United States Patent

Conklin et al.

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[45] **Feb. 1, 1972**

[54] CODED ORAL SOLIDS MAGAZINE AND DISPENSER

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[73] Assignee: **Brunswick Corporation,** by said Conklin and said Rogers

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[21] Appl. No.: **13,465**

[52] **U.S. Cl.** **141/98,** 141/104, 141/320

[51] **Int. Cl.** **B65b 1/04,** B65b 3/04

[58] **Field of Search** 141/1, 100–107, 141/98, 94, 231, 234–248, 250–284, 285, 291–294, 311, 319–322, 351–362, 363–366; 340/172.5

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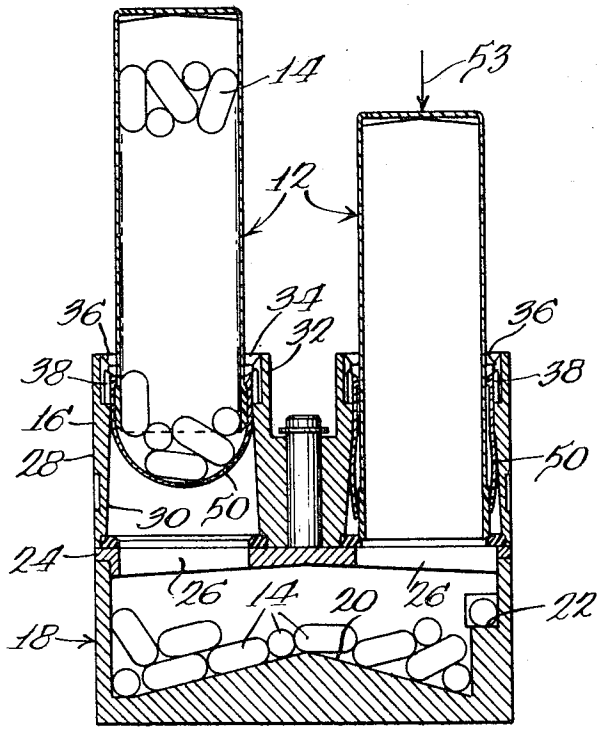
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[57] **ABSTRACT**

A pill-containing magazine and dispensing receptacle combination for use in pill-dispensing systems of the type having a plurality of receptacles, each for dispensing a different type of pill. Each magazine is provided with a code representing the type of pill contained therein and each receptacle from which the pills are to be dispensed is provided with a code sensing means that precludes operative association of a magazine bearing the wrong code, and therefore containing the wrong type of pill, with the receptacle to insure that only the correct type of pill can be dispensed from a given receptacle.

12 Claims, 10 Drawing Figures



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SHEET 1 OF 3

Fig. 1.

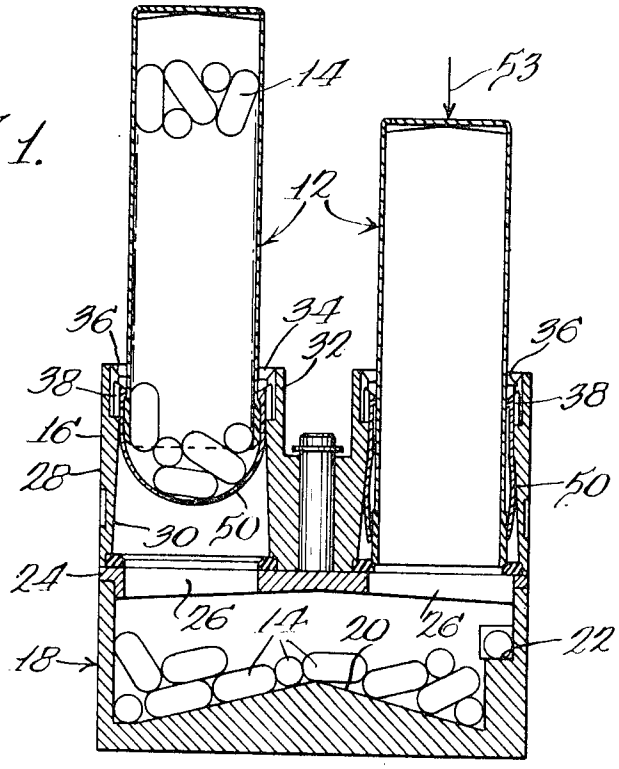
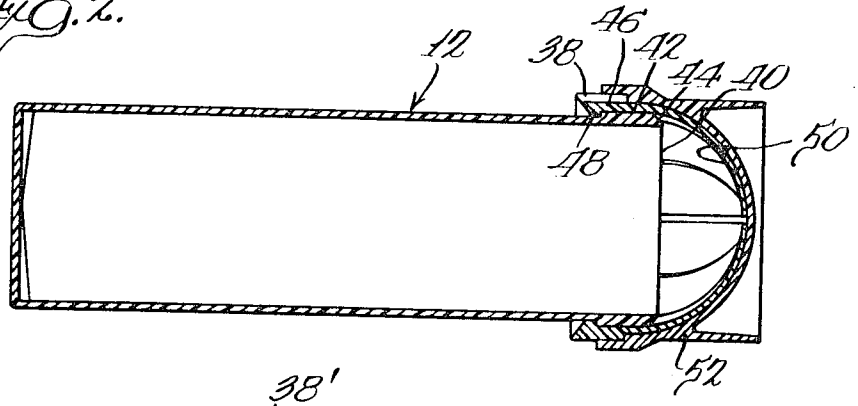


Fig. 2.



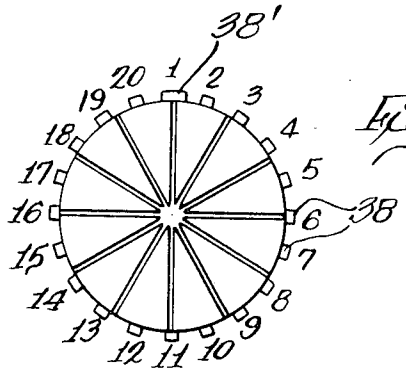


Fig. 3.

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Attys

Fig. 4.

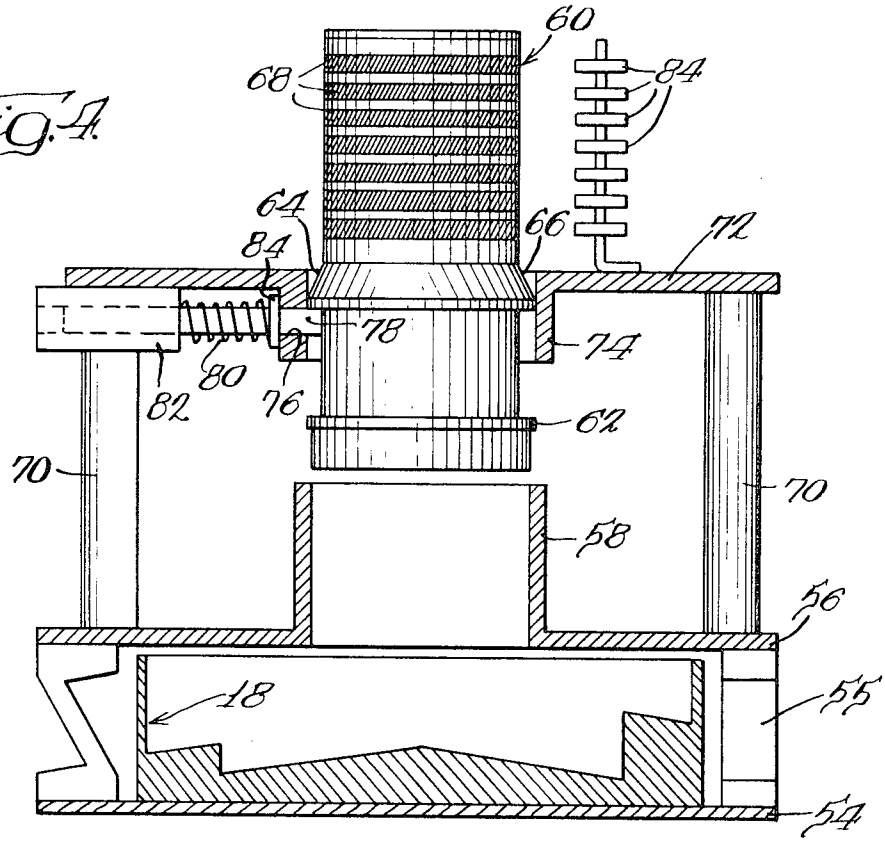

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Fig. 5.

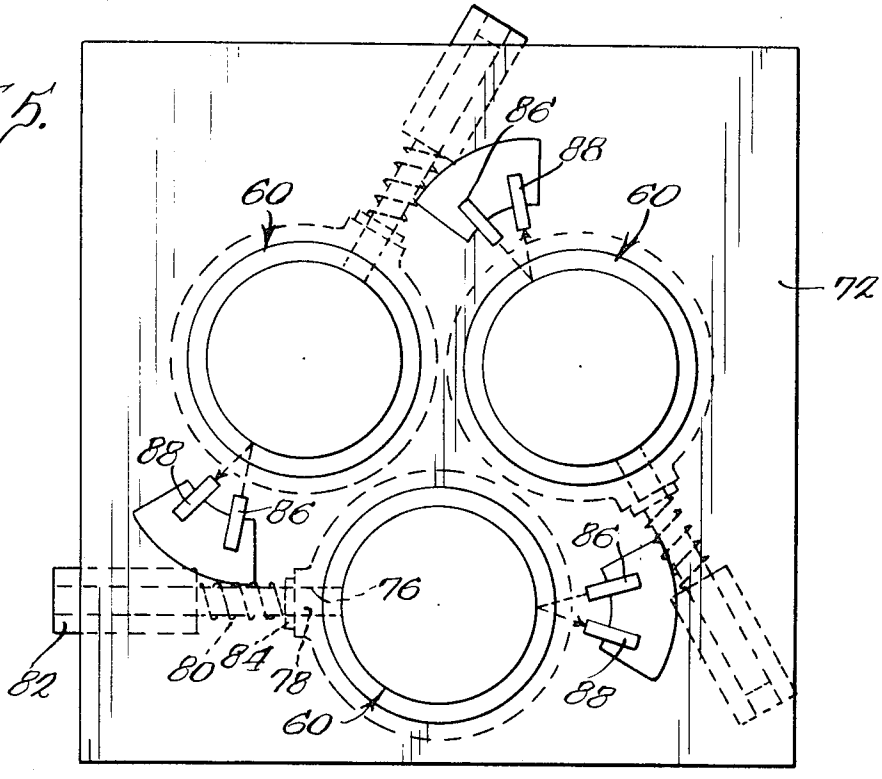

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Fig. 6.

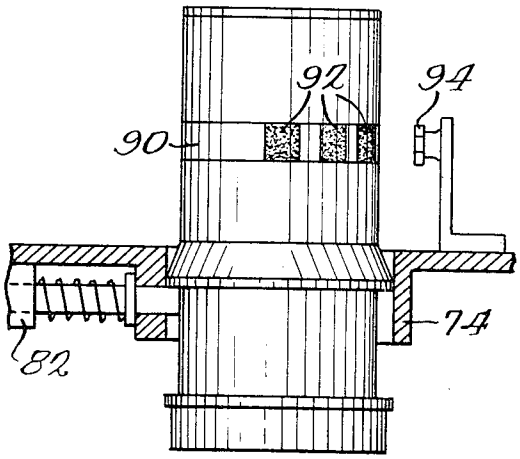


Fig. 7.

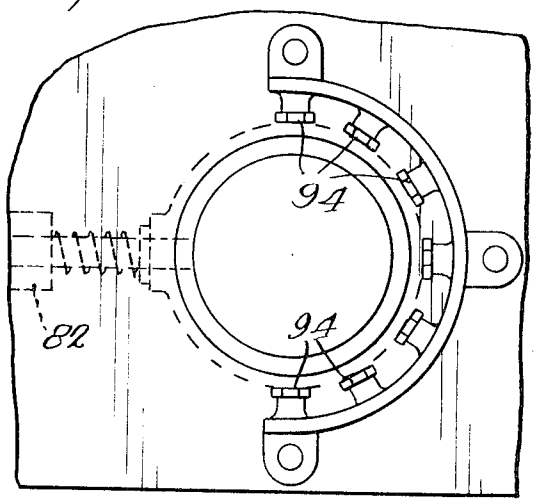


Fig. 8.

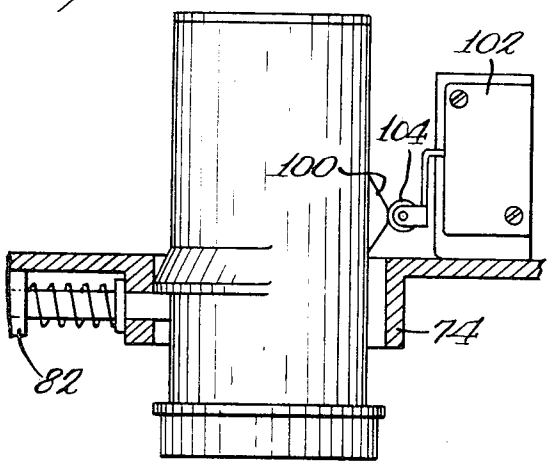


Fig. 9.

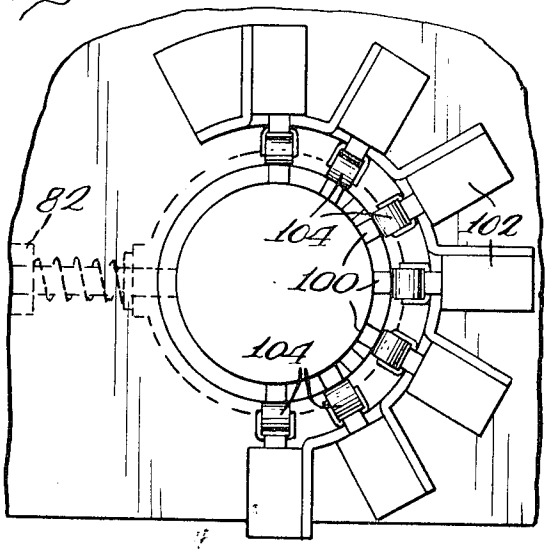
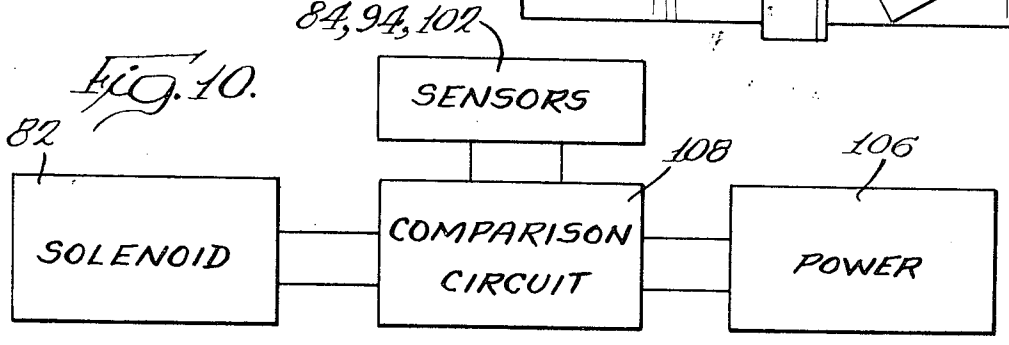


Fig. 10.



CODED ORAL SOLIDS MAGAZINE AND DISPENSER

BACKGROUND OF THE INVENTION

For years, hospitals and pharmacies have been plagued with the problem of improperly filled prescriptions due to human error. Not infrequently, a patient has been given wrong medication because the person filling the prescription has inadvertently filled the prescription out of the wrong bottle of pills or the like. While many such errors have gone by unnoticed and without harmful result, in some cases, patients have been made extremely ill and even died either from not receiving the correct medication or from receiving the wrong one.

As a result, some large hospitals have moved to the use of pill-dispensing systems that are arranged so that if instructed properly, a prescription will be properly filled. In general, such systems have worked well and cut down the errors in filling prescriptions. However, apart from a possible error in operating the system, the systems are still subject to human error.

Quite typically, such systems will include a plurality of receptacles, each containing a particular type of pill. When the system is instructed to deliver a prescription of a particular type of drug, means associated with the receptacle containing that drug will be actuated to dispense the same. If the receptacle is filled with the correct drug and the correct receptacle is addressed by the operator, the prescription will be correctly filled. However, if an attendant has improperly filled a receptacle intended to contain drug A with drug B, no matter whether the operator addresses the system correctly, the system will still deliver the improper drug.

SUMMARY OF THE INVENTION

It is the principal object of the invention to provide, in a pill-dispensing system, means whereby only the correct drug may be delivered to a dispensing receptacle in that system. The invention contemplates a number of structures by which this object can be achieved. According to a first embodiment of the invention, there is provided a pill magazine which may be associated with a dispensing receptacle and remain in association therewith until the supply of pills contained in the magazine is exhausted. Thereafter, the magazine may be replaced. In order to eliminate the association of a pill magazine with the wrong receptacle, the pill magazine is provided with a code in the form of a splinelike key arrangement and the receptacle is provided with a complementary key arrangement. For each type of drug, the key arrangement is varied so that of the plurality of receptacles and complementary magazines, only one type of magazine may be mated with a particular receptacle. Therefore, only a magazine containing the correct pills for a given receptacle may be mated therewith so that the receptacle cannot be improperly filled with the wrong type of pills.

The invention may also be implemented by three other embodiments disclosed herein. Again, all rely on a coding of the magazine and sensing means associated with the pill-dispensing receptacle. Each further includes a lockout device which precludes the magazine from being inserted into association with the receptacle unless the code sensed by the sensing means matches predetermined information. The lockout device according to the three embodiments corresponds to those surfaces of the complementary keys in the first embodiment which preclude insertion of the magazine if the key code on the magazine is not the complement of that on the receptacle.

Of the three embodiments, one employs coding on the magazine in the form of reflective tape together with light sources and photocell pickups to sense the arrangement of reflective tape and thus the code. When the code on the magazine matches the preprogrammed code, a solenoid latch is actuated to permit insertion of the magazine into the receptacle.

Another embodiment employs magnetic coding on the magazines together with magnetic sensors on the receptacle. Again, when a match is made, a solenoid latch is temporarily energized to allow insertion of the magazine.

Another embodiment applies surface irregularities on the magazine which are sensed by the actuators of microswitches or the like. Again, a solenoid operated latch is employed to permit insertion when the code on the magazine matches the programmed code on the receptacle.

Additionally, each of the magazines includes a novel closure arrangement. Typically, the magazines are inverted when inserted into the corresponding receptacles and in order to preclude the pills from falling out when the magazine is inverted and before the same is accepted by the receptacle, each magazine is provided with a novel closure arrangement. Surrounding the opening of each magazine is a closure member slidably mounted on the magazine and having a plurality of flexible fingers overlying the opening to retain pills therein. When a match has been obtained and the magazine is accepted by the receptacle, the magazine may be pushed downwardly with the inner edge of the same deflecting the flexible fingers outwardly to cam them open and permit the pills to be released into the receptacle.

Other objects and advantages of the invention will become apparent from the following specification taken in conjunction with the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a vertical section of one form of a magazine and receptacle arrangement made according to the invention;

FIG. **2** is a vertical section of a magazine;

FIG. **3** is a plan view of the top of a magazine;

FIG. **4** is a vertical section of another embodiment of a magazine and receptacle;

FIG. **5** is a plan view of the structure shown in FIG. **4**;

FIG. **6** is a fragmentary vertical section of another embodiment of the invention;

FIG. **7** is a fragmentary plan view of the structure illustrated in FIG. **6**;

FIG. **8** is a fragmentary vertical section of still another embodiment of the invention;

FIG. **9** is a fragmentary plan view of the structure illustrated in FIG. **8**; and

FIG. **10** is a block diagram of one form of a control circuit which may be used with the embodiments of the invention illustrated in FIGS. **4–9**, inclusive.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

An exemplary embodiment of the invention is illustrated in FIG. **1** and is seen to comprise a cylindrical magazine, generally designated **12**, containing a plurality of pills **14**. The magazine **12** is inverted and received in the neck **16** of a receptacle, generally designated **18**, from which the pills **14** may be dispensed. The receptacle **18** includes a conically shaped bottom **20** with a spiraled ramp **22** progressing upwardly therefrom. Vibrating means (not shown) may be associated with the receptacle **18** to cause the pills **14** to travel up the ramp **22** to be dispensed one at a time. The manner by which such may be accomplished is well known in the art and forms no part of the instant invention.

The receptacle **18** includes a cover member **24** having apertures which may be aligned with the magazines **12** so that a plurality of magazines may be associated with each receptacle. Mounted on the cover **24** is a magazine receiving member **28** having conically shaped openings **30** therein. The upper end of each conically shaped opening **30** terminates in a neck **32** having an upper taper **34** which serves as a lead-in chamfer for a receptacle **18**. The opening **30** further includes a plurality of key ways **36** arranged circumferentially arounds its inner periphery. The key ways **36** receive complementary keys **38** on the magazine **12**.

Referring now to FIGS. **2** and **3**, the keys **38** may be seen in greater detail. As shown in FIG. **3**, 20 such keys **38** are provided with the first key, generally designated **38'**, having a significantly greater width than the remaining keys to serve as an index point. In essence, the 20 keys provide 20 bits of information, and by eliminating various ones of combinations of ones

of the keys 38, a total of over one million numbers are possible. As a result, over a million magazines 12 may be formed, each having a unique configuration of the keys 38.

In a pill-dispensing system, the key ways 36 associated with each receptacle 18 are varied so that only a given one of the magazines 12 may be associated with a given one of the receptacles 18. That is, if the arrangement of key ways 36 on the receptacle 18 is not the precise complement of the arrangement of keys 38 on the magazine 12, the magazine 12 cannot be associated with the magazine 18 to nest therein as shown in FIG. 1 due to the presence of one or more keys 38 and absence of complementary key ways 36. Accordingly, when the keys do not match, the person attempting to place the magazine 12 in association with the receptacle 18 will be apprised of that fact. This is taken advantage of by using the receptacle 18 only to dispense the particular type of drug as, for example, drug A. Accordingly, the magazine 12 having the complementary key arrangement is filled with drug A and no other type of drug. The same can therefore be associated only with the receptacle 18 designated to dispense drug A.

Because the magazines 12 are inverted when inserted, unique closure means are provided. As best seen in FIG. 2, the end of the magazine 12 adjacent an opening 40 therein is provided with a small peripheral flange 42 having a tapered outer edge 44. Fitting about the same is a collar 46 having an inturned flange 48 and a plurality of flexible fingers 50 which extend inwardly and arcuately to cover the opening 40. An additional closure 52 may be used to normally cover the fingers 50.

When the magazine 12 is associated with the receptacle 18 in the manner aforesaid with the closure 52 removed as illustrated at the left-hand side of FIG. 1, and the operator is satisfied that the keys complement each other, the magazine may then be forced downwardly in the direction of an arrow 53. As a result, the tapered edge 44 will cam the flexible fingers 50 outwardly so that they will no longer cover the opening 40 and the pills contained therein will fall downwardly into the receptacle 18. The conical taper 30 provided in the member 28 accommodates the flexible fingers 50 at this time.

The foregoing arrangement insures that pills 14 will not inadvertently be dropped into an improper receptacle 18 before a match is obtained.

A second embodiment of the invention is illustrated in FIGS. 4 and 5 and employs coding means other than the complementary keys 36 and 38 mentioned previously. The receptacle 18 is again illustrated and is formed similarly to the receptacle 18 illustrated in FIG. 1. The same is mounted on a base 54 and vibration isolating means 55 are interposed between the base 54 and a cover member 56 which has an upturned neck 58 which may receive the inverted top of a magazine, generally designated 60. The magazine 60 may include a closure including the fingers 50 described previously in conjunction with the first embodiment. Additionally, the same includes a flange 62 which is adapted to limit downward movement of the magazine 60 be engaging the neck 58.

About midway along the length of the magazine 60 is an outwardly extending flange 64 having a tapered upper surface 66 for purposes to be seen hereinafter. Above the flange 64 are a plurality of bands 68 of reflective tape which serve as coding means. Accordingly, seven bits of information are provided and there may be a total of 127 different combinations of the tape band 68 ranging from all bands absent to but one band present.

Standards 70 secured to the cover member 56 mount a plate 72 having a downturned neck 74 through which the magazine 60 may be received. One portion of the neck 74 includes an aperture 76 through which a plunger 78 normally extends to engage the underside of the flange 64. A spring 80 is interposed between one side of a solenoid 82 and a washer 84 mounted on the plunger to normally urge the plunger 78 to the position shown in FIG. 4.

The plate 72 also mounts a plurality of sensing devices, there being the same number of sensing devices 84 as there are bands 68 on the container. Referring to FIG. 5, it will be seen that each sensing device comprises a light source 86 and a photocell 88. As a result, light from a given light source 86 may be reflected by the associated band 68 to the associated photocell 88 if the band 68 is present while such reflection will not take place if the band 68 is absent.

Also as illustrated in FIG. 5, the plate 72 may mount a plurality of the just-described means so that more than one magazine 60 may be associated with a given receptacle 18 at any given time.

The overall arrangement is such that when a particular code in the form of the band 68 is present and is sensed by the photocells 88, the solenoid 82 will be temporarily energized to pull the plunger 78 out of engagement with the underside of the flange 64 thereby permitting the magazine 60 to be moved downwardly into association with the corresponding neck 58. Thereafter, further movement of the magazine 60 may be employed to move the fingers 50 (not shown) to a retracted position so that the pills contained in the magazine 60 will empty into the receptacle 18. As will be apparent after such downward movement, the correct code will no longer be sensed by the photocells 88 so the solenoid 82 will be deenergized thereby conserving power.

When all of the pills in the magazine 60 have dropped therefrom into the receptacle 18, the same may be easily removed by grasping the same and lifting upwardly. The tapered upper surface 66 on the flange 64 facilitates such removal by merely camming the plunger 78 against the bias of the spring 80 so that no energization of the solenoid 82 is required for such removal.

A further embodiment is illustrated in FIGS. 6 and 7 and is generally similar to that illustrated in FIGS. 4 and 5 except that in lieu of the bands 68, there is provided a single coded band 90 bearing up to seven magnetized portions 92. In the case of the embodiment illustrated in FIGS. 6 and 7, sensing means comprising toroids 94 are mounted in sufficient proximity to sense the presence or absence of the magnetic material spots 92 on the band thereby changing the inductance of a conventional circuit associated with each toroid 94. When coincidence is obtained, a solenoid 82 is energized to permit the magazine to be brought into operative association with a corresponding receptacle.

FIG. 8 illustrates still a further embodiment of the invention wherein a plurality of outward projections 100 are provided on each magazine as coding means. Located about the periphery of each magazine receiving neck 74 are a plurality of microswitches 102 each having actuators 104 which may be engaged by the outward projections 100, if present according to the designated code, to change the condition of the corresponding switch 102. When the predetermined code is sensed, a solenoid 82 is again engaged to permit complete insertion of the magazine.

In the case of the embodiment illustrated in FIGS. 4 and 5, the magazine 60 may be received in any position of rotation about its longitudinal axis and still properly sensed. However, in the case of the embodiments illustrated in FIGS. 6–9, the circumferential position of the magnetic spots 92 or the projections 100 is significant and accordingly, a single key (not shown) may be provided to insure that the magazine is in proper position of orientation with respect to its longitudinal axis to achieve proper sensing.

As in the case of the embodiment illustrated in FIG. 4, once the magazine and the embodiments illustrated in FIGS. 6–9 are permitted to move downwardly into association with its corresponding receptacle 18, the resultant moving of the magnetic spots 92 away from the toroids 94 or the moving of the projections 100 out of engagement with the microswitch actuators 104 will result in deenergization of the corresponding solenoid. Of course, if the flange 64 is employed with a tapered upper surface, removal of the same may be had in the same manner as the removal of the magazine 60 illustrated in FIGS. 4 and 5.

In order to control energization of the solenoid **82**, there may be provided a source of power **106** which feeds a conventional comparison circuit **108**. The comparison circuit **108** is preprogrammed individually for each receptacle **18**. For example, if a particular receptacle is adapted to have associated therewith only a magazine **60** having all of the bands **68** present, the comparison circuit **108** may be constructed according to conventional techniques so that each of the photocells **88** must be illuminated before the solenoid **82** will be energized. Similarly, if but one of the bands **68** is present on a magazine **60** to be associated with a particular receptacle, the comparison circuit **108** may be constructed so that the presence of any illuminated one of the photocells **88** other than the photocell for sensing the particular band will preclude energization of the solenoid **82**.

The comparison circuits **108** employed in conjunction with the toroids **94** and the microswitches **102** may be similarly constructed according to the same method using conventional techniques that are particularly well known in the data processing arts.

From the foregoing, it will be appreciated that a pill-dispensing system made according to the invention and employing means for precluding the insertion of a pill magazine into operative association with a dispensing receptacle and including code means on the magazine and sensing means associated with the receptacle will substantially eliminate the possibility of human error during the refilling of such systems, and by eliminating a substantial source of human error, make such systems less susceptible to misuse due to human error.

We claim:

1. In a pill-dispensing system, the combination comprising:
- a receptacle from which particular pills may be dispensed;
- a magazine for containing pills to be dispensed and adapted to be associated with said receptacle to provide the receptacle with pills to be dispensed therefrom; and
- means associated with said magazine and said receptacle for precluding association of said magazine with said receptacle when said magazine does not contain the particular pills to be dispensed from the receptacle.

2. The combination of claim **1** wherein said precluding means comprises code means on said magazine and code sensing means on said receptacle.

3. The combination of claim **2** wherein said code means comprises key means on said magazine and said code-sensing means comprises complementary key means on said receptacle.

4. The combination of claim **2** wherein said code means comprises means on said magazine for varying a characteristic of light and said code-sensing means comprises photoelectric means.

5. The combination of claim **2** wherein said code means comprises means on said magazine for varying a magnetic characteristic and said code-sensing means comprises magnetic sensing means.

6. The combination of claim **2** wherein said code means comprises surface irregularities on said magazine and said code-sensing means includes switch means adapted to be engaged by said irregularities.

7. The combination of claim **1** wherein said magazine comprises a container having an opening; and a closure mounted on said container for normally closing said opening, said closure comprising a plurality of flexible fingers covering said opening and adapted to be cammed open by said container when said closure is moved relative to said container in one direction thereon.

8. The combination of claim **2** wherein said precluding means further includes lockout means for normally precluding association of said magazine with said receptacle, said lockout means being operative in response to said code-sensing means for allowing association of said magazine with said receptacle when a predetermined code on the magazine is sensed by said code-sensing means.

9. In a pill-dispensing system, the combination comprising:
- a receptacle designated to receive and dispense a single type of drug in pill form for use in filling a prescription and including means for receiving a pill-containing magazine;
- a magazine containing said single type of drug in pill form for receipt in said receiving means and for loading said receptacle with said single type of drug;
- means on said magazine defining a code unique to the type of drug contained therein;
- means on said receptacle for sensing the code on the magazine before the magazine is fully received by said receiving means; and
- means for precluding full receipt of said magazine by said receiving means when the code on the magazine does not represent said single type of drug for which said receptacle is designated to dispense.

10. The combination of claim **9** wherein each receptacle is provided with at least two of said receiving means whereby at least two of said magazines containing said single type of drug can be associated with said receptacle at any given time.

11. In a medication-dispensing system, the combination comprising:
- a receptacle for receiving a particular type of medication to be dispensed, and including a magazine receiving opening;
- a magazine for containing the particular type of medication to be dispensed and receivable within said opening to load the receptacle;
- a plurality of keys on said magazine configured in a code representing the type of medication contained in the magazine; and
- complementary keys on said receptacle configured in a code representing the type of medication to be dispensed from the receptacle and arranged to preclude operative receipt of said magazine within said opening except when the configuration of said complementary keys is the exact complement of the configuration of the keys on said magazine;
- whereby only a magazine containing the type of medication to be dispensed from the receptacle can be received within said opening to load said receptacle.

12. The combination of claim **11** wherein said magazine includes an opening through which the medication to be dispensed is loaded into said receptacle, and a closure for said magazine opening including a collar slidable on said magazine and a plurality of flexible fingers extending from said collar to overlie said magazine opening, whereby sliding said collar on said magazine in one direction will cause said fingers to move from a position overlying said magazine opening so that the contents of said magazine may pass through said magazine opening.

* * * * *