

[54] APPARATUS FOR THE PROGRAMMED
TREATMENT OF BED WETTING
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[58] Field of Search..... 300/235, 309.4, 311;
128/138 A

[56] References Cited
UNITED STATES PATENTS
3,460,123 8/1969 Bass 340/235
FOREIGN PATENTS OR APPLICATIONS
1,174,346 12/1969 Great Britain 128/138 A

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[57] ABSTRACT

A method and apparatus for treatment of patients who have the problem of bed wetting. Whereas, formerly the method of treatment of such patients was to provide a loud alarm and bright spotlights which would be turned on in response to each incident of bed wetting so as to awaken the patient, this system provides two types of alarms. The first type has a loud bell and spotlight which are adapted to immediately awaken the patient. A second alarm is provided which after a selected delay time awakens the patient's caretaker, that is, parent or nurse, who then proceeds to take care of the patient. The choice as to whether a single event of bed wetting will operate the first alarm or the second alarm is preset into the system so that some selected percentage of the events operate the first alarm and the remaining percentage of events operate the second alarm. These can be controlled in a random, or other type of sequence. This improved apparatus treatment of enuresis serves not only to control the habit of bed wetting, but also prevents a relapse of the patient once he has been treated.

8 Claims, 5 Drawing Figures

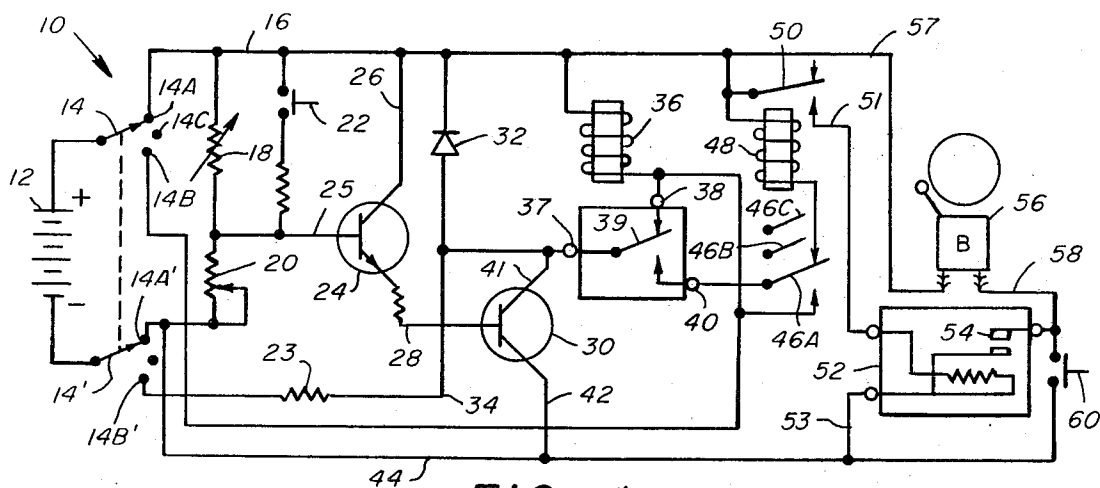


FIG. 1

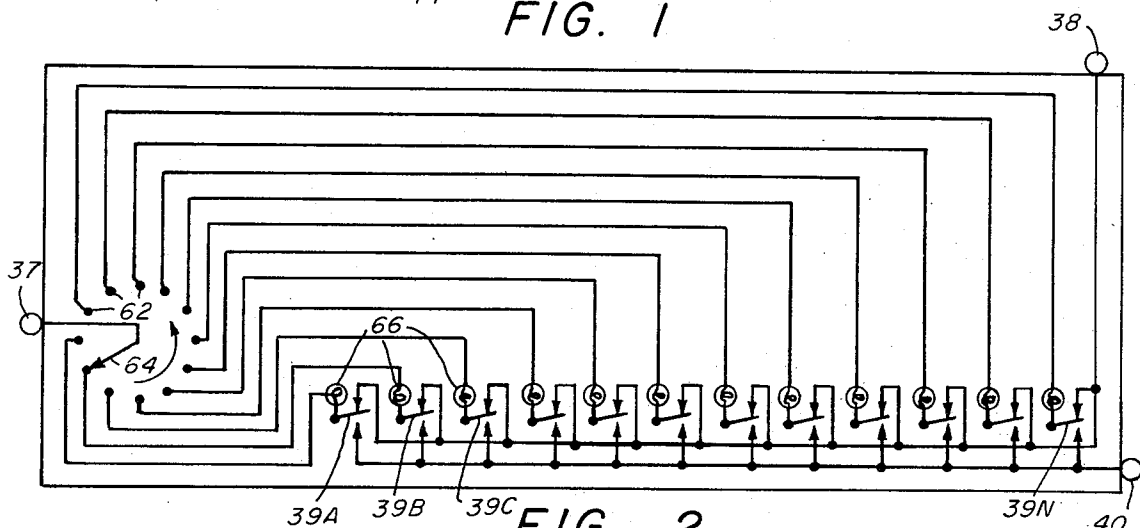


FIG. 2

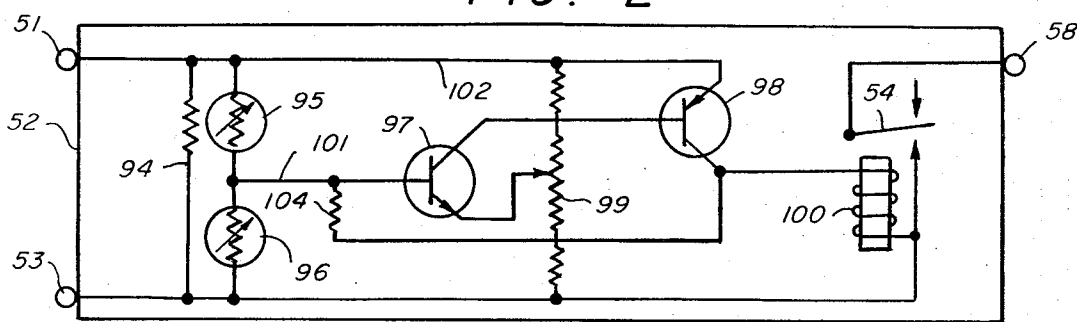
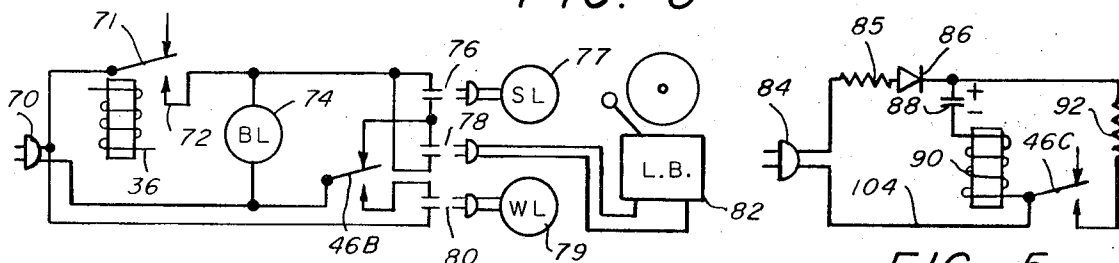


FIG. 3



APPARATUS FOR THE PROGRAMMED TREATMENT OF BED WETTING

BACKGROUND OF THE INVENTION

Programmed enuresis treatment (PET) is a conditioning system designed for the study and/or treatment of enuresis nocturna (bed wetting). PET differs from other conditioning devices for the treatment of bed wetting in several respects, foremost is that PET provides intermittent reinforcement. Intermittent reinforcement may be distinguished from continuous reinforcement in that with the latter, the act of bed wetting is immediately followed by an alarm 100 percent of the time. With intermittent reinforcement the alarm is activated according to a preset schedule of reinforcement. A typical intermittent schedule would be that the large alarm would be activated immediately after wetting 70 percent of the time. It is theorized that intermittent reinforcement should lead to successful treatment of bed wetting, but with a reduction of the relapse rate. It has been shown by various researchers that as many as 50 percent of the children successfully treated with 100 percent continuous reinforcement, resume bed wetting within several months of treatment. Intermittent reinforcement has been investigated in a research study conducted by the inventor whose preliminary findings indicate that the relapse rate is significantly reduced in the intermittent reinforcement treatment group compared to the rate of relapse in the continuous reinforcement group.

This invention is in the field of instrumentation. More particularly, it is in the field of instrumentation for the study and treatment of bed wetting.

SUMMARY OF THE INVENTION

It is a primary object of this invention to provide an apparatus which can be used to treat children for bed wetting in a program that will not only provide a cure, but will also provide a smaller percentage of relapse than for those treatments provided by prior art instrumentation.

This and other objects are realized and the limitations of the prior art are overcome in this invention by providing a programmed schedule of reinforcement. The PET system of this invention regards each act of bed wetting as a trial. The trials in which the alarm is not activated upon wetting are called "non reinforcement trials." Thus, in a 70 percent reinforcement schedule seven out of 10 wetting incidents will be followed with an immediate alarm which would waken the patient. The other three trials would be nonreinforced. In a nonreinforced trial the act of wetting would trigger a time delay which would then (say 20 minutes later) activate a small signal located in the patient's caretaker's room. The 20 minute delay is such that the patient is very unlikely to benefit from the experience of the wetting incident and being aroused by his caretaker shortly afterwards. Dependent on treatment or research requirements, zero reinforcement may also be programmed on the apparatus of this invention. With a zero reinforcement schedule the phenomenon of bed wetting can be studied and evaluated within a patient without affecting any of the parameters of bed wetting in a therapeutic manner. When used as a research-treatment device PET will also provide a count of the number of wettings that have occurred within any par-

ticular night. The apparatus can count up to any desired number of wetting incidents before it automatically recycles.

PET differs from all other prior art enuresis treatment devices presently available in that it provides intermittent and zero reinforcement as well as continuous reinforcement. PET achieves this capability through a programming system. The core of the programming system is an electronic stepper relay. Each point of the stepper relay is wired to a single pole, double throw switch. With a 12 point stepper relay there would be 12 single pole, double throw switches. PET is programmed to activate either the large immediate alarm or the smaller 20 minute delay alarm depending on the position of the switch on any particular trial. If the switch is placed in the up position the large immediate alarm is activated on the wetting incident, whereas, if the switch is placed in the down position the 20 minute timer is activated, which after 20 minutes activates the small alarm in the parent's room. Thus each point of the stepper represents a trial (wetting incident) and can be programmed, depending on the switch positions for that point, to provide either immediate reinforcement or a nonreinforced trial. The stepper automatically advances to the next point (trial) when either the immediate or delayed alarm is shut off. When either alarm is shut off the PET is then deactivated and cannot respond to the alarm. A service light is provided which cannot be turned out until the PET is again reactivated. The presence of the service light forces the caretaker to remember to reactivate PET in order to detect the next wetting incident. The act of reactivation of the PET causes the service light to be shut off automatically. Finally, PET features a wet pad light which is lit as long as there is moisture on the pad even when the PET is inactivated. This light informs the parent that the pad is still wet. If PET is reactivated when the wet pad light is on, PET will respond by activating one of the two alarms, depending on its program. PET is able to count the number of wettings and thereby identify the position of the stepper relay through a series of very small light bulbs wired in series with each single pole, double throw switch.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects of this invention and a better understanding of the principles and details of the invention will be evident from the following description taken in conjunction with the appended drawings, in which:

FIG. 1 is a schematic diagram of the principal circuit of the invention.

FIG. 2 illustrates a detail of the circuit of FIG. 1 comprising the stepping switch and the programming switches.

FIG. 3 illustrates a detail of FIG. 1 comprising a time delay relay.

FIG. 4 illustrates the circuit controlled by the principal relay which sounds the principal alarm.

FIG. 5 indicates the control of the stepping relay.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings and in particular to FIG. 1, numeral 10 indicates generally the circuit diagram of the apparatus. There is a battery which is nominally 6 volts, which goes to switch 14 which has three

positions in which the switch blade goes to contact 14A, 14B, or 14C. Contact 14C is the off position. Contact 14B is a test position and there is a spring return to bring the blade 14 back to contact 14C. The positive end of the battery 12 is connected through switch 14 to line 16 while the opposite pole 14' is connected through contacts 14A' to line 44.

There is a bed wetting detection pad which is represented as a variable resistance 18 in series with a control resistance 20 connected across the battery 12. The pad 18 comprises a sheet of rubber into which is molded a network of wires in such a manner that any moisture on the surface of the pad will conduct current between the wires and thus reduce the resistance 18 to a small value, which is dependent upon the amount of the conducting liquid between the wires. The pad is made so that by using a dry towel to sponge off the surface, the surface can be dried to a point where the resistance will again go to a high value until the next bed wetting episode occurs.

The pad resistance 18 in series with resistance 20 provides a potentiometer with the midtap line 25 going to the base of the transistor 24. When the resistance 18 drops to a low value the potential of line 25 rises and causes the transistor 24 to conduct current from line 16 through lead 26 to lead 28 which is connected to the base of transistor 30. Conduction through transistor 24 causes transistor 30 to conduct and pass current from line 16 through relay coil 36 through lead 38 to switch 39 to lead 37 and lead 41 through transistor 30 and lead 42 to return lead 44 to the battery.

Relay coil 36 is illustrated in FIG. 4 as controlling a relay switch 71. A.C. 115 volt power is applied by lead 70 to the switch 71 controlled by relay coil 36. When the coil is energized, relay 71 pulls in and closes connection to contact 72 which puts a.c. power on plugs 76 and 78. Plug 76 goes to a bright spotlight and plug 78 goes to a very loud signal bell 82. The return circuit is through manual switch 46B back to the power line. In FIG. 1 switch 39 corresponds to one of a plurality of switches which are connected to separate contacts on a multipoint stepping switch 64 of FIG. 2. Referring briefly to FIG. 2 there is shown a lead 37 going to a rotating switchblade 64 which is stepped by a magnetic coil assembly shown in FIG. 5. The switchblade 64 makes contact successively with different contacts 62. Each of these go to a separate lamp 66 in series with a switchblade 39A, 39B, 39C . . . 39N. Each of the switches 39A, 39B, etc. are single pole, double throw manual switches. In the up position the switch connects with a contact point, all of which are tied together and go to terminal 38. In the down position the switches 39 go to a plurality of contacts which are tied together to terminal 40. Thus, the switch 39 corresponds to each one of the switches in FIG. 2. Different actual switches are connected in the circuit in response to the movement of the blade 64. Resistor 23 of FIG. 1 is a current limiting resistance for lamps 66.

When the switches are in the up position as shown and switch 39 goes to contact 38 the relay 36 pulls in and sounds the loud bell 82 and turns on the spotlight 77. When the switchblade 39 is in the down position and contact 37 then makes contact with lead 40, connection then goes to a manual three pole, double throw switch 46 that has three blades 46A, 46B, 46C. Blade 46A goes to a contact leading to relay coil 48 connected to line 16. This switch is only effective when

switch 39 is in the down position. Consider for a moment that the switch 39 is in the down position leading to lead 40 so that when the resistance 18 is reduced due to a wetting incident, the transistor 30 will pass current from line 16 through coil 48 through switchblade 46A through switch 39 through the transistor to the return lead 44. This will pull in the relay contact 50 closing it to lead 51 and applying power to the time delay relay 52. This relay can be set for large time delays, up to 20 minutes or more. At the end of this delay the relay contacts 54 pull in. This places power across the small bell 56 so that it will sound an alarm when the pad 18 is wet.

Switch 60 is a test push button which can be pressed in order to determine whether the alarm bell 56 is working. Similarly, the push button switch 22 can be pushed which provides a resistance between leads 25 and 16 corresponding to the resistance 18 when the pad is wet. This operates the equipment as if there were a wetting incident on the pad 18. This is for test purposes of the equipment.

The time delay relay 52 is illustrated in FIG. 3 where the terminals 51 and 53 correspond to the same terminals in FIG. 1 and terminal 58 corresponds to the lead 58 to the bell 56. When the relay 48 pulls in and contact 50 makes contact with 51, the 6 volt power is applied between terminals 51 and 53 of the circuit of FIG. 3. There is a resistance 94 across the input line which when power is applied, begins to heat up. Resistance 94 and thermistor 95 are both encased in a metal slug so that as the resistor 94 heats up and conducts heat to the metal and so heats the metal up and so heats the thermistor 95, the resistance of the thermistor drops as its temperature increases. A corresponding thermistor 96, which is provided to take account of variations of temperature in the room in which the equipment is installed. If there is no current to 94, then thermistors 95 and 96 both vary somewhat with room temperature. However, when there is power applied, thermistor 95 heats up to a much higher temperature. As it does so its resistance drops the potential of lead 101 rises, and the transistor 97 begins to conduct. This causes conduction through transistor 98 which passes current from lead 102 through transistor 98 through relay coil 100 back to terminal 53. When the relay coil has current the relay contact 54 closes and applies power to lead 58, which causes the alarm 56 to sound. The potentiometer 99 is provided as an adjustment in the delay time. The higher the setting of the potentiometer the longer the delay time and vice versa. Feedback resistor 104 is used to reduce shattering of the relay 100.

Referring now to FIG. 5 there is a circuit provided with 115 volt a.c. power through plug 84. This goes through a high resistance 85 and a diode 86 to a series capacitor 88 and through the coil 90 of a stepping relay and back through lead 104 to the power circuit. Because resistor 85 is a high value, a very small current is provided to charge the capacitor 88 which current is too small to cause the relay to pull in. However, when switch 46C is closed, the charged capacitor 88 is discharged through resistor 92 and through the coil 90 causing the relay to step one position, that is, the switch 64 in FIG. 2 is stepped one position to the next contact. When switch 46C is opened again, the capacitor 88 is again recharged ready for the next operation of the relay when the switch 46C is again closed. It will be

clear that the switch 46A of FIG. 1, 46B of FIG. 4 and 46C of FIG. 5 form a three pole two position switch, which is a manual switch, the operation of which will now be explained.

OPERATION OF THE APPARATUS

The apparatus is operated in the following manner. Power is derived from the battery 12 through switch 14 with positive voltage on lead 16 and negative voltage on lead 44. The resistor 18 representing the resistance of the bed pad is the detector for the wetting event. When this resistance drops to a low value the transistor 24 conducts and so causes transistor 30 to conduct and if the switch 39 is in the up position, which calls for a loud alarm, the relay 36 is closed across the power line and (referring to FIG. 4) the relay contact 71 closes to 72 and applies a.c. power across the blue light 74 which is a signal light indicating that the bed pad is wet and therefore of low resistance. Also, the a.c. power is applied to the plugs 76 and 78 through switch 46B. Plug 76 provides power to a bright signal spotlight shining on the patient and plug 78 goes to a loud bell 82. Both the light and the bell are intended to quickly awaken the patient. Thus, in this condition there is immediate response of alarm, and the patient quickly comes to realize that the alarm is caused by the wetting. This is called a reinforced trial, where there is immediate response to the patient.

On the other hand, when there is to be a nonreinforced trial, the corresponding switch 39 is pushed to the down position where lead 37 connects to lead 40. This takes relay 36 out of service so that the spotlight 77 and loud bell 82 cannot operate. When the pad 18 becomes low resistance the transistor 24 and 30 conduct and pass current from lead 16 through relay coil 48 through switch 46A and relay 48 pulls in, closing contact 50 to contact 51 and starting the time delay of relay 52. When relay 52 pulls in, contacts 54 are closed and the alarm bell 56 sounds. Bell 56 is a soft bell and is normally located in the bedroom of the parent so that the child is not awakened by it.

The parent is awakened and goes to the patient and dries the pad so that its resistance 18 now comes to a higher value. When the parent or caretaker or nurse goes to the patient the first thing he does is to push switch 46A to the bottom contact. This serves to break the alarm by opening relay 48 and shutting off the bell 56. On the other hand, if the switch 39 had been in the up position and relay coil 36 was conducting, opening of switch 46B would cause the circuit to be opened for the alarm bell 82 and signal spotlight 77.

The first thing that the caretaker does is open switch 46A by pushing it to the lower contact. This turns off any alarm that has been sounding. By pushing down switch 46 contact 46B goes to the lower contact and through plug 80 turns on a working light 79. The working light 79 indicates therefore that the switch 46 is in the lower position. This is not a normal position and so whoever is taking care of the patient realizes when the working light is on that the switch 46 must again be raised to activate the apparatus. When it is raised the working light goes off. In FIG. 5 as has been described, the capacitor 88 is in operating condition and charged at all times when there is power on the plug 84. When the caretaker pushes down the switch 46, switch contact 46C is pushed to the lower contact and therefore connects the relay coil 90 through series resistance

92 to discharge capacitor 88, sending a large pulse of current through the relay coil 90 and causing the relay arm 64 to be stepped to the next position. In other words, after each incident has occurred, the caretaker, in turning off the bell or other alarm, turns on the working light and automatically cycles the stepping switch to the next contact. In this way the stepping switch provides a count of the number of events that have occurred up to that time.

There are signal lights 66 in series with each of the switches 39. The purpose of these is to indicate which of the points of the switch 64 is connected to the slider arm 64. This is done by depressing the switch 14 until the contacts 14B and 14B' are in use. When this is done contact 14B, for example, is connected to either lead 38, through switch 39 to lead 37 back through lead 34 to contact 14B' or if the switch 39 is in the down position it goes through switch 46A through 39 and back to 14B'. There will be only one switch 39 in circuit, namely, the one corresponding to the contact on which the blade 64 is resting at that moment. This indicates the serial number of the current wetting event.

When the caretaker has dried the pad 18 so that the blue light has gone off, he observes that the working light 79 is still on and indicates that the apparatus is not in operating condition until switch 46 is placed in the upper position. When this is done the signalling system is again put into readiness for operation and the switch 46C is opened permitting the capacitor 88 to recharge again in readiness for the next operation.

While the invention has been described with a certain degree of particularity, it is manifest that many changes may be made in the details of construction and the arrangement of components. It is understood that the invention is not to be limited to the specific embodiments set forth herein by way of exemplifying the invention, but the invention is to be limited only by the scope of the attached claim or claims, including the full range of equivalency to which each element or step thereof is entitled.

What is claimed is:

1. Apparatus for the programmed treatment of bed wetting, comprising:

- a. means to detect each incident of bed wetting;
- b. first alarm means responsive to said means to detect to awaken the patient promptly on detection of bed wetting;
- c. second alarm means responsive to said means to detect, to awaken a caretaker after a selected time delay; and
- d. programmable selector means for selecting which of a series of successive incidents of bed wetting will operate said first alarm, and which will operate said second alarm.

2. The apparatus as in claim 1 in which said means to detect comprises insulated sheet means with a plurality of conductors embedded in the surface.

3. The apparatus as in claim 1 in which said programmable selector means comprises a multicontact stepping switch with a plurality of single pole, double throw selector switches, each connected to one contact on said stepping switch.

4. The apparatus as in claim 1 including switch means to manually turn off said alarms and including working light means adapted to be turned on when said switch means is turned off.

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5. In an apparatus for the programmed treatment of bed wetting, including means for detecting each incident of bed wetting, and first alarm means to waken the patient immediately, and second means to waken the caretaker after a selected time delay, the method of operation comprising:

- a. detecting each incident of bed wetting;
- b. responsive to each said incident, initiating one or the other of said first alarm or said second alarm; and
- c. programming the selection of said first and second

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alarms for each successive incident.

6. The apparatus as in claim 5 in which said selection is made on a random basis.

7. The apparatus as in claim 5 in which said first alarm is selected on the occurrence of at least 50 percent of said incidents.

8. The apparatus as in claim 5 in which said first alarm is selected on the occurrence of at least 70 percent of said incidents.

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