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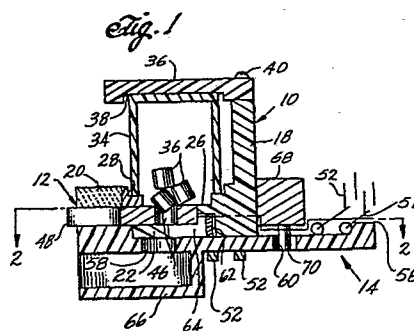
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54 **Product dispensing device and method.**

57 A product dispenser includes a storage station (34) for storing items of a product to be dispensed, an exit from the dispenser (58), and an intermediate station (46) inaccessible from the exit except during delivery of an item to the exit. A transport member (12) carries one item or a predetermined number of items of the product at a time from the storage station to the intermediate station. An item or the predetermined number of items at the intermediate station are delivered to the exit through a gate (14) movable between an open position and a closed position. A perceptual indication of the presence of an item or the predetermined number of items at the intermediate station is given by a window (20) in the dispenser or other means so the user may know when to open the gate. A latch (70) enables and disables the gate responsive to a timer at prescribed time intervals and another latch (62) disables the transport member when the gate is open so delivery of the prescribed number of items to the exit may not be exceeded.



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PRODUCT DISPENSING DEVICE AND METHOD

Background of the Invention

This invention relates to the product dispensing art and, more particularly, to a device and method for reliably
15 dispensing controlled amounts of product such as medication.

Effective drug treatment by physicians often depends upon patient compliance in following the prescribed regimen of drug dosage. One apt example of this is the treatment of schizophrenic patients with tranquilizers and anti-
20 depressants such as lithium and librium. The common experience has been that, as a patient begins to feel better, he stops taking the medication, either intentionally or by forgetting. As the body fully metabolizes the medication, symptoms reappear. The patient sometimes then attempts to take excessive
25 medication, thereby causing adverse psychological consequences.

There are a number of known medication dispensers that release pills or capsules at prescribed timed intervals. However, it is believed that all such dispensers can only handle pills or capsules stored in ordered fashion.

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1 Summary of the Invention

The invention permits units of a product, such as medication, stored with random orientation to be dispensed one at a time or a predetermined number at a time at
5 prescribed time intervals.

One aspect of the invention is a product dispenser including a storage station for storing items of a product to be dispensed, an exit from the dispenser, and an intermediate station inaccessible from the exit except during
10 delivery of an item to the exit. A transport member carries one item or a predetermined number of items of the product at a time from the storage station to the intermediate station. In the preferred embodiment, an item or the predetermined number of items at the intermediate
15 station are delivered to the exit through a gate movable between an open position and a closed position. A perceptual indication of the presence of an item or the predetermined number of items at the intermediate station is given by a window in the dispenser or other means so the user may know
20 when to open the gate. A latch enables and disables the gate responsive to a timer at prescribed time intervals and another latch disables the transport member when the gate is open so delivery of the prescribed number of items to the exit may not be exceeded.

25 Provision of the intermediate station permits items of the product to be stored in random orientation at the storage station. Since the transport member can only carry one item or a predetermined number of items at a time, an excessive number of items cannot reach the intermediate station before
30 the gate is opened. If too few items or no items reach the intermediate station, the user can continue to operate the transport member until the prescribed number of items are there present for delivery to the exit before opening the gate.

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- 1 Another aspect of the invention is a method for dispensing medication in pill form at prescribed time intervals comprising the steps of storing the pills in a chamber with random orientation, ascertaining the presence
5 or absence of a pill at an inaccessible position, attempting to carry the pills singly from the chamber to the inaccessible position until one pill reaches the inaccessible position and, after ascertaining the presence of a pill at the inaccessible position, delivering such pill to the
10 exit at a prescribed time interval.

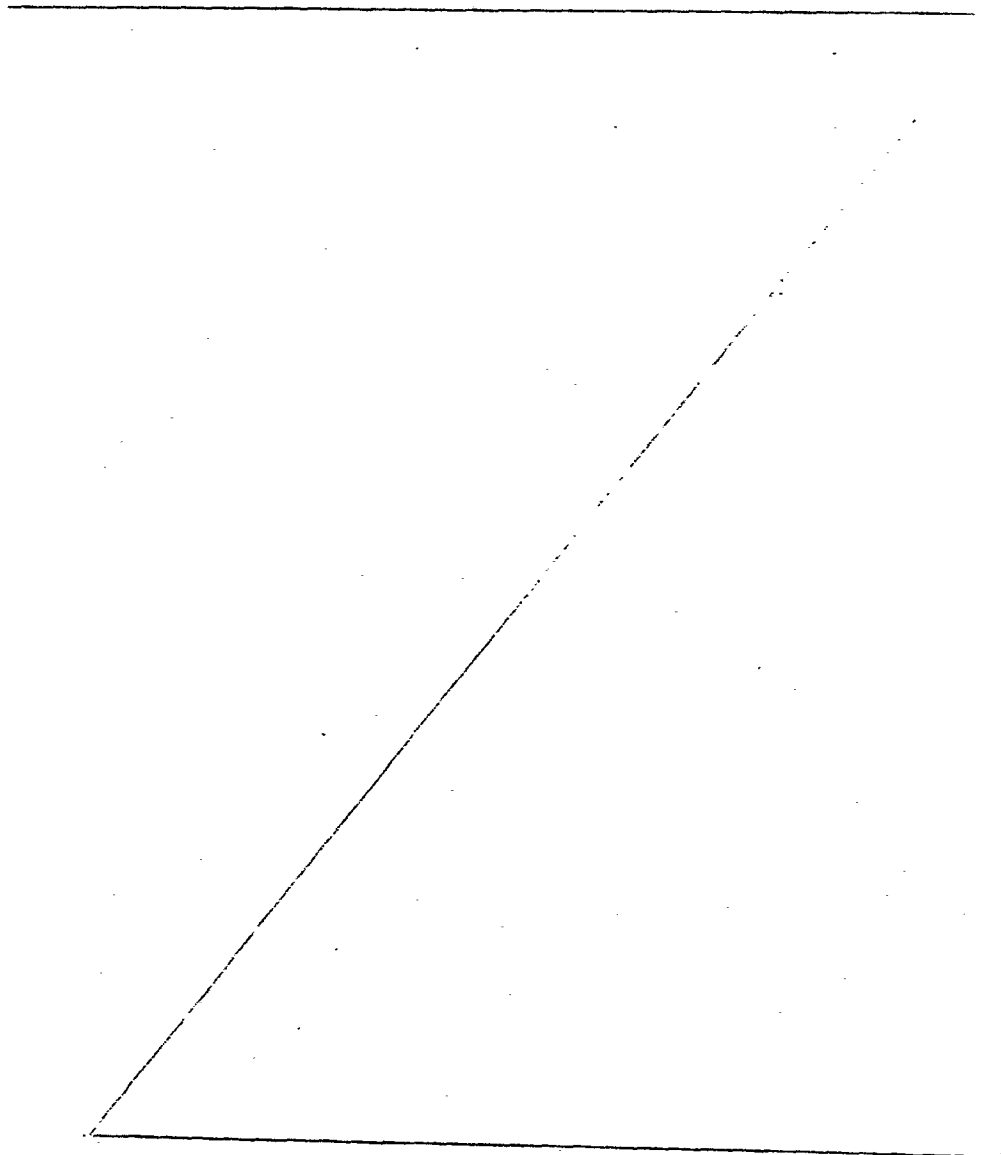
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1 Brief Description of the Drawings

The features of a specific embodiment of the best mode contemplated of carrying out the invention are illustrated in the drawings, in which:

5 FIG. 1 is a side-sectional view of a product dispenser incorporating the principals of the invention;

FIG. 2 is a top-sectional view of the dispenser through plane 2-2 of FIG. 1;

FIG. 3 is a perspective view of the gate of the dispenser;

10 FIG. 4 is a perspective view of the dispenser body; and

FIG. 5 is a schematic, partially block diagram of electrical circuitry for controlling the dispenser.

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1 Detailed Description of the Specific Embodiment

5 In FIGS. 1 and 2, a product dispenser comprises a base 10, a rotatable wheel-shaped transport member 12, and a translatable gate 14. As depicted in FIG. 4, base 10 is basically rectangular in shape. It has a horizontal top surface 16 from which a vertical cap mounting wall 18 perpendicularly extends. A window 20 is formed of a transparent material at the front of base 10 adjacent to top surface 16. A semi-circular, horizontally extending slot 10 24 is formed in the front of base 10 under window 20. An opening 26 surrounded by an upwardly facing recess 28 extends from the top of base 10 to slot 24. A rectangular groove 32 is formed in the bottom of base 10 below slot 24 from front to rear. Groove 32 has a step 30 near the front of base 10, which makes the front of groove 32 open into slot 24 and the back of groove 32 shallower than the front. A portion 22 of base 10 separates the back of groove 32 from the portion of slot 24 below opening 26.

20 As illustrated in FIG. 1, a cylindrical product container 34 is mounted in recess 28 with its open top facing down. Randomly oriented items 36 such as pills or capsules of medication having the same size and shape are stored in container 34. A cap 36 has a circular recess 38 for receiving the upturned bottom of container 34. Cap 36 is secured 25 on the end of mounting wall 18 by fasteners 40 so as to clamp container 34 to base 10. If desired, a lock could be provided to prevent unauthorized removal of container 34. Opening 26 is substantially larger than items 36 so as to permit unobstructed passage thereof to bore 46.

30 Transport member 12 fits in slot 24, where it is guided for free rotation by the circular side wall of slot 24, which extends substantially more than half way around transport member 12. A portion of transport member 12 protrudes out of slot 24 in front of base 10 to permit its rotation by 35 the user's thumb. Transport member 12 has an off-center

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1 axial bore 46, which forms a cavity therein. Bore 46 is
sufficiently large to hold one, and only one, of items 36,
i.e., it is not large enough under any circumstances to
hold two or more items thereof. Bore 46 is so positioned in
5 transport member 12 that as transport member 12 rotates,
bore 46 passes under opening 26 in base 10, thereby permit-
ting one of items 36 to enter bore 46 by force of gravity.
Slight reciprocating motion of transport 12 may be necessary
to assist alignment of an item with bore 46. Opposite bore
10 46, transport member 12 has a radial slot 48. Bore 46 is
suitable for round items. Generally, the shape of the open-
ing in transport member 12 would match that of the item.

Gate 14 comprises an elongated slide portion 50 having
a rectangular cross section fitting in groove 32 of base 10.
15 Slide portion 50 has a central portion that translates back
and forth in groove 32. The height of this central portion
is the same as the depth of the back of groove 32, so
that it is flush with the bottom surface of base 10. Gate
14 is held in groove 32 by bars 52 or other means attached
20 to the bottom surface of base 10. Slide portion 50 has a
stepped stop portion 54 at its front end and a ramped cam
portion 56 at its rear end. Near stop portion 54, a rec-
tangular opening 58 extends through slide portion 50 from
end-to-end parallel to bore 46. The height of stop portion
25 54 is the same as the depth of the front of groove 32, so
that it is flush with the bottom surface of base 10. Near
cam portion 56, slide portion 50 has a hole 60. A peg 62
extends upwardly from the top surface of slide portion 50
between bore 58 and hole 60. Peg 62 is sufficiently small
30 to fit in slot 48. Peg 62 rides in a slot 64 formed in base
10 along part of the length of groove 32. Slot 64 is so
positioned to extend forward and rearward of slot 24 as
shown in FIG. 2 and is sufficiently deep to extend vertically
from groove 32 to approximately the middle of slot 24 so as
35 to be able to carry peg 62 into and out of engagement with

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1 slot 48. Gate 14 also has a box-shaped exit portion 66 extending downwardly and forwardly of slide portion 50 so as to lie under bore 58. Gate 14 is translatable between a closed position in which stop 54 abuts step 30 and an open position in which peg 62 abuts the front of slot 62. In the closed position of gate 14, opening 58 lies under portion 22 of base 10 as shown in FIG. 1. Thus, none of items 36 can pass through opening 58 to exit portion 66. In the open position of gate 14, opening 58 lies in front of step 30 in the path of bore 46 so that bore 46 and opening 58 are alignable with each other. However, gate 14 cannot be opened unless slot 48 is aligned with peg 62, which requires bore 46 to be in front of base 10 as shown in FIG. 2.

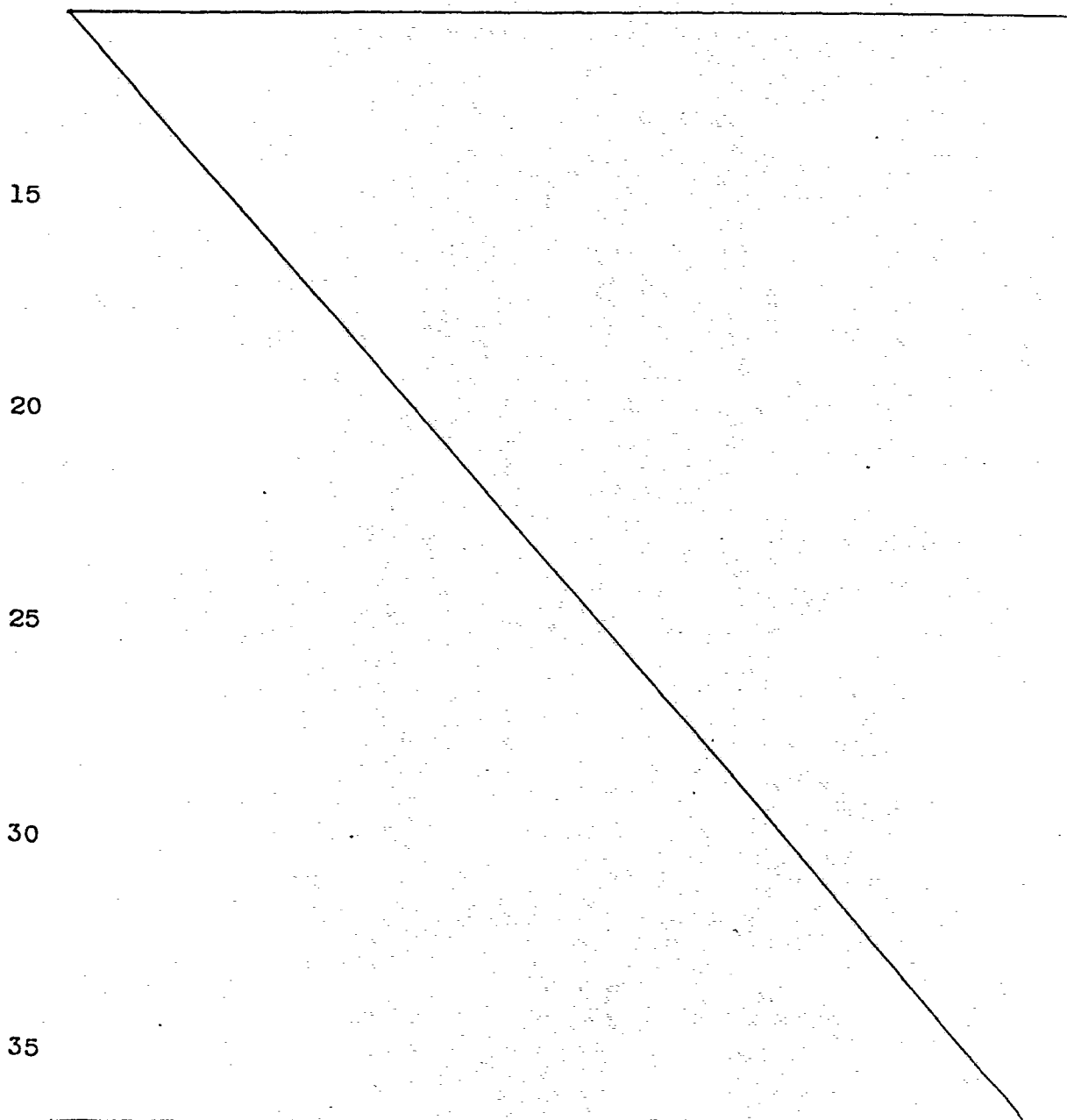
15 A solenoid actuator 68 is attached to the back of base 10 by means not shown. Actuator 68 has a retractable, i.e., axially movable, pin 70 which is aligned with hole 60 when gate 14 is in its closed position. Pin 70 is biased downwardly by a spring not shown so it is normally inserted in hole 60. When actuator 68 is energized, pin 70 is retracted from hole 60 by the solenoid. Normally open microswitches S1 and S2 are arranged in the path of gate 14 so as to be closed successively, first switch S1 and then switch S2, by cam portion 56, as gate 14 moves away from its closed position toward its open position. Hole 60 is sufficiently large relative to pin 70 to permit movement of gate 14 toward its open position sufficiently for cam portion 58 to actuate switch S1 with pin 70 in hole 60.

In operation, gate 14 is normally closed and pin 70 is inserted in hole 60 so that gate 14 is latched and cannot be translated to its open position. As cam portion 56 moves over switch S₁, actuator 68 is not energized so pin 70 continues to latch gate 14 in its closed position. At prescribed time intervals, as described below in detail in connection with FIG. 5, an alarm is given to the user of the dispenser that one item of the product may be taken therefrom.

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1 Thereafter, when the user acknowledges the alarm and begins
to translate gate 14 toward its open position and cam portion 56 passes over switch S1, actuator 68 is energized to retract pin 70, which unlatches gate 14 and permits the user
5 to open gate 14. As cam portion 56 passes switch S2 while opening gate 14, actuator 68 is de-energized and the circuit is reset. Prior to opening gate 14, the user rotates
transport member 12 with his finger to swing bore 46 from a position under container 34 to a position under window 20,
10 which is called herein the "intermediate station." Transport



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1 member 12 normally carries with it one of items 36 from container 34 to the intermediate station. The user can ascertain the presence of one of items 36 at the intermediate station by observation through window 20. If transport member 12
5 fails to carry one of items 36 with it to the intermediate station, the user can try again until he is successful in carrying one of units 36 to the intermediate station, before translating gate 14 to its open position. If the user fails to carry an item to the intermediate station before opening
10 gate 14, he loses the opportunity to recover an item until the next prescribed time interval has elapsed because gate 14 can only be opened once at each time interval. When one of items 36 is at the intermediate station, the user opens gate 14, causing the item at the intermediate station to fall through
15 bore 58 by force of gravity onto exit portion 66, where the user can gain access to such item. While gate 14 is open, transport member 12 is latched in place at the intermediate station by the presence of peg 62 in slot 48 so that the user cannot carry more items to bore 58. Peg 62 prevents the
20 opening of gate 14 unless transport member 12 is at the intermediate station. When the user closes gate 14 again, pin 70 is urged by the actuator spring into hole 60, thereby latching gate 14 in its closed position once again until the next time interval has elapsed. In summary, the user can retrieve one,
25 and only one, of units 36 at a time and only at prescribed time intervals, although the items are stored with random orientation in their container.

FIG. 5 shows a preferred arrangement for electrically controlling actuator 68, the solenoid of which is represented
30 as a coil 72. The output of a digital clock 74 is coupled by a decoder 76 to one set of inputs of each of coincidence gates 78 and 80. The positive terminal of a battery 82 is coupled by a plurality of individually actuatable timing switches 84 to the other set of inputs of coincidence gate 78.

1 Similarly, the positive terminal of battery 82 is coupled
by a plurality of individually actuatable timing switches 86
to the other set of inputs of coincidence gate 80. The
states of timing switches 84 determine the prescribed time
5 intervals at which items may be recovered from the dispenser
and the states of timing switches 86 determine the time
window after the lapse of each interval during which the items
may be recovered from the dispenser. R-S flip-flops (FF) 88
and 90 each have an S input, an R input, a Q output, and a
10 $\bar{Q}$ output. The output of coincidence gate 78 is connected to
the S input of flip-flop 88. The output of an AND gate 92 is
connected to the R input of flip-flop 88. The output of
coincidence gate 78 is connected to one input of AND gate 92.
The positive terminal of battery 82 is coupled through a
15 normally open, manually operated switch 94 to the other input
of AND gate 92. The Q output of flip-flop 88 is connected
to the S input of flip-flop 90 and to a beep oscillator 96.
Beep oscillator 96 drives a loud speaker 98. The output of
an OR gate 100 is connected to the R input of flip-flop 90.
20 The output of coincidence gate 80 is connected to one input
of OR gate 100. The positive terminal of battery 82 is
coupled through switch S_2 to the other input of OR gate 100.
The Q output of flip-flop 90 and the $\bar{Q}$ output of flip-flop 88
are connected to the inputs of an AND gate 102. Switch S_1
25 and solenoid coil 72 of actuator 68 are connected in series
between the output of AND gate 102 and the negative terminal
of battery 82, which is grounded.

In operation, when the decoded output of clock 74
coincides with the beginning of one of the time intervals,
30 flip-flop 88, which serves as an actuating flip-flop, is set by
coincidence gate 78, thereby turning on beep oscillator 96
and setting flip-flop 90. Flip-flop 90 serves as a control
flip-flop. As a result, speaker 98 produces an audible alarm,
which alerts the user. The user then closes switch 94 to
35 acknowledge his awareness of the availability of an item, which

1 resets flip-flop 88. The output of AND gate 102 is then energized because both its inputs are energized. This enables gate 14. When switch S1 is thereafter closed by cam portion 56, solenoid coil 72 is energized by the output of
5 AND gate 102. When switch S2 is subsequently closed by cam portion 56, flip-flop 90 is reset, thereby de-energizing solenoid coil 72 and disabling gate 14.

If the user does not retrieve an item within the prescribed time period, i.e., does not open gate 14, flip-flop
10 90 is reset by coincidence gate 80 so that thereafter an item cannot be recovered until the elapse of another time interval, at which time flip-flop 88 is again set by coincidence gate 78.

By way of example, if it is desired to dispense an item at 8-hour intervals, namely at 8 a.m., 4 p.m., and mid-
15 night and to provide a one-hour time window, switches 84 would be set so coincidence gate 78 produces indications at 8 a.m., 4 p.m., and midnight and timing switches 86 would be set so coincidence gate 80 produces indications at 9 a.m., 5 p.m., and 1 a.m.

20 The logic of the use of the dispenser calls for gate 14 to be opened upon coincidence of the following conditions: first, an item at the intermediate station and second, the elapse of the prescribed time interval. In the described mode of operation, the first condition is determined by the
25 user. Alternatively, it could be determined by a sensor such as a photocell, in which case an AND gate could be added to set flip-flop 88. (The sensor and coincidence gate 78 would be connected to its inputs.)

The described embodiment of the invention is only considered
30 to be preferred and illustrative of the inventive concept; the scope of this invention is not to be restricted to such embodiment, various and numerous other arrangements may be devised by one skilled in the art without departing from the spirit and scope of this invention. For example, bore 46 could be dimen-
35 sioned relative to the size of items 36 to carry to the

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1 intermediate station 2, 3, 4, or other predetermined number
of items at a time rather than one; this could be carried
to the extreme, where the described device is used to dispense
product in powder form. Furthermore, instead of window 20,
5 other means such as a sensor and an alarm could be used to
provide a perceptual indication of the presence of an item at
the intermediate station. Moreover, transport member 12 could
be translatable instead of rotatable or gate 14 could be
rotatable instead of translatable. Further, gate 14 could be
10 automatically controlled to open responsive to coincidence
gate 78 if desired and/or transport member 12 could be auto-
matically controlled responsive to a sensor to keep operating,
i.e., rotating, until an item is at the intermediate station.

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1 WHAT IS CLAIMED IS:

1. A product dispenser comprising:
a storage station for storing items of a product
5 to be dispensed;
an exit from the dispenser;
an intermediate station inaccessible from the exit
except during delivery of an item to the exit;
means for carrying one item of the product at a
10 time from the storage station to the intermediate station;
means for providing a perceptual indication of
the presence of an item at the intermediate station; and
means for delivering an item at the intermediate
station to the exit.

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2. The dispenser of claim 1, additionally comprising
timing means and means responsive to the timing means for
enabling and disabling the delivering means.

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3. The dispenser of claim 2, in which the means for
enabling and disabling the delivering means comprises
means for enabling the delivering means responsive to the
timing means at predetermined time intervals and for disabling
the delivering means after every delivery thereby of an item
25 to the exit.

25

4. The dispenser of claim 2, in which the means for
enabling and disabling the delivering means comprises means
for enabling the delivering means responsive to the timing
30 means at predetermined time intervals and for disabling the
delivering means after every delivery thereby of an item to
the exit or a predetermined time duration after every en-
ablement, whichever occurs first.

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1 5. The dispenser of claim 3, in which the means
for providing a perceptual indication comprises a window
in the dispenser between the exterior thereof and the
intermediate station.

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 6. The dispenser of claim 5, additionally comprising
means for disabling the carrying means during delivery of
an item to the exit by the delivering means.

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 7. The dispenser of claim 6, in which the storage
station includes a base having an opening larger than one
item of the product and means for clamping a product
container above the opening.

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 8. The dispenser of claim 7, in which the carrying
means comprises a movable transport member having a cavity
large enough to hold one item but not large enough to hold
more than one item, the cavity being movable from a position
underneath the opening of the base to a position at the
intermediate station.

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 9. The dispenser of claim 8, in which the transport
member is a rotatable wheel and the cavity is an axial
transport bore extending through the wheel from end to end.

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 10. The dispenser of claim 9, in which the delivering
means is a movable gate having a gate bore from end to end
parallel to the transport bore, the gate bore being movable
between a closed position in which it is out of alignment
with the transport bore and an open position in which it is
aligned with the transport bore to permit items at the
intermediate station to fall through the gate bore to the
exit.

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1 11. The dispenser of claim 10, in which the gate is
translatable between the closed position and the open
position.

5 12. The dispenser of claim 11, in which the disabling
and enabling means comprises a hole in the gate, an axially
movable pin aligned with the hole in the gate in its closed
position, and means responsive to the timing means for
retracting the pin from the hole and inserting the pin in
10 the hole.

13. The dispenser of claim 12, in which the means for
disabling the carrying means comprises a slot in the wheel
diametrically opposite the transport bore and a pin in the
15 gate positioned to engage the slot when the transport bore
is at the intermediate station, thereby preventing rotation
of the wheel.

14. The dispenser of claim 13, in which the pin is
20 normally inserted and the means for retracting and inserting
the pin comprises:

storage means for storing one or more preset times;
means for comparing the one or more preset times
in the storage means with the indication of the timing means;
25 a sensual indicator;
a control flip-flop having a first state and a
second state;

means upon coincidence of the indication of the
timing means and the one or more preset times for actuating
30 the indicator and for setting the control flip-flop in its
first state;

a normally open pin retracting switch closed by the
movement of the gate away from its closed position; and

means responsive to the closure of the switch when
35 the control flip-flop is in its first state for retracting the
pin.

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1 15. The dispenser of claim 14, additionally comprising
a normally open reset switch closed responsive to the
movement of the gate away from its closed position further
than the movement required to close the pin retracting
5 switch and means responsive to the closure of the reset
switch for resetting the control flip-flop to its second
state.

16. The dispenser of claim 15, in which the means for
10 actuating the indicator comprises:

an actuating flip-flop having a first state and
a second state;

means upon coincidence of the indication of the
timing means and the one or more preset times for setting
15 the actuating flip-flop in its first state;

means for connecting the actuating flip-flop to
the indicator to actuate the indicator when the actuating
flip-flop is in its first state; and

means after setting the actuating flip-flop in
20 its first state for resetting the actuating flip-flop in
its second state responsive to a manually operable switch.

17. The dispenser of claim 16, additionally comprising
means for connecting the actuating flip-flop to the control
25 flip-flop to set the control flip-flop in its first state
when the actuating flip-flop is set in its first state.

18. The dispenser of claim 17, in which the means for
retracting the pin is responsive to the closure of the pin
30 retracting switch when the control flip-flop is in its first
state and the actuating flip-flop in its second state.

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1 19. The dispenser of claim 1, in which the means for
providing a perceptual indication comprises a window in the
dispenser between the exterior thereof and the intermediate
station.

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20. The dispenser of claim 1, additionally comprising
means for disabling the carrying means during delivery of;
an item to the exit by the delivering means.

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21. The dispenser of claim 1, in which the carrying
means comprises a movable transport member having a cavity
large enough to hold one item but not large enough to hold
more than one item, the cavity being movable from a position
underneath the opening of the base to a position at the
15 intermediate station.

22. The dispenser of claim 1, in which the delivering
means is a movable gate having a gate bore from end to end,
the gate bore being movable between a closed position in
20 which it is out of alignment with the intermediate station
and an open position in which it is aligned with the
intermediate station to permit items at the intermediate
station to fall through the gate bore to the exit.

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23. A method for dispensing medication in pill form
at prescribed timed intervals comprising the steps of:

storing the pills in a chamber with random
orientation;

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ascertaining the presence or absence of a pill
at an inaccessible position;

attempting to carry the pills singly from the
chamber to the inaccessible position until one of the pills
reaches the inaccessible position; and

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after ascertaining the presence of a pill at the
inaccessible position, delivering such pill to an exit after
elapse of a prescribed time interval.

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1 24 . The method of claim 23, additionally comprising the
step of preventing performance of the step of attempting to
carry the pills during the delivering step.

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Fig. 1

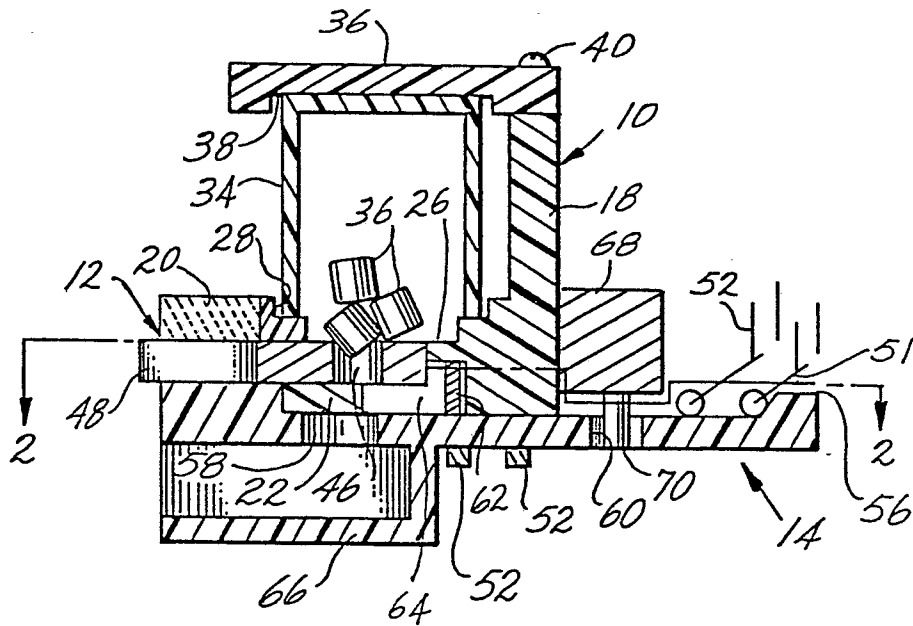


Fig. 2

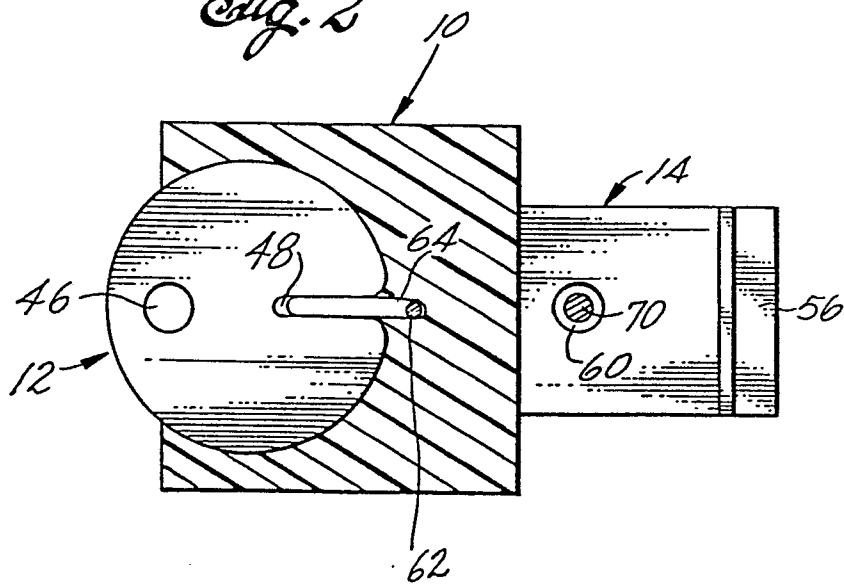


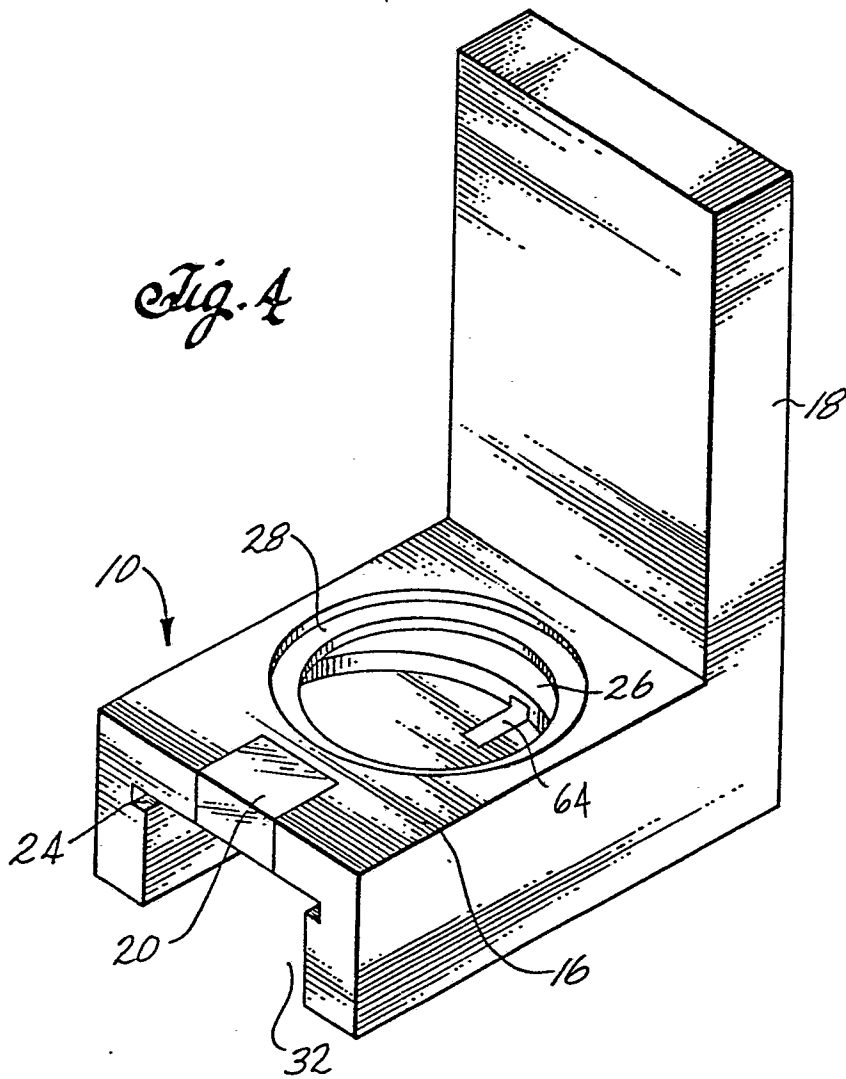
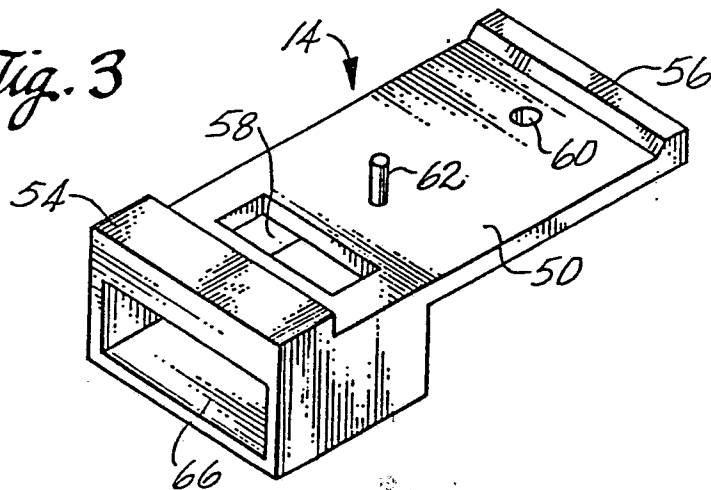
Fig. 4*Fig. 3*

Fig. 5

