(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 962 898 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
08.12.1999 Bulletin 1999/49

(51) Int. Cl.[6]: **G07F 1/04**, G07F 9/04, G07D 3/14

(21) Application number: **99116486.4**

(22) Date of filing: **07.02.1997**

(84) Designated Contracting States:
BE DE FR GB SE

(30) Priority: **23.10.1996 GB 9622094**

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
97902494.0 / 0 880 758

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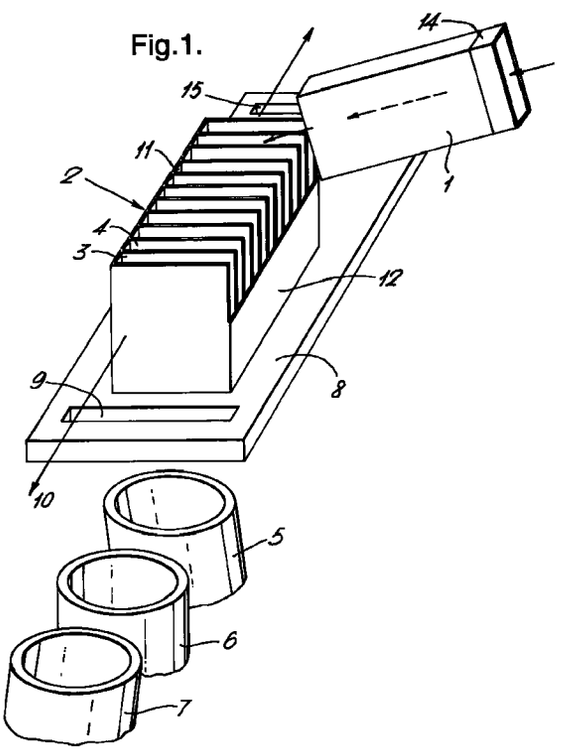
Remarks:
This application was filed on 23 - 08 - 1999 as a divisional application to the application mentioned under INID code 62.

(54) A coin handling system

(57) An apparatus for sorting coins, comprises: a coin entry path (1); a sensor for sensing the denomination of a coin (14); a memory for storing information about the denomination and/or location of a coin; a carriage (2) having a plurality of storage compartments (3, 4) for carrying one or more coins; a plurality of coin exit paths (5, 6, 7); a moveable coin retaining means (8) defining an opening (9) and constituting one wall of the carriage; drive means for moving the coin retaining means and the carriage; and control means for controlling the apparatus such that the said opening is translationally moveable into a given coin exit path, thereby allowing a given coin to travel from a compartment along the given coin exit path in use. The carriage comprises a carousel rotatable about a horizontal axis. This arrangement provides a more compact apparatus which can take up less height.

Fig.1.



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Description

[0001] This invention relates to a coin handling system, comprising: a coin entry path (1); a sensor (14) for sensing the denomination of a coin; a carriage (2) for coins, the carriage having a plurality of compartments (3, 4); a coin retaining means (8); drive means (43) for moving the carriage; memory means for storing information from the sensor corresponding to the denomination and/or location of a coin; and control means (39) associated with the memory means for controlling the drive means to select a given coin for release.

[0002] The basic requirements for a coin handling system are a) an ability to separate coins into different denominations, b) an ability to provide a temporary store for a minimum number of coins (typically 20), and c) the ability to return the same coins to the user on cancellation of a transaction as the user inserted in the first place to minimise the potential for fraud.

[0003] Several different approaches to providing coin sorting apparatus have been proposed. In one approach, coins are sorted on the input side of the escrow by routing different denomination coins through different coin entry chutes to respective coin buckets each of which can hold several coins. This arrangement takes up a lot of space.

[0004] Another approach uses a rotary carousel which rotates about a vertical axis. Such a system is disclosed in US 4,836,825. In this system, a coin validator is followed by a buffer coin box serving as a temporary store for newly inserted coins, The buffer has an indexable circular magazine (driven by a stepper motor) which is topless and bottomless and comprises P + 2 radial compartments located in a stationary cartridge. The floor of the cartridge has an opening two compartments wide which is equipped with a bolt for closing off the left or right hand side of the opening or both. The apparatus consists of a plurality of these coin store systems each containing a different denomination coin and aligned vertically to dispense change in a coin exit path which runs vertically through the openings in the floors of the cartridges. This apparatus yields a sorting function by stacking a plurality of coin carriages vertically. As a result the apparatus is very bulky and there is a height penalty resulting in a large distance between the height of the coin entry slot and the coin exit slot.

[0005] A further approach, disclosed in WO 91/06073, comprises a coin handling system as defined in the first paragraph above. The carriage in this system comprises a tube housing a helical member with coins stored between successive turns of the helix, the coins being reciprocated in the tube by rotating the helical member and the tube having entry and exit holes which can be rotated to provide openings through which coins can fall. Although conceptually elegant, such helical structures are difficult to use if coins having very different diameters and/or thickness have to be handled at the same time, such as for example a current British 5 and 50 pence piece, or a British 5 pence and £1 piece. This helix system also requires three moving parts.

[0006] A further known coin handling system is described in DE-A-3 234 120.

[0007] According to a first aspect of the invention there is provided a coin handling system as defined in claim 1 (omitting the reference numerals). This can result in a more compact system which takes up less height whilst returning coins at a height close to that of the coin entry path.

[0008] Embodiments of the invention will now be described by way of example only, with reference to the accompanying diagrammatic drawings in which:-

Figure 1 shows an oblique view of part of a coin handling apparatus,
Figure 2 shows a sequence of cross sections of part of an apparatus,
Figure 3 shows an oblique view of part of a second apparatus
Figure 4 and 5 show a side elevation and a plan view of a third apparatus,
Figure 6 shows an oblique view of an embodiment according to the invention, and
Figure 7 shows an ejector means which can be used with the apparatus of Figure 4 and 5.

[0009] In Figure 1 a coin handling system for sorting coins is shown, comprising: a coin entry path (1); a sensor (14) for sensing the denomination of a coin; a memory means (not shown in the present Figure) associated with control means, the memory means storing information about the denomination and/or location of a coin; a carriage (2) for coins having a plurality of compartments (3,4); a plurality of coin exit pats (5,6,7); a moveable coin retaining means (8) defining an opening 9, 15); drive means (not shown in Figure 1) for moving the coin retaining means and the carriage; and control means (not shown in Figure 1) for controlling the apparatus such that the said opening is translationally moveable into a given coin exit path, thereby allowing a given coin to travel from a compartment along the given coin exit path in use. Each compartment may contain one or more coins.

[0010] In the example shown in Figure 1 the carriage resembles a magazine for a 35 mm slide projector. It comprises a plurality of substantially parallel sheet metal squares which are equally spaced along the axis (10) of motion of the carriage. These squares are affixed to side members (11, 12) on either side of the carriage to form a plurality of compartments open at the top and bottom. The compartments are open at the top and one side, so that coins from the coin entry path (1) (which in the present example comprises a sheet metal chute having a coin denomination sensor (14)) may fall into the compartments under the action of gravity. In the example shown, the coins enter at an angle to the vertical but exit vertically. Thus the coins enter and exit in dif-

ferent directions. As an alternative the coins may be made to enter the compartment vertically. Although the compartments of the carriage are open at the bottom, the coins are retained therein because of the presence of the coin retaining means (8) which comprises an elongate member having an opening (9, 15) in the form of a slot therein. In the present example this member is also fabricated from sheet metal.

[0011] Located beneath the coin retaining means are a plurality of coin exit paths (5, 6, 7). In the present example these comprise tubular metal chutes which are in communication with cash boxes or a coin return path or storage hoppers (not shown). The coin retaining means is provided with two openings (9, 15) and is translationally moveable (in the present example slideable along the long axis of the carriage) relative to the rest of the carriage. This gives the advantage of being able to release a coin from either end of a liner carriage without having the opening move along the entire carriage.

[0012] Although in the present example a straight carriage is used, this may be replaced by a rotatable carriage having a vertical axis of rotation (as shown in Figures 4 and 5) or by a rotatable carriage having a horizontal axis of rotation (as shown in Figure 6). As an alternative, a coin store may be used such as that described in US 5,407,388, which comprises a helical structure for retaining coins between turns thereof such that the coins may be moved in either of two directions by rotation of the structure.

[0013] The rotatable carriage having an axis of rotation which is substantially horizontal is particularly advantageous. An example of an embodiment according to this aspect of the invention is shown in Figure 6, and comprises a carriage 2 rotatable about a substantially horizontal axis 53. Each compartment in this embodiment is open on one side only, in the present case being open towards the left hand side of the page which corresponds to the front of the machine in use. Such an arrangement is advantageous because the compartment of the carousel which receives coins from the coin entry path may be arranged to be lower in height when a coin is received in it (for example when it is in position 51 in Figure 6) than when a coin is released from it in operation (for example when it is in position 52 in Figure 6). This advantage may be realised even if a coin retaining means which is not translationally moveable is present. In the embodiment shown in Figure 6 the coins enter and leave the storage compartments through an opening in the front wall of the carriage. The coins are preferably ejected by operation of an actuating member (not shown) which is preferably located on the back wall of each compartment and which pushes the coin out of the selected compartment in response to a control signal.

[0014] Although in the examples described in detail above the apparatus is constructed from sheet metal, as an alternative it may be fabricated from a rigid plastic material or a mixture of plastic and metal parts.

[0015] In practical applications of such apparatus, it is mounted in a chassis or housing so that the internal workings cannot be interfered with by a normal user. This housing is not shown in the diagrams, and is not an essential feature of the invention.

[0016] In use, coins arrive in the carriage (or escrow) via the coin entry path and fall into one of the storage compartments. The first coin would usually (but not necessarily) fall into the compartment closest to one end of the carriage as shown in Figure 1. The carriage and coin retaining means will then be moved in unison by the control means (not shown in Figure 1) so that the next coin may be received in an adjacent compartment. the movement may be provided by, for example, a stepper motor under microprocessor control The carriage and the coin retaining means (which in the present example constitutes the floor of the carriage) are mounted on a bearing system (not shown in the Figure) to minimise the effects of friction.

[0017] Figure 2 shows a sequence of events required to dispatch coins previously stored in the compartments of the carriage. The reference numbers shown are the same as those given to the corresponding features in Figure 1.

[0018] Figure 2a shows an apparatus according to the invention after receiving three coins (20, 21, and 22) via the coin entry path. The figures in the sequence illustrate the delivery of coin 20 to coin exit path 6, followed by coin 21 to coin exit path 5.

[0019] Firstly, the movable carriage 2 carrying the coins 20, 21 and 22 is moved to the right of the figure in unison with the coin retaining means 8. When the opening 9 is in alignment with the given coin exit path (6 in this case), the coin retaining means stops. This is the situation shown in Figure 2b. The carriage 2 then moves to the left relative to the coin retaining means and the coin exit paths, until the compartment carrying coin 20 is in communication with the opening 9. The coin 20 will then fall into the coin exit path 6 influenced by the force of gravity, as shown in Figure 2c, The carriage and the coin retaining means are then caused to move once more in unison to bring the opening 9 into alignment with the coin exit path 5, as shown in Figure 2d. The coin retaining means remains in this position whilst the carriage 2 moves further to the left until the compartment carrying coin 21 is in communication with the opening 9 as shown in Figure 2e. The coin 21 then falls into coin exit path 5 under the influence of gravity as before.

[0020] In normal operation the dispatch sequence shown in Figure 2a - e continues until all the coins have left the carriage. The carriage and the coin retaining means is then optionally returned to its initial position to be ready for the next transaction.

[0021] The apparatus described above and shown in Figure 1 and 2 may be operated in other sequences. For example, as an alternative the carriage and coin retain-

ing means may be moved along separately in turn.

[0022] As a further alternative the carriage and coin retaining means may be moved in unison such that a given coin or compartment is directly above or in alignment with a given coin exit path, and the coin retaining means is then moved to bring the opening into alignment with the compartment or coin such that the coin travels along the given coin exit path.

[0023] An alternative coin carrying carriage is shown in Figure 3. In this carriage (2) the compartments (3, 4) are formed from triangular sheets of a rigid plastic material affixed to a side member (11). The triangular pieces are approximately equilateral and have their edges arranged parallel to one another. The coin retaining means 8 is constituted in this embodiment by a rigid plastic side wall defining an opening 9 in the middle. The side wall extends for a length equal to or greater than twice the length of the rest of the carriage so that regardless of the position of the opening only one compartment at a time can release a coin. An advantage of this arrangement is that in operation coins enter the compartments from above, but will exit the compartment through the side wall 8. Thus the coins enter and exit the compartments in different respective directions, enabling the apparatus to take up less height.

[0024] Figure 4 shows a side elevation of a further example of an apparatus, together with control and drive means. In this further example, the carriage (2) comprises a circular carousel rotatable about a substantially vertical axis (30). The floor of the coin compartments consist of a rotatable sheet metal coin retaining means (8) having an opening therein (not shown). As an alternative the floor may have a plurality of openings. The floor is rotated about the axis 30 by a stepper motor (31) via a pulley and toothed belt drive system (32). The side walls of the carriage are rotated about the same axis (independently of the floor) by a second stepper motor (33) via a second pulley and toothed belt drive system (34). The apparatus also comprises coin exit chutes (5,6,7) and a coin entry chute (1), as before. The coin validator (14) is an industry standard unit such as a Mars Electronics Cashflow 330 unit or a Coin Controls C435 unit, for example. The apparatus further comprises optical coin sensors (35, 36, 37, 38) and a control system (39). The control system includes a microcontroller with on board ROM and RAM memory to accommodate the application control software, analogue to digital converters and stepper motor drive circuitry to control the stepper motors, and sufficient input/output interfaces to interface with the coin validator (40), an external controller (41), the optical coin sensors (42) and the stepper motors (43).

[0025] A plan view of part of the apparatus of Figure 4 is shown in Figure 5. In this Figure the reference numerals have the same meaning as in the other drawings described above. In this Figure, there are however two more coin exit chutes shown (44 and 45).

[0026] In operation, coins enter the system through the validator (14) where invalid coins are rejected and acceptable ones routed through a short chute (1) past the entry sensor (35) into a vacant compartment in the escrow carriage (2). On detecting that the incoming coin has cleared the entry sensor, the control program will drive both stepper motors to move the carriage and floor to a position ready to accept the next coin. Should a subsequent coin enter the validator before the previous one has settled in the escrow and the escrow moved to the next vacant position, then it will be rejected. This sequence will continue until all coins have been accepted, at which point the dispensing operation can commence.

[0027] To deliver coins to the required exit chute, the carriage and floor are moved in tandem until the end coin is above the requisite chute, then the floor is moved to present the floor aperture beneath the coin which falls into the chute. The carriage exit sensor is used to observe the coin falling from the carriage, and as soon as this has happened both the carriage and floor are moved to dispense the next coin. As an alternative to the carriage exit sensor, a simple time delay can be used to allow time for the coin to fall out of the compartment. This process continues until all coins have been dispensed, whereupon the carriage and floor are optionally returned to their initial positions ready to accept coins from a new transaction.

[0028] In the above examples, the coin retaining means has comprised a solid member defining an opening. As an alternative, the coin retaining means may comprise a member having holes therein which are too small to allow coins to pass through.

[0029] Although in the above examples the coins fall through the opening under the influence of gravity, the system may include an ejector means which will only allow release of a given coin when activated. An ejector means of this type might comprise for example a shutter or gate means associated with either the opening or the coin exit path, or an actuating member which pushes a coin out of a given storage compartment in response to a control signal. A shutter or gate means of this type might for example, operate to close off all or part of the opening until a given coin is positioned such that it will travel along a given coin exit path through the opening when the gate means is placed in an open condition. The presence of such an ejector means can give the advantage that coins may be dispatched sequentially from selected compartments which are not adjacent or separated by empty compartments or at one end of the carriage.

[0030] A preferred example of an ejector means is the shutter mechanism shown in Figure 7. Without such a device coins must be dispensed sequentially in either direction along the carriage. With such a device coins can be dispensed in any order. This means that if desired the escrow may be used to store coins beyond a single transaction and dispense them as change for a later transaction.

[0031] The prior art helical device disclosed in WO 91/06073 has a number of potential disadvantages which the apparatus of the present invention can mitigate. Firstly, the helical device is not efficient at the routing of coins. The number of exit paths is limited in a fundamental way by the circumference of the rotatable tubes so that there is a limit to the number of exit paths which can be independently. The embodiment shown in this prior art patent having a helix diameter approximately equal to one coin diameter can only open two exit paths independently, whereas the apparatus described in the present invention can independently route to any number of exit paths. Secondly, the exit paths available to the helix system are fixed by the physical locations of the openings along the axis of the helix, whereas in the present invention the exit paths are defined by software within the path swept out by the opening as it moves, and can therefore be easily adapted to coincide with different carriage configurations or compartment positions. Thirdly, the helix system requires more operations to dispense consecutive coins to different exit points than the present invention. It will therefore be slower than the present invention in use. Lastly, in the present invention any exit path is individually accessible without simultaneously revealing any other.

[0032] The provision of a coin handling system according to the present invention can provide protection against the laundering of counterfeit coins. This type of fraud can be achieved in bulk/sequential escrows where, for example, a £1 coin followed by a 50 pence coin could be inserted and a 50 pence item purchased. In this scenario £1 has to be given but it cannot be the coin which was inserted because it was not the last coin in. Therefore if the original coin inserted was a counterfeit a fraud would have been committed. However if the escrow was a unit which could dispense coins in any order the original counterfeit coin could be returned thus preventing the attempted fraud. Secondly, change cannot be given from bulk escrows and sequential escrows can only give multi-denominational change if there is more than one escrow. Systems which can dispense coins in any order can give multi-denominational change from a single escrow thereby reducing cost and size of the system.

[0033] The shutter of Figure 7 is based on a ratchet and pawl mechanism and requires no additional drive means. In Figure 7 the shutter (60) is viewed from below the coin retaining means (61). The coin carriage and exit paths are not shown in this diagram to improve clarity. The shutter in this example is carried by the coin retaining means and rotates with it. The shutter is coupled to the coin retaining means by biasing means such as a spring or a resilient member (not shown). The shutter of Figure 7 operates as follows. The coin retaining means 61 comprises the floor of the coin carriage or escrow, and in Figure 7a both the floor 61 and the shutter 61 are rotating anticlockwise in unison. A rod member 62 acts as a pawl, and the outer edge of the shutter 61 is shaped to act as a ratchet. As the assembly rotates, the outer edge of the shutter passes the pawl without engagement. and the shutter then is biased outwards by a biasing means (not shown) such as a resilient member or a spring which couples the shutter 60 to the floor 61. The point at which the shutter has passed the pawl is shown in Figure 7b. The shutter and coin retaining means is now stopped from rotating further by a signal from the control means. The shutter and coin retaining means are then driven in the reverse direction (i.e. clockwise in the present example). As the assembly rotates in the reverse direction the outer part of the shutter 60 engages with the pawl 62. This prevents the shutter from rotating with the rest of the assembly. As the coin retaining means continues to rotate clockwise, the stationary shutter moves relative to the coin retaining means and is forced back against a biasing means such as a resilient member or spring (not shown). This action reveals the opening 9 in the coin retaining means, thereby releasing a selected coin from a compartment into a given coin exit path. The surfaces of the coin retaining means and the shutter facing the coins is preferably feathered or interlinked by a comb method so that their interface would not affect a coin passing over them in use.

[0034] The term coin as used in the present specification includes legal tender, tokens, counterfeit coins, or other disc-like bodies which can be sorted by means of their dimensions or mass or other properties (such as, for example, magnetisability).

[0035] In addition to the above description of specific embodiments according to the invention, the content of the priority documents, especially the drawings, is hereby incorporated herein by reference.

Claims

1. A coin handling system, comprising: coin entry path (1); a sensor (14) for sensing the denomination of a coin; a carriage (2) for coins, the carriage having a plurality of compartments (3, 4); a coin retaining means (8); drive means (43) for moving the carriage; memory means for storing information from the sensor corresponding to the denomination and/or location of a coin; and control means (39) associated with the memory means for controlling the drive means to select a given coin for release, characterised in that the carriage comprises a carousel which is rotatable about a substantially horizontal axis, the compartment of the carousel which receives coins from the coin entry path being lower in height when a coin is received in it than when a coin is released from it in operation.

2. A coin handling system as claimed in claim 1, further comprising: a plurality of coin exit paths (5, 6, 7); the coin retaining means (8) being moveable

and defining an opening (9); drive means (43) for moving the coin retaining means and the carriage; memory means for storing information from the sensor corresponding to the denomination and/or location of a coin; the coin retaining means constitutes a side and/or floor of the carriage which is translationally moveable relative to the rest of the carriage, the carriage and the coin retaining means being moveable such that the opening is moveable into a given coin exit path, thereby allowing a selected coin to be released from a compartment and to travel along the given coin exit path in use.

3. A coin handling system as claimed in any preceding claim in which the selected coin is released by operation of an ejector means (60).

4. A coin handling system as claimed in claim 3 in which the ejector means comprises a shutter adjacent said opening.

5. A coin handling system as claimed in any preceding claim in which the coin retaining means and the carriage are moveable in unison until the compartment holding a given coin is in alignment with a given coin exit path, the coin retaining means then being moveable relative to the rest of the carriage until the opening is in alignment with said coin exit path, thereby allowing the given coin to travel along the given coin exit path.

6. A coin handling system as claimed in claim 2 - 4 in which the coin retaining means and the carriage are moveable in unison until the opening is in alignment with a given coin exit path, the carriage then being moveable relative to the opening until a compartment holding a given coin is in alignment with said opening, thereby allowing the given coin to travel along the given coin exit path in use.

Fig.1.

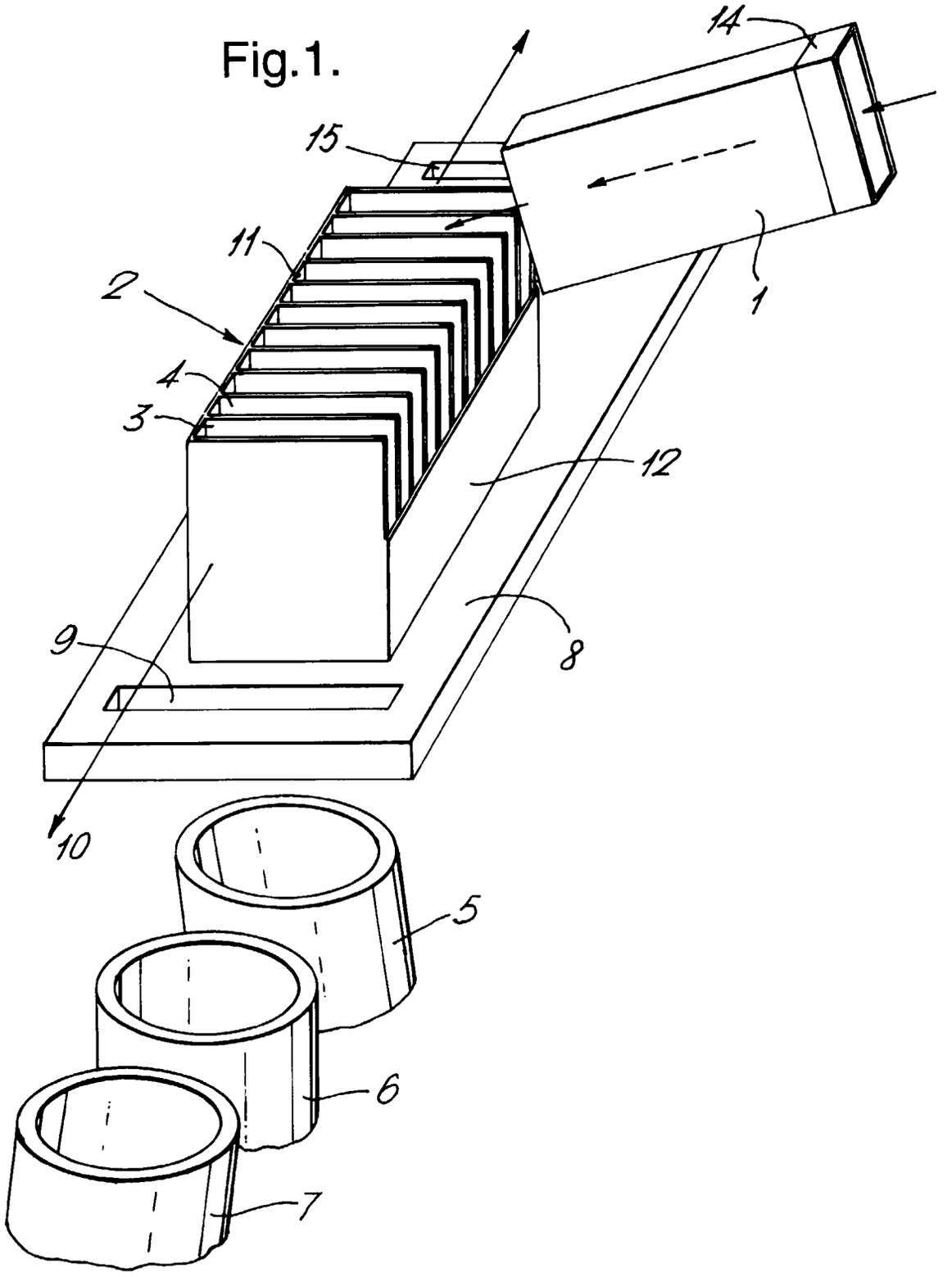
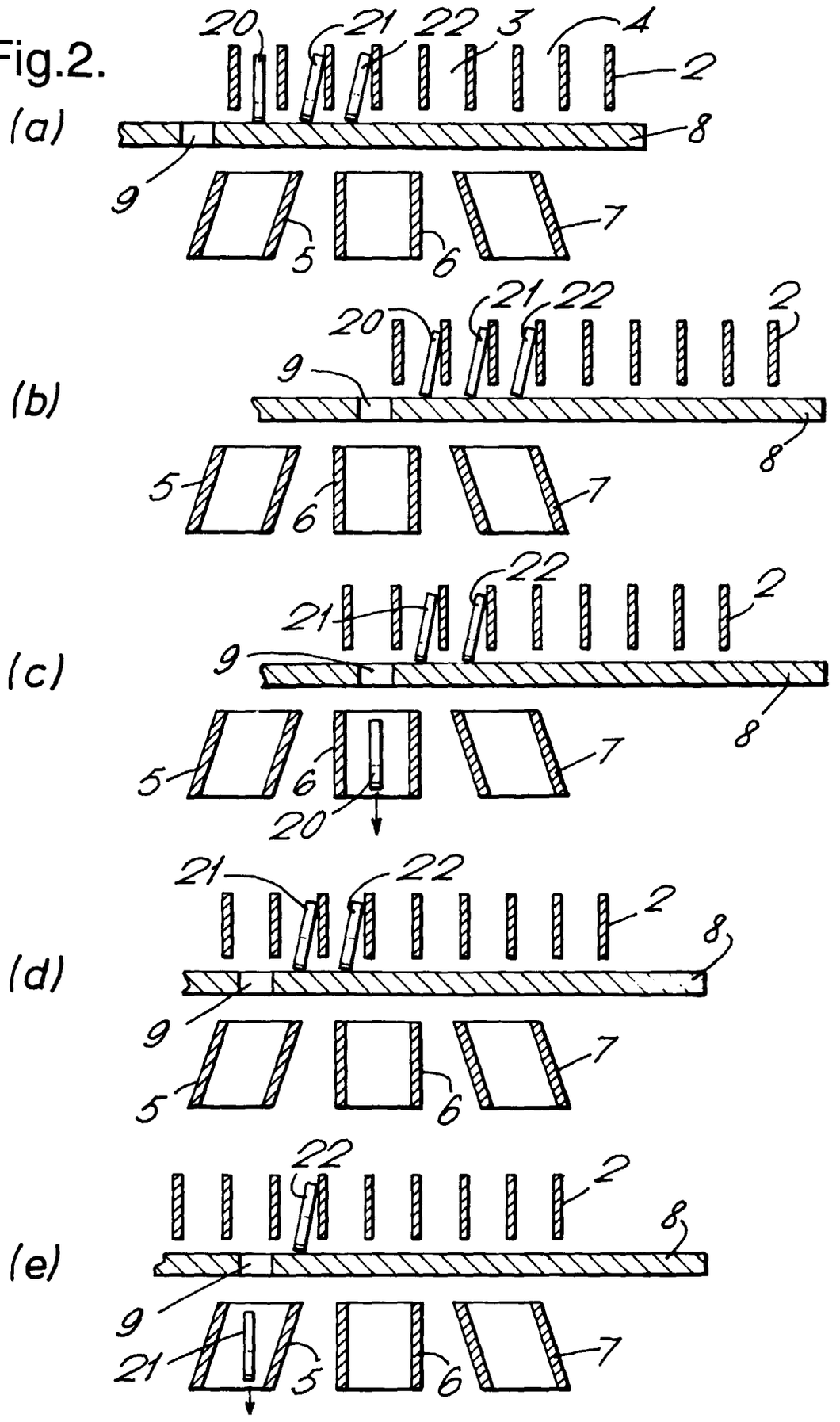


Fig.2.


(a)
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(b)
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Fig.3.

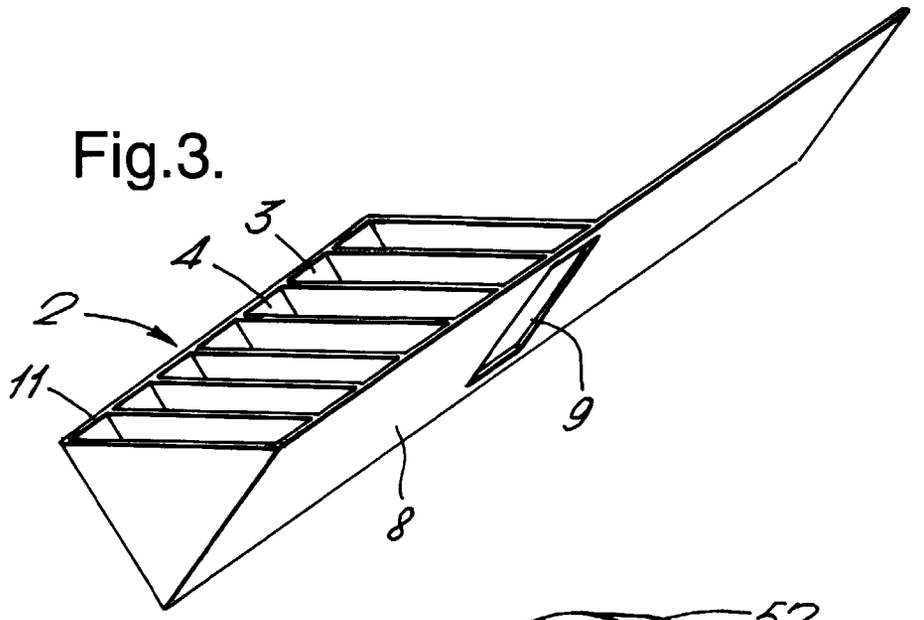


Fig.6.

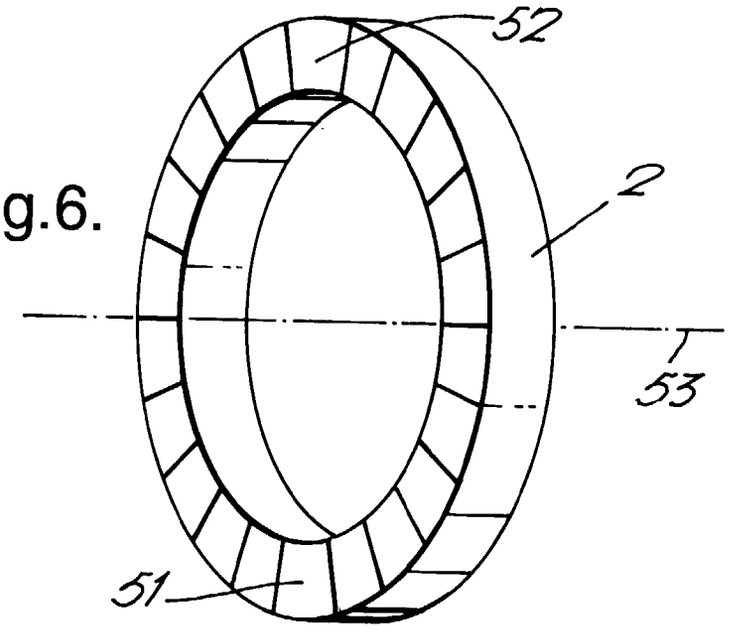
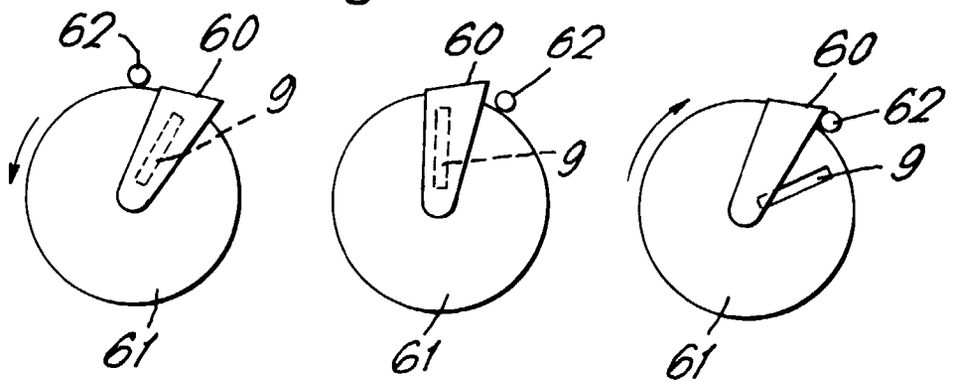


Fig.7.



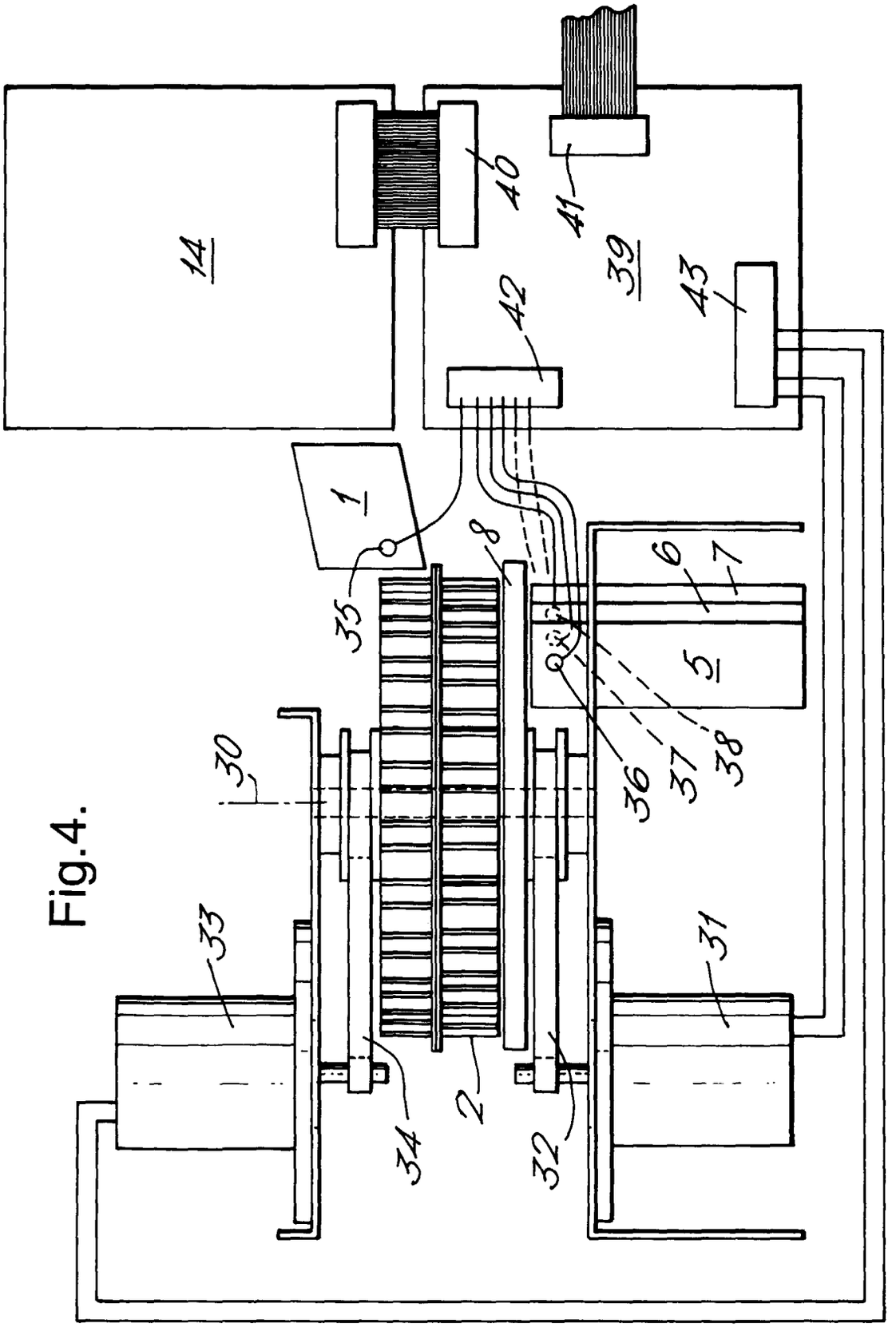


Fig.4.

Fig.5.