

DRAWINGS ATTACHED

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(54) AN IMPROVED WATCHMAN'S CHECKING SYSTEM

(71) We, WORMALD BROTHERS INDUSTRIES LIMITED, a company incorporated in the State of New South Wales, Commonwealth of Australia, of 1 Phillip Street, Sydney, New South Wales, 2000, Commonwealth of Australia, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to equipment used by watchmen to permit checking-in at pre-arranged check points during the course of their round of duties. More particularly it pertains to equipment of this kind which automatically detects any abnormality in the watchman's round.

Mechanical systems have been employed of which a well known type employs a key, carried by the watchman, whose wards are modified by insertion in the lock at the outstation at any checkpoint, to permit it to fit the lock in the outstation at the next checkpoint in the sequence of the watchman's round. Disadvantages exist with purely mechanical systems and a general trend has existed towards electrical or electronic systems.

In some examples of these systems manually operable switches are provided at the various outstations as an indication of a watchman's visit, and in others a key requires to be inserted at the outstation to register the visit. In all such electrical systems electrical connection must be made from the outstations at the checkpoints to a master checkpoint which often is positioned as the last station in the sequence.

The prime object of this invention is to provide a watchman's checking system having electrical means for recording the watchman's round, which does not require permanent electrical connection between the outstations and the master station.

[Price 25p]

In one general form the invention provides a watchman's checking system of the type composed of a plurality of fixed position outstations at checkpoints to be visited in a predetermined sequence by a watchman during his round of duties, and a portable device carried by the watchman for placing in register with the outstations in turn for recording each visit to the checkpoint for the purpose of checking the correctness of his round, said system being characterized in that the portable device comprises a chain of electrical switching circuits each responsive solely to a respective outstation, when in register with the portable device, to operate if all previous switching circuits in the chain have been activated, the operating sequence of the chain corresponding to a prearranged sequence of visits to the checkpoints, and means for signalling from the portable device when the round is completed an indication of the correctness or incorrectness of the round.

A vendible item will also be the portable device of which there may be many supplied for use in such a system, and this device per se is provided through another general form of the invention.

A better understanding of the invention will be had by reference to the following detailed description of a preferred embodiment read in conjunction with the accompanying drawings, in which:—

Fig. 1 is a schematic representation of the circuitry of a portable device intended to be carried by a watchman;

Fig. 2 shows schematically the circuit of the master station which will invariably be at the final checkpoint to be visited in the watchman's round of duties;

Fig. 3 is a simplified circuit of one stage of the shift register shown in Fig. 1;

Fig. 4 is a portion of the step adder-shift register of Fig. 1 serving to illustrate its operation;

Fig. 5 illustrates schematically the function of the resetting coil;

Fig. 6 serves to simplify explanation of the three pulse transmitters shown in Fig. 1;

5 Fig. 7 is a schematic representation of the individual receivers at the master station shown by Fig. 2;

Fig. 8 similarly shows the activating transmitter sensory receiver of Fig. 2; and

10 Fig. 9 is a simplified diagram of the interconnections between the relays and the switches of Fig. 2.

One feature of the system shown by the drawings is the complete absence of metallic contacts between any of the out stations and the portable "memory" bank. Furthermore, no wiring is employed between out stations and the master station although the latter will be connected to a central supervisory location. The master station may be connected via telephone cable to the supervisory signal location and to a 240V power outlet.

Preferably, but not essentially, the system employs an electro magnetic pulse transmission mating method. The principle of mutual inductance pick-up of two coils placed side by side with their centres on the same axis is employed to operate a transistorised step adder-shift register and various pulse switching devices.

The apparatus can be considered as being divided into the following parts:

1. A Portable Unit carried by the watchman which comprises:

- 35 (a) A step adder memory bank with matrix pick up coils L1 L8.
- (b) A pulse generator to activate the last read out, or master, station and produce a "correct" signal.
- 40 (c) A pulse generator to activate the master station and produce a "wrong" signal.
- (d) A pulse generator to activate the memory bank.
- 45 (e) A step adder reset coil and amplifier.
- (f) A 6 volt Ni Cd battery pack.

2. A number of outstations (Up to ten) installed at prearranged checkpoints en rout comprising:

- (a) Two link coils, placed on a faceplate coinciding with the matrix principle to give the station identification capabilities.
- 55 (b) A matrix faceplate locating guide.

3. A master station (say 11th position) comprising:

- 60 (a) A sensory receiver for "correct" signal.
- (b) A sensory receiver for "wrong" signal.
- (c) a sensory receiver for receiving pulses from the portable unit's activating generator.
- 65

(d) A step adder reset generator.

(e) Ac-Dc power supply.

THE PORTABLE UNIT

The sequence of the watchman's route and the outstation identification is achieved 70 by means of matrix configuration of the coil faceplate. Twelve coils are used in a nine call unit, three coils for the pulse transmitters, eight coils for the step-adder-shift register memory circuit and one coil for the reset signal pick up. The coils are placed 75 on a rectangular faceplate in three rows of four coils. A similar plate is used for every out station but only two coils are used by the outstations for link energy transfer from 80 the activating pulse generator of the portable unit and any of the eight step adder pick up coils in the portable unit. The master station, however, has four coils, two pick up coils for the "right" and 85 "wrong" signals, one pick up coil for the activating transmitter sensory receiver and a reset transmitter coil. The positioning of the coils on the faceplate is used to identify stations in the following manner. 90

Assuming that the step adder is reset and the round is started beginning at the first out station en route, the activating transmitter coil is located for example at the left hand top corner and the pick up coil for the first stage step adder is located on the second row of coils underneath the transmitting coil. The first out station link coils will then be located to coincide with the activating transmitter coil and the first stage step adder pick up coil which is located in the same position on the matrix faceplate. As each out station is visited, (providing it is in the right sequence) a progressive step adder stage is activated and locked "on". For example, if the step adder circuits are activated in the wrong sequence, i.e. No. 1, No. 3, No. 4 etc. then only stage No. 1 of the circuit will be locked "on". Stages No. 3, 4 etc., cannot operate before stage No. 2 110 as the step adder circuit is connected as a "shift register" where each progressive stage obtains its D.C. power from its preceding stage only if the latter is switched "on". 115

As all the stages are progressively activated by the respective outstations, stage No. 8 is activated and locked "on" by outstation No. 8. Stage No. 8 is important if one considers that this stage will lock only if the correct sequence of the route has been carried out. It is therefore this stage which deactivates the transmitter (coil TC) and activates the transmitter (coil TD) in the event of a "correct" call sequence and does not deactivate the transmitter (coil TC) nor activate the transmitter (coil TD) in the event of an "incorrect" call sequence. It is obvious then that if the transmitter (coil TC) has not been deactivated the master 130

station will perceive an "incorrect" signal and inversely so when the transmitter (coil TD) is activated the master station will perceive the "correct" signal. The transmitters (coil TC and TD) are fed by the stage No. 8 of the step adder in such a way that they cannot operate simultaneously in the "on" condition but only one at a time depending on the "on" or "off" state of the stage No.

Two transmitters are used for the memory bank read out "right" and "wrong" signals, one for each signal, to ensure a stable state of the master station i.e. (a) no signal, (b) "right" or "wrong" signal, (c) no signal.

THE MASTER STATION

The last read out, i.e. the master station incorporates two receivers, one for "correct" signal and one for "incorrect" signal. Each receiver is connected to a relay having four sets of change over contacts. Following the theory of the step adder principle it will be obvious that the step adder must be reset at the end of each operation whether it was activated correctly or not. The resetting transmitter generator is therefore activated by either relay ("correct" or "incorrect") for the whole duration of the "check" time. Since the read out transmitters (coils TC and TD) in the portable unit cannot give a "correct" signal while the step adder is reset as this would yield an "incorrect" signal, then a time delay is introduced before the resetting transmitter is operated, sufficiently long so that either relay, RL1 or RL2 is activated and locked "in" through its own contacts.

Interlocking the relays provides a means of holding each relay "on" but it provides only one half path between the battery and the relay's coils. The other path is provided by a third receiver amplifier also situated in the master station whose pick up coil is made to coincide with the activating transmitter in the portable unit thus sensing the activating transmitter and finally through a switching transistor completing the current path to either RL1 or RL2 relays. This method ensures the resetting of the relays on completion of the check. The activating transmitter sensor-amplifier will drop either relay RL1 or RL2 when no longer activated.

Specific reference will now be made to the drawings for a more detailed explanation of the system.

THE STEP ADDER-SHIFT REGISTER

The circuit shown in Fig. 3 depicts a simplification of each stage of Fig. 1 which constitutes a shift register but its main function as it will be seen later is as a step adder. When the switch SW1 is first closed there is no current flow through either transistor Q1 or Q2 as both transistors Q1

(NPN) and Q2 (PNP) are zero biased (ignoring leakage of the silicon transistors between emitter-collector or base to collector) but when a pulse of positive polarity is applied to the base of Q1, then Q1 will conduct collector current through R3 and R4. At the same time the base of Q2 (PNP) will draw current from the junction of R3 and R4 which are voltage divider and current limiter resistors, through its emitter thus forward biasing transistor Q2.

In turn the collector current of transistor Q2 will flow through resistors R1 and R2 and forward bias transistor Q1. Since its base is connected to the junction of resistors R1 and R2 both transistors Q1 and Q2 will "bottom". On the other hand a negative pulse applied to the base of transistor Q1 will cut off transistor Q1. The collector current of transistor Q1 will no longer flow through resistors R3, and R4, thus transistor Q2 will return to zero bias and in turn block its collector current through resistors R1 and R2 unbiassing transistor Q1. Transistors Q1 and Q2 will thus return to a non conducting state. The positive "on" pulses are supplied by the pick up coils L1...L8 on the matrix faceplate connected between resistor R1 and the negative supply rail.

Now, with reference to Fig. 4 if one considers transistors Q1 and Q2 locked in the "on" state, both transistors are bottomed i.e. fully conducting, therefore at the collector of transistor Q2 will appear the full positive rail potential, ignoring the voltage drop across transistor Q2. The collector of transistor Q2 is used to supply the current for the successive stage. It is therefore evident that stage No. 2 cannot be fired before stage No. 1 because its supply path to the battery is broken by stage No. 1 and similarly each successive stage is drawing power through stage No. 1.

Referring to Figs. 1 and 5, it will be obvious then that the resetting of the whole step adder is a relatively easy matter. It is only necessary to reset stage No. 1, to drop each stage from the supply battery circuit. The resetting of the stage No. 1 is accomplished by shorting the base of its transistor Q1 to the negative supply rail. This pulses transistor Q1 out of conduction which in turn switches off transistor Q2 and all the other stages drawing current through this transistor. The "shorting" of the base of transistor Q1 to the negative supply rail is performed by transistor Q3 and its pick up coil RA.

When a positive pulse is applied to the base of transistor Q3, picked up by its coil RA in the base circuit, transistor Q3 conducts collector current derived from the junction of resistors R1 and R2 shunting resistor R1 and the forward biased junction

base-emitter of transistor Q1. This transistor will cease to conduct collector current due to greatly reduced base current and subsequently will switch off transistor Q2.

- 5 A practical limit of ten step adder stages is feasible using a six volt supply battery and silicon transistors Q2 (PNP) type. The limitation is understood if it is considered that all the step adder stages operate in series and that each transistor Q2 exhibits its knee voltage between its emitter and collector (approx. 0.5V) then each successive stage will operate on 0.5 volts less than its previous stage, and so on. The last stage will operate on 0.5V DC only, assuming 0.5 volt drop per stage.

The shift register has been called a step adder because as each successive state has been "fired" the drain of the battery has been increased by approximately the same amount, thus taking advantage of this, it is intended to pass the battery current through a current meter calibrated to indicate to the watchman if a particular outstation was activated or not.

THE PULSE TRANSMITTER

The portable unit of Fig. 1 contains three identical pulse transmitters, one of which is shown in Fig. 6.

- 30 Transistor Q5 is a unijunction transistor pulse generator. The emitter of transistor Q5 is connected to the junction of capacitor C1 and resistor R6. Capacitor C1 is charged through resistor R6 until the potential across capacitor C1 reaches the characteristic peak firing point of transistor Q5 discharging the capacitor into base No. 1 load resistor R5 and transistor Q4 base. Part of the transistor Q5 base No. 1 current will be contributed by base No. 2. Transistor Q5 will remain in the conductive state until capacitor C1 potential drops to transistor Q5's characteristic "Valley point". Transistor Q5 will then switch itself off and the capacitor will begin charging up through resistor R6 repeating the cycle. At each conduction cycle of transistor Q5 a positive pulse appears on its base No. 1. This positive pulse is applied to the base of transistor Q4 (a NPN transistor) bottoming it for the duration of the pulse width. The collector load of transistor Q4 is the transmitting coil B, C or D, the diode D1 prevents the back EMF of the coil from damaging the transistor Q4 when it ceases to conduct abruptly on the end of the pulse. The activating transmitter (coil TB) is made to operate for the duration of the whole route and the final check of the workman and it will remain on as long as switch SW1 is operated. However, the transmitters (coils TC and TD) distinctive functions (as discussed earlier) will be dependant on the state of the last step adder stage (No. 8). If Fig. 6 be analysed again it will be

obvious then that if the resistor R6 is open circuited, transistor Q5 will cease generating pulses and in turn transistor Q4 will remain in a non conductive state. It is this method that is used to turn the transmitters (coils TC and TD) off or on. The transmitter (coil TC) is normally operating but it is turned off when the last stage (No. 8) is activated. This is accomplished by connecting resistor R6 of transmitter (coil TC) to the collector of transistor Q1 of the last step adder stage. If Fig. 3 be analysed again, it will be obvious that when the stage is at the off condition, a positive supply potential will appear on the collector of transistor Q1 through resistors R3 and R4. It is therefore through these resistors that the capacitor of C1 (of the coil TC transmitter) is charging, causing transistor Q5 to generate pulses, but when the step adder stage No. 8 is conducting, then transistor Q1 is in a saturated state dropping its collector voltage to only approx. 0.5 volts, much below the peak firing point of transistor Q5 thus cutting the coil TC transmitter off.

Inversely so, transmitter (coil TD) is turned on when the collector of transistor Q2 of the last step adder stage becomes + 5 volts, charging the capacitor C1 through R6. It is evident then that the transmitters (coils TC and TD) cannot operate simultaneously because the transistors Q1 and Q2 of the last step adder stage saturate simultaneously thus switching transmitter (coil TD) on and switching transmitter (coil TC) off. At the reversal of condition of the same stage the opposite occurs, where the transmitter (coil TD) is now switched off and the transmitter (coil TC) is switched on.

THE CHECKING STATION'S READ OUT RECEIVERS

With reference to Figs. 2 and 7 it will be seen that transistors Q6 and Q7 are normally in the unbiased (zero bias) condition, but when a positive pulse is applied to the base of transistor Q6 supplied by the pick up coil RC or RD, transistor Q6 will bottom for the duration of the whole pulse length thus almost the whole battery potential will appear across resistor R8 being the collector load of transistor Q6. The diode D2 will conduct (being forward biased) via resistor R9, a current limiting resistor. The capacitor C2 will therefore charge with negative potential at the junction between the anode of diode D2 and the base of transistor Q7 (PNP type) biasing this transistor into conduction. Transistor Q7 is connected as an emitter follower closing relay RL on its emitter load.

ACTIVATING TRANSMITTER — SENSORY RECEIVER

This receiver is shown exclusively by Fig. 8 and is similar in operating principle to the two receivers described above but for

the different types of transistors (P-N-P, NPN) employed. The reason for this, as it will be soon obvious, is in the interlocking principle of relays RL1 and RL2 after the

5 "right" or "wrong" signal has been received. The receiver operates relays RL1 or RL2 as long as the sensory coil RB has been activated by the activating transmitter in the portable unit. The coil RB must therefore

10 coincide with the activating transmitter's coil on the matrix board. The transistor Q8 is normally in the unbiased state, but when the pick up coil RB induced current is passed via resistor R11, a current limiting resistor through the emitter base junction, transistor Q8 bottoms for the duration of each pulse drawing collector current through resistor R12. Normally the collector of transistor Q8 is negative and the diode D3 is reverse biased and cannot

20 pass current. But when transistor Q8 is in a bottomed state its collector is positive, thus diode D3 conducts current via limiting resistor R13. The capacitor C3 will therefore charge with positive potential at the junction of the cathode of diode D3 and the base of transistor Q9 (NPN type) biasing transistor Q9 into conduction. Transistor Q9 is connected as an emitter follower having the coil of relay RL as the emitter load.

25 **RELAY INTERLOCKING SYSTEM**

30 As the portable unit matrix faceplate is placed on top of the master station's faceplate, pulses of two transmitters must be received. The first transmitter is the activating transmitter which is normally switched on for the duration of the whole test en route. The second transmitter as has been explained, is either the "right" or "wrong" signal transmitter. As the faceplates are closed together, the activating transmitter receiver (coil RB) will always operate bottoming transistor Q9 (Figs. 2 and 8). The emitter of transistor Q9 (NPN) will therefore switch the battery positive potential to both relay coils RL1 and RL2.

40 At the same time, a "right" or "wrong" signal transmitter has activated the respective receiver. Either the "right" or "wrong" receiver is connected to its own relay via its counter-part's relay's contacts. When either of the receivers operate, transistor Q7, a PNP transistor, is bottomed switching the battery negative potential to the other side of the relay coil (see particularly Fig. 9).

55 The "right" signal receiver operates relay RL2 via a single pair of change-over contacts of relay RL1 and the "wrong" signal receiver operates relay RL1 via a single pair of change over contacts of relay RL2. In fact another pair of change-over contacts is used for each interlocking operation to isolate the unwanted relay from the circuit

65 and to isolate the operating receiver at the

same time by connecting the already closed relay directly to the negative terminal of the battery. The reason for this technique of interlocking will become clear when it is considered that shortly afterward either relay RL1 or RL2 has closed, the cancelling transmitter will reset the step adder, and the step adder in the reset condition (as discussed earlier) will turn "on" the "wrong" signal transmitter.

70 With this interlocking technique either signal will be received, stored and locked, before the step adder is reset. The relays RL1 and RL2 will remain locked as long as the activating transmitter receiver is excited. When the portable unit is removed from the master station, transistor Q9 will switch off the positive side of the battery, thus relay RL1 or RL2 will drop, returning to normal.

75 THE RESET TRANSMITTER

The rest transmitter circuit used in the checking station is essentially exactly the same as the other three transmitters in the portable unit (see Fig. 6). Only a small time delay is introduced into the circuit designed to delay the transmission for a small amount of time.

80 As this transmitter is turned "on" by either relays RL1 or RL2, the required time delay must be in excess of the operating time of the relays, the reason being that as soon as the reset transmitter is turned on the signal receivers can no longer hold in their respective relays in the correct way, it is therefore necessary to make sure that the relay is closed properly before the corresponding receiver is turned off.

85 Audio tones may be employed for transmission between the portable unit and the outstations, with somewhat improved efficiency because of the possibility of using "ferrite" materials, for example "potcores". "Potcore" halves could be aligned side by side on the matrix board and the other halves aligned on the corresponding boards. Each half "potcore" would then contain half the winding which could be turned for best efficiency. The potcore idea offers the possibility of potting the whole assembly in epoxy resin, thus keeping the airgaps as small as possible for best efficiency. The use of audio tones for transmission would permit simplifying the circuitry because only a single transistor oscillator need then be built.

90 On the other hand different counting methods could be employed making use of commercially available microcircuit computer logic bits i.e. KJ flip flops etc.

95 The matrix faceplate could be substituted by changing its shape, for example, smaller physical dimensions could be achieved if the coils could be wound coaxially to a cylinder shape which is pushed into the sta-

tion's holes ranging in depth and rotational guiding etc.

Other modifications will also suggest themselves to one skilled in the art and they also are intended to fall within the scope of this invention. For example, a timing device may be incorporated at the master station as well as at say one outstation, which will be connected to the master station, to provide an alarm condition when the watchman's round has been unduly delayed.

By the use of the equipment of the present invention the round sequence by the watchman may be altered between rounds in a comparatively simple manner. Various combinations of wired plugs may be inserted into the portable unit which serves as an electronic key, which will predetermine the correct sequence of visits to the outstations. Furthermore, a meter may be wired into the unit which will indicate the last station visited.

Another feature which is not provided by mechanical systems is the possibility of incorporating a timing circuit into the portable unit so that a minimum and/or maximum time limit can be set between visits to successive out stations. This may serve to deter watchmen from too quickly or too slowly executing their round of duties.

WHAT WE CLAIM IS:

1. A watchman's checking system of the type composed of a plurality of fixed position outstations at checkpoints to be visited in a predetermined sequence by a watchman during his round of duties, and a portable device carried by the watchman for placing in register with the outstations in turn for recording each visit to the checkpoints for the purpose of checking the correctness of his round, said system being characterized in that the portable device comprises a chain of electrical switching circuits each responsive solely to a respective outstation, wherein register with the portable device, to operate only if all previous switching circuits in the chain have been activated, the operating sequence of the chain corresponding to a prearranged sequence of visits to the checkpoints, and means for signalling from the portable device when the round is completed an indication of the correctness or incorrectness of the round.

2. A watchman's checking system according to claim 1, wherein each of the switching circuits in the operable chain responds to an electric pulse delivered by its respective outstation when in register with the portable device.

3. A watchman's checking system according to claim 2, wherein the electric pulse is transmitted from the portable device and relayed by an outstation to the respective switching circuit of the portable

device.

4. A watchman's checking system according to claim 2 or 3, wherein transfer of the pulse between each outstation and the portable device is effected by electromagnetic coupling.

5. A watchman's checking system according to any one of the preceding claims, wherein the chain of switching circuits is a shift register each stage of which has individual input energizing means for switching it "on", said means being a coil.

6. A watchman's checking system according to claim 5, wherein said input coils of all said switching circuits in the chain are physically positioned in matrix configuration in the portable device, and each outstation has a single coupling energizing coil physically positioned at the outstation to correspond in position in the matrix configuration with a respective coil in the portable device when the portable device is located in predetermined register with the outstation.

7. A watchman's checking system according to claim 5 or 6, wherein a pulse generator is incorporated in the portable device and has a transmission coil positioned in said matrix configuration, and a receiving coil is located in some or all of the outstations and positioned to receive pulses transmitted by the transmission coil when the portable device is placed in register with the outstations.

8. A watchman's checking system according to any one of the preceding claims, wherein said means for signalling from the portable device an indication of the correctness or incorrectness of the round comprises a pulse generator responding to a switched "on" condition of the last switching circuit in said chain to transmit a signal to a final, or master, outstation when the portable device is placed in register therewith, indicative of performance by the watchman of a correct round.

9. A watchman's checking system according to claim 8, wherein transmission of said correct round signal is by electromagnetic coupling between one or more coils in the portable device and a coil or coils in the final outstation.

10. A watchman's checking system according to claim 9, wherein the portable device has a further pulse generator activated when the last switching circuit in said chain is in an "OFF" condition, said further pulse generator when activated and being electromagnetically coupled to the final outstation transmitting a signal indicative of an incorrect performance of a watchman's round.

11. A watchman's checking system according to any one of the preceding claims, wherein signalling means are provided be-

tion's holes ranging in depth and rotational guiding etc.

Other modifications will also suggest themselves to one skilled in the art and they also are intended to fall within the scope of this invention. For example, a timing device may be incorporated at the master station as well as at say one outstation, which will be connected to the master station, to provide an alarm condition when the watchman's round has been unduly delayed.

By the use of the equipment of the present invention the round sequence by the watchman may be altered between rounds in a comparatively simple manner. Various combinations of wired plugs may be inserted into the portable unit which serves as an electronic key, which will predetermine the correct sequence of visits to the outstations. Furthermore, a meter may be wired into the unit which will indicate the last station visited.

Another feature which is not provided by mechanical systems is the possibility of incorporating a timing circuit into the portable unit so that a minimum and/or maximum time limit can be set between visits to successive out stations. This may serve to deter watchmen from too quickly or too slowly executing their round of duties.

WHAT WE CLAIM IS:

1. A watchman's checking system of the type composed of a plurality of fixed position outstations at checkpoints to be visited in a predetermined sequence by a watchman during his round of duties, and a portable device carried by the watchman for placing in register with the outstations in turn for recording each visit to the checkpoints for the purpose of checking the correctness of his round, said system being characterized in that the portable device comprises a chain of electrical switching circuits each responsive solely to a respective outstation, wherein register with the portable device, to operate only if all previous switching circuits in the chain have been activated, the operating sequence of the chain corresponding to a prearranged sequence of visits to the checkpoints, and means for signalling from the portable device when the round is completed an indication of the correctness or incorrectness of the round.

2. A watchman's checking system according to claim 1, wherein each of the switching circuits in the operable chain responds to an electric pulse delivered by its respective outstation when in register with the portable device.

3. A watchman's checking system according to claim 2, wherein the electric pulse is transmitted from the portable device and relayed by an outstation to the respective switching circuit of the portable

device.

4. A watchman's checking system according to claim 2 or 3, wherein transfer of the pulse between each outstation and the portable device is effected by electromagnetic coupling.

5. A watchman's checking system according to any one of the preceding claims, wherein the chain of switching circuits is a shift register each stage of which has individual input energizing means for switching it "on", said means being a coil.

6. A watchman's checking system according to claim 5, wherein said input coils of all said switching circuits in the chain are physically positioned in matrix configuration in the portable device, and each outstation has a single coupling energizing coil physically positioned at the outstation to correspond in position in the matrix configuration with a respective coil in the portable device when the portable device is located in predetermined register with the outstation.

7. A watchman's checking system according to claim 5 or 6, wherein a pulse generator is incorporated in the portable device and has a transmission coil positioned in said matrix configuration, and a receiving coil is located in some or all of the outstations and positioned to receive pulses transmitted by the transmission coil when the portable device is placed in register with the outstations.

8. A watchman's checking system according to any one of the preceding claims, wherein said means for signalling from the portable device an indication of the correctness or incorrectness of the round comprises a pulse generator responding to a switched "on" condition of the last switching circuit in said chain to transmit a signal to a final, or master, outstation when the portable device is placed in register therewith, indicative of performance by the watchman of a correct round.

9. A watchman's checking system according to claim 8, wherein transmission of said correct round signal is by electromagnetic coupling between one or more coils in the portable device and a coil or coils in the final outstation.

10. A watchman's checking system according to claim 9, wherein the portable device has a further pulse generator activated when the last switching circuit in said chain is in an "OFF" condition, said further pulse generator when activated and being electromagnetically coupled to the final outstation transmitting a signal indicative of an incorrect performance of a watchman's round.

11. A watchman's checking system according to any one of the preceding claims, wherein signalling means are provided be-



tween the final outstation and a supervisory centre to indicate thereto the correctness or incorrectness of the watchman's round.

12. A watchman's checking system according to any one of the preceding claims, wherein the switching circuits comprise individual interconnected transistor stages and supply potential is applied to each stage only when all preceding stages are switched "ON".

13. A watchman's checking system according to claim 12, wherein resetting of the operable chain of switching circuits is effected by switching "OFF" the first stage of the chain of switching circuits.

14. A portable device to be carried by a watchman during his round of duties entailing visiting in predetermined sequence a plurality of checkpoints containing fixed position outstations, said portable device being placed in register with the outstations in turn for recording in the portable device each visit to a checkpoint for the purpose of checking the correctness of the watchman's round, said portable device comprising a chain of electric switching circuits each responsive solely to a respective outstation, when in register with the portable device, to operate only if all previous switching circuits in the chain have been activated, the operating sequence of the chain corresponding to a prearranged sequence of visits to

the checkpoints, and means for signalling from the portable device when the round is completed an indication of the correctness or incorrectness of the round.

15. A portable device according to claim 14, wherein the switching circuits are arranged in stages with each stage having an energizing coil, and an actuating transmitter is provided in the portable device and has an output coil, said output coil being arranged to be electromagnetically coupled through the circuitry of an outstation, when the portable device is placed in register therewith, to the energized coil of a stage of the chain of switching circuits corresponding to the particular relaying outstation.

16. A portable device for use in a watchman's checking system, substantially as herein described with reference to Figs. 1 and 3 to 6 of the drawings accompanying this specification.

17. A watchman's checking system substantially as herein described with reference to the drawings accompanying this specification.

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