pulse will have no initial effect on trigger input **266,** but the pulse will trigger input **276.** Initially, it will be assumed that the output Q is high from both milivibrators, so the Q output is low to both inhibit inputs. When the positive input pulse triggers multivibrator **278** a positive pulse is put out on data line **204.** The $\overline{Q}$ output goes low causing NAND gate **294** to output to go high and NAND gate **296** to go low. This gives a negative going simultaneous clock pulse of 2 milliseconds duration on clock output line **205,** thereby indicating that a one bit had been read.

A negative going pulse is produced on line **200** when the trailing edge of a magentic track representing a 1 bit passes the magnetic head **190.** This negative going pulse must be completely ignored by the circuit for proper decoding. When a zero bit is detected a negative pulse appears on line **200** followed by a positive pulse. Likewise, this positive pulse must be ignored for proper decoding.

The cross connection of multibrators **268** and **278,** via the $\overline{Q}$ outputs, inhibits the opposite multivibrator during a 2 millisecond period following the first triggering of one of the multivibrators. This time period blanks out the circuit during the time that the magnetic read heads produce a signal on detecting the trailing edge of the magnetic track. Thus, the cross connection prevents false triggering by insuring that only one multivibrator is energized for each detection of a magnetic track.

If the initial input from the read amplifier **200** had been a negative going pulse, the multivibrator **268** would have been actuated. This would cause the $\overline{Q}$ output thereof to go low, and the Q output to go high. The low $\overline{Q}$ output is coupled through capacitor **290** and produces a high output from gate **294.** This is inverted by gate **296** to produce a low going pulse on clock line **205.** The absence of a simultaneous appearance of a positive pulse on line **204** now indicates a zero had been read.

In FIG. **10,** the indicator driver **220** is illustrated in detail. Line **216** from the comparator is coupled through a NAND gate **310** and a resistor **312** to the gate input **314** of a three terminal switching device such as an SCH 316. The gate input **314** is shunted to ground **226** through a resistor **318.** The SCR **316** controls the NO GO indicator **51.** The positive potential line **250** from switch **240** is coupled through a resistor **322** and a light emitting diode (LED) **324** to the anode of SCR **316.** The cathode of the SCR is directly coupled to ground **226.**

To control the GO indicator **50,** resistor **322** is also coupled through a second light emitting diode (LED) **330** to the anode of an SCR **332** having its cathode directly coupled to ground **226.** The gate input **334** for SCR **332** is coupled to ground **226** through a resistor **340,** and is coupled through a resistor **342** to the output of a NOT gate **344.** The input of NOT gate **344** is coupled to the output of NOT gate **310.**

In operation, line **216** goes positive when a match is indicated by the comparator. This produces a negative signal to gate **314** and a positive signal to gate **334.** When switch **240** is closed to indicate that valid information is present on line **216,** SCR **332** is triggered into conduction, thereby completing a current path to ground through the LED **330.** This produces a visual GO indication, authorizing a nurse or technicain to apply a treatment to a patient. Alternatively, if line **216** had a zero output when switch **240** was closed, SCR **316** would be energized, causing LED **324** to be illuminated to provide a NO GO indication. The energized LED continues to produce a visual output until the circuit is broken by the opening of switch **240.**

In FIG. **11,** the tag reader **37** is diagrammatically illustrated. Parts serving corresponding functions to parts in the cross-check reader **46** of FIG. **8** have been identified by the same reference numeral, and will only be briefly described in this section. The sliding tray **36** has a platen driver and a latch mechanism identical with that previously described for the sliding tray **44** of FIG. **8.** The individual tag **30** to be read is located in a receptacle **350,** only one receptacle being provided since a pair of tags are not to be compared. Platen **158** includes a print cam **352** which actuates a linkage **354** after the tag **30** has been driven completely passed read head **190,** thereby closing a switch **356** in order to ground an input and initiate a print cycle, as will appear. Since the tag reader **37** is not intended to be portable, it can be located near an external source of AC power, and hence battery operation is not provided. The reader **37** may be powered by a conventional power supply (not illustrated), connected to a conventional source of AC line voltage. Thus, the only timing provided by the platen **158** is for automatically intitating a print cycle.

As the magnetically coded tag **30** is driven passed the magnetic read head **190,** by the platen driver mechanism previously described, a series of pulses are amplified in read amplifier **200** and coupled to the derived clock circuit **202,** illustrated in detail in FIG. **9,** in order to produce data pulses on line **204** and clock pulses on line **205.** A 24 bit shift register **207** steps the data through storage units in response to the clock pulses. When all bits have been stored, the 24 output lines, collectively labeled **210,** have valid information. These lines are coupled to a printer electronics control unit **360,** of known design, which controls a conventional printer mechanism **362** in order to print the data being inputted to the control **360** on the paper strip or web **39.** Desirably, the printer electronics control unit **360** includes a BCD to decimal converter, so that the data output includes the decimal equivalent of the patient ID number. The printer selected for this purpose is of the type which can simultaneously or serially print **21** spaces or characters of information across the web **39.** By way of example, the spaces may be allocated for data information of the type illustratively shown in the drawing. Control unit **360** has a number of sets of inputs corresponding to the number of items to be printed. Any conventional control for printing plural data can be used as unit **360,** and the data can be sampled, or entered as serial or parallel words, as desired.

A number of different types of data may be inputted to the control unit **360** for printing at the same time that the patient ID number is recorded. A service code generator **370** includes six thumbwheel selectable switches **372,** each switch having a wheel with 10 decimal digits 0 through 9. The switches **372** are of the known type which have a direct output in BCD, four lines for each switch, thus producing on a calbe **376** a 24 bit parallel word corresponding to the selected six digit service code. In operation, each station in the hospital is assigned a service code or a block of service codes. Referring to FIG. **1**, the clinical laboratory **54** could be assigned decimal numbers from 100,000 to 199,999, for example. Individual numbers within this range would be assigned to services and tests performed in the labroatory. Number 100,001 could stand for a glucose test, number 100,002 for a CPK test, and so on. A similar procedure would apply for the pharmacy **34**, which could be assigned numbers in the range 200,000 to 299,999. Commonly prescribed drugs would be assigned a range of individual numbers with individual numbers within the range indicating the dosage of the drug.

A date set unit **380** includes a plurality of switches **382** which provide a 20 bit paralle word on a cable **384**, which word indicates the date.

An electronic clock **386** can be provided, of the type which maintains the correct time after being initially set to the correct time when the unit is first turned on. This known clock **386** has a plurality of time set buttons **390** for resetting time after the unit has been turned off. Associated with clock **386** is a digital clock converter **392** which produces a 16 bit parallel word on a cable **394**, which word corresponds to the present time.

The data input cables **210, 376, 384** and **394**, all input to the control **360**, which operates to actuate the printer mechanism **362** only when a print signal is received from a NAND gate **400**. One input of gate **400** is coupled to the terminal of switch **356** which is closed by engagement of linkage **354** with the print cam **352**. The other input of gate **400** is coupled to a 24 bit clock test electronics unit **402** whose input is coupled to the clock line **205**. Unit **402** may be a 24 bit counter for producing an output after counting 24 clock pulses. Only when unit **402** has an output and the switch **356** closes is a print signal generated. Thus, unit **402** prevents a print operation should less than 24 bits be read from tag **30**, or should more than 24 bits be read, due to a malfunction.

Desirably, printer **360** has a serial digital data output line **404** which may be coupled to a conventional ASC II code converter **406** having an output directly coupled to the central data processing **60**, FIG. **1**. Alternatively, the converter **406** can operate a known type of card punch, in order to produce an IBM card or the like which contains data corresponding to the data printed on paper web **39**. Other data providing units or different combinations of units may also be utilized in the tag reader **37**.

We claim:

1. In an identification system for relating items with patients, cross-check means for insuring that an identifying item corresponds to an identified patient, comprising:

first identification tag means adapted to be dispensed from bracelet means attached to a single patient;

said first identification tag means carrying thereon magnetic means having a plurality of magnetic fields arranged to form a unique magnetic code for identifying a single patient;

second identification tag means adapted to be dispensed from the bracelet means and carrying thereon magnetic means having a plurality of magentic fields corresponding to the plurality of magnetic fields carried by said first identification tag means to form the unique magnetic code thereon;

means for removably attaching said second identification tag means to an item which is to be associated with said single patient;

and reader means for comparing the unique codes of said first and second identification tag means comprising plate means mounted for movement along a predetermined path between first and second positions, first and second input receptacles for respectively receiving said first and second identification tag means, said receptacles being disposed on said plate means for simultaneous movement therewith, first and second magnetic read heads disposed adjacent said path for respective association with said first and second input receptacles, energy storage means coupled to said plate means for storing energy in response to movement of said plate means from said first position to said second position, said plate means being movable from said second position to said first position by the energy stored in said storage means for moving said first and second identification tag means relative to said first and second read heads to produce a first series of signals corresponding to the unique magnetic code of said first identification tag means and a second series of signals corresponding to the unique magnetic code of said second identification tag means, circuitry means responsive to said first and second series of signals for producing a signal comparison, and means responsive to said signal comparison to provide a match indication when the magnetic codes of said first and second identification tag means are identical.

2. The identification system of claim **1** wherein said energy storage means includes spring means for normally urging said plate means toward said first position, damper means for controlling the speed of movement of said plate means from said second position to said first position, and said attaching means includes an adhesive layer on said second identification tag means.

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