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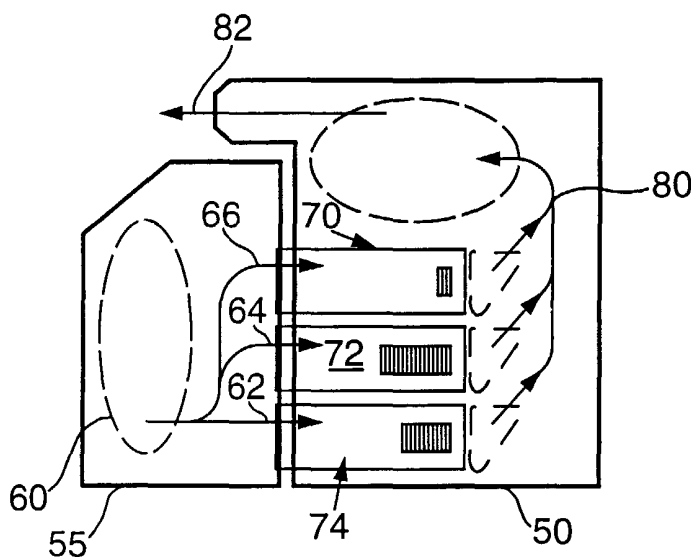
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: DOCUMENT STORE, ACCEPTOR AND RECIRCULATOR



(57) Abstract: A document store for removably fitting to a document handling device. The store has a housing (1) with a first opening (19) through which documents can be dispensed from the housing and a second opening (3) through which documents can be supplied to the housing. A stacking device (11) within the housing (1) receives documents supplied through the second opening (3) and forms them into a stack. The stack is urged towards the first opening (19).



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DOCUMENT STORE, ACCEPTOR AND RECIRCULATOR

The invention relates to a document store, for example for storing banknotes or other documents of value, a document acceptor and a document recirculator.

Banknote dispensers are well known and typically incorporate a secure housing in which is located a transport system together with one or more document stores or cassettes which store banknotes of respective, different denominations. The transport system can then selectively feed banknotes from one or more of the stores to an outlet in accordance with a customer request. From time to time, it is necessary to replenish the cassettes and this involves opening the housing so that the empty cassette can be withdrawn and replaced by a new, full cassette.

With continued demands on automatic handling of documents, document acceptors such as banknote acceptors have been developed which enable customers to deposit banknotes. These banknotes are received at an acceptance inlet, fed through a detection system so that their denomination etc. can be determined and then stored.

Document recirculators are also known which not only accept documents but allow those documents to be dispensed thus reducing the need to replenish stocks of documents to be dispensed.

Examples of these systems are illustrated in GB-A-2122008, GB-A-2104877, EP-A-0024704 and US-A-4726474.

US-A-5076441 also illustrates a recirculator having a till in one end of which banknotes are inserted and from the other end of which they are retrieved.

These known recirculators are purpose built and also rely on notes being fed through the acceptance side for notes to dispense.

In accordance with a first aspect of the present invention, a document store for removably fitting to a document handling device has a housing with a first opening through which documents can be dispensed from the housing

and a second opening through which documents can be supplied to the housing; a stacking device within the housing for receiving documents supplied through the second opening and forming them into a stack; and means for urging
5 the stack towards the first opening.

We have developed a new type of document store, typically a banknote cassette, which has an in-built stacking device as well as means for urging the stack towards the first opening so that the store can be used
10 both for accepting and dispensing documents. The store is self-contained so it can be removed and inserted as required and without the need for locating adjacent a stacking device.

We also provide a document handling device comprising
15 a transport system for transporting documents, and at least one document store according to the first aspect of the invention removably mounted in cooperation with the transport system to enable documents to be supplied to or dispensed from the store.

20 The transport system may be any conventional friction or vacuum feed arrangement.

An important application of this store is in enabling a document dispenser to be converted into a document recirculator. Thus, in accordance with a second aspect of
25 the second invention, a document acceptor for connecting to a document dispenser to form a document recirculator includes an inlet; and a transport for transporting documents received at the inlet to a storage location, the storage location containing a document store according to
30 the first aspect of the present invention, the document store being connectable to a dispense transport of a document dispenser.

In this way, it is possible to use an existing dispenser and convert it into a recirculator by locating an
35 acceptor adjacent the dispenser and providing one or more document stores according to the first aspect of the

invention, the document stores typically extending between the acceptor and dispenser.

In some cases, the urging means may be provided separately from the stacking device and, for example, could
5 comprise a pressure plate or the like in a conventional manner. In the preferred approach, however, the urging means is formed at least in part by the stacking device. The stacking device typically comprises a rotatably mounted
10 stacking wheel having a plurality of radially extending tines. In a second preferred approach, suitable shaping of the profile of the stacking wheel having a plurality of radially extending tines provides the urging facility, thus removing the need for an additional pressure plate.

We have also developed a new type of stacking device
15 comprising one or more rotatable coils extending from the second opening towards the first opening; and a control system for rotating the or each coil whereby a document supplied through the second opening is received between adjacent turns of the or each coil, rotation of the coils
20 transporting the document towards the first opening.

In other applications, the document store can be used with a document dispenser so as to provide a convenient way of refilling the store without having to remove the store.

Another important advantage of the store according to
25 the first aspect of the invention is that it allows documents to be simultaneously stored in and dispensed from the store. This is most conveniently achieved when the stacking device itself, such as the tines of a stacking wheel, provides the required urging pressure on the stack.

30 Some examples of banknote cassettes, dispensers and recirculators according to the invention will now be described with reference to the accompanying drawings, in which:-

Figure 1 is a schematic view of a dispenser attached
35 to an acceptor with a number of document stores;

Figure 2 illustrates a first example of a document store in more detail;

Figure 3 is a view similar to Figure 2 but with a stack of documents during a dispense operation;

Figure 4 is a view similar to Figure 2 but with the stack of documents during an accept operation;

5 Figure 5 is a view similar to Figure 2 but of a second example of a document cassette;

Figure 6 illustrates the Figure 5 example with a stack of notes;

Figure 7 is a front view of the Figure 5 example;

10 Figure 8 illustrates the Figure 6 example with a smaller number of notes; and,

Figure 9 is a view similar to Figure 4 but of a third example.

The primary component of the invention is a document
15 store, in this example a banknote cassette, which can both accept and dispense documents. A first example of such a store is shown in Figures 2 to 4. The store comprises a housing 1 having a shutter 2 which can be retracted (Figure 4) so as to define an acceptance opening 3 through which
20 documents can be delivered to the housing. Located within the housing is a stacking device 4 comprising a carriage 5 on which are mounted a number of laterally spaced transport belts 6 (only one visible in Figure 2) entrained around rollers 7 and forming a nip with fixed transport rollers 8
25 mounted to the housing 1. A further belt 9 entrained around rollers 10 is also mounted on the carriage and cooperates with a stacker wheel 11 having a set of radially outwardly extending tines 12 and mounted on the carriage 5. The transport belts 6 are driven by a motor 13 mounted on
30 the carriage 5 while the stacker wheel 11 is driven (clockwise) by a motor 14 also mounted on the carriage 5. The motors are driven under the control of a microprocessor (not shown) located either within the housing 1 or within the host machine or system.

35 The carriage 5 can move to and fro within the housing 1, being guided by rails (not shown) and being urged towards the position shown in Figure 2 by a spring 15

anchored at an end 16 to the carriage 5 and at its other end 17 to the housing 1.

The housing also supports a feed shutter 18 which can be moved to open a dispense outlet 19 (Figure 3) through which documents can be dispensed.

Movement of the shutters 2,18 is controlled by the acceptor and dispenser mechanisms respectively.

Finally, a pressure plate 20 is supported, for example pivoted, on the carriage 5 and is movable between an active position shown in Figures 2 and 3 and a retracted position shown in Figure 4 in which it enables banknotes to be stacked by the stacker wheel 11. The pressure plate is pivoted, for example, by a motor (not shown).

In some cases the pressure plate could be omitted, pressure being applied to the stack by the resilience of the tines 12 and force delivered by the spring 15.

Figure 3 illustrates the cassette with a stack of banknotes 25, the shutter 18 having been retracted (as shown) so that the banknotes can be extracted through the dispense outlet 19. It will be seen in Figure 3 that the carriage 5 has moved to the left against the spring bias so as to accommodate the note stack 25. The notes are urged towards the dispense outlet 19 by the pressure plate 20 under the influence of the spring 15.

Figure 4 illustrates the cassette when in the document receiving condition. In this case, the shutter 2 has been retracted allowing documents to be introduced through the acceptance opening 3 where they are guided by rotation of the transport belts 6 driven by the motor 13 towards the stacking wheel 11. The pressure plate 20 is retracted (for example using a piston/cylinder or motor mechanism not shown) allowing the banknotes to be conveyed via the stacking wheel 11 into the stack 25.

Figures 5 to 7 illustrate a second example of a banknote cassette. In this case, a housing 1 is provided as before together with a dispense opening 19 and an acceptance opening 3 with their corresponding shutters

18,2. However, in place of the stacking mechanism 4, a pair of drive coils 30,32 are mounted on the carriage 5, the carriage having laterally spaced note guides 34. A return spring 15 urges the carriage 5 to the right as shown in the drawings. Notes delivered through the acceptance opening 3 are received between adjacent turns of the coils 30,32 following which rotation of those coils moves the notes towards the dispense outlet 19. As a note stack 25 is formed, the carriage 5 will be urged to the left against the spring action.

Applicable to each of the implements described, the carriage return spring 15 means of biasing the carriage 5 could be replaced by a servo driven worm and wheel or toothed belt assembly and suitable sensing means of known type to automatically control the position of the carriage. Alternatively, the spring 15 could be replaced by a stepping or DC motor/intermediate rack & pinion and electronic feedback arrangement to control the tine/stack pressure.

In an alternative arrangement, the correct feeder pressure can be applied without the need for a carriage by having these coils 30,32 stop short of the feeder unit so that the coils do not drive the pack of banknotes directly behind the feeder (the feeder note stack). In this method, the correct contact force against the feeder unit is maintained by rotating the coils to bring more banknotes into the back of this feeder stack. This system uses force sensors fitted to the feeder unit which transmit a signal to drive the coils when the force falls below a pre-set limit and to stop driving when the force increases to a second, upper limit and in this manner maintains the force within acceptable limits.

Thus, as shown in Figure 8, as the number of banknotes in the feeder stack diminishes, the feeder contact force also diminishes. Accordingly, it is necessary to have a minimum number of banknotes at all times to ensure that the feeder stack is maintained. To achieve this a number of

banknotes 26 are maintained within the coils to recharge the pack as the feeder contact force diminishes.

Figure 1 illustrates the manner in which a dispenser 50 is converted into a recirculator. An acceptor or deposit module 55 is provided which is located adjacent the dispenser 50. The acceptor includes a transport 60 for transporting accepted banknotes past authenticity and denomination checkers (not shown) to one of three outlets 62,64,66 aligned with respective cassette locations 70,72,74 in the dispenser. Normally, conventional dispense cassettes would be located in the locations 70-74. In this case, however, cassettes according to the invention, for example as shown in Figures 2-4, are located in each of these locations. During an acceptance operation, the respective shutters 2 of the cassettes are opened allowing notes to be supplied to those dispense outlets in accordance with their denomination and the pressure plate 20 is retracted. For example, £5 notes could be supplied to the cassette in location 70, £10 notes to the cassette in location 72, and £20 notes to the cassette in the location 74. These notes are then stacked by the stacking mechanism 4 following which the pressure plate 20 is returned to its active position.

Subsequently, during the dispense operation, the shutters 18 will be opened allowing notes to be extracted as required by the customer from appropriate cassettes, and fed via a transport mechanism 80 to a dispense outlet 82.

The deposit module 55 could be located in place of the conventional door enabling access to the dispenser.

In another example (not shown) the deposit module 55 could be replaced by a banknote refilling module. In this, a stack of banknotes is provided in a store within the module, the module then being presented to the dispenser. The module has a transport in a similar way to deposit module 55 (but no acceptor opening) so that banknotes from

the stores within the module can be selectively supplied to the cassettes in the dispenser.

In the examples described above, although the apparatus in which the store(s) is located can accept
5 banknotes and dispense banknotes, these operations are generally not carried out at the same time. An important advantage of the invention, however, is that the store can be operated to enable both actions to occur simultaneously.

Figure 9 is a diagram of a modified form of the first
10 example (Figures 2-4) in which it can be seen that both shutters 2,18 have been opened so that banknotes can be supplied to the back of the stack 25 through the acceptance opening 3 and dispensed from the front of the stack 25 through the dispense outlet 19 simultaneously. In order
15 that banknotes can be accepted at the back of the stack 25, the pressure plate 20 is retracted but sufficient pressure is maintained on the rear of the stack by the tines 12 of the stacking wheel 11 under the urging force of the spring 15. In some cases, the pressure plate 20 could even be
20 omitted where the resilience of the tines 12 is sufficient to maintain the required pressure. In a further alternative, the pressure plate 20 could be oscillated between its retracted and active positions.

CLAIMS

1. A document store for removably fitting to a document handling device, the store having a housing with a first opening through which documents can be dispensed from the housing and a second opening through which documents can be supplied to the housing; a stacking device within the housing for receiving documents supplied through the second opening and forming them into a stack; and means for urging the stack towards the first opening.
2. A store according to claim 1, wherein the urging means includes the stacking device.
3. A store according to claim 1, wherein the urging means includes a pressure member separate from the stacking device.
4. A store according to claim 3, wherein the pressure member is movable to a retracted position to enable documents to be added to the stack.
5. A store according to any of the preceding claims, wherein the urging means includes a bias member such as a spring.
6. A store according to any of the preceding claims, wherein the stacking device comprises a rotatably mounted stacking wheel having a plurality of radially extending tines.
7. A store according to claim 6, wherein the stacking wheel is mounted on a carriage movable towards and away from the first opening.
8. A store according to claim 7, when dependent on at least claim 5, wherein the carriage is urged towards the first opening by the bias member.
9. A store according to any of claims 1 to 5, wherein the stacking device comprises one or more rotatable coils extending from the second opening towards the first opening; and a control system for rotating the or each coil whereby a document supplied through the second opening is received between adjacent turns of the or each coil,

rotation of the coils transporting the document towards the first opening.

10. A store according to claim 9, wherein the stacking device comprises a pair of substantially parallel coils.

5 11. A document handling device comprising a transport system for transporting documents; and at least one document store according to any of the preceding claims removably mounted in cooperation with the transport system to enable documents to be supplied to or dispensed from the
10 store.

12. A document handling device according to claim 11, wherein the transport system is adapted to supply documents to the store and disperse documents from the store simultaneously.

15 13. A document acceptor for connecting to a document dispenser to form a document recirculator, the document acceptor including an inlet; and a transport for transporting documents received at the inlet to a storage location, the storage location including a document store
20 according to any of claims 1 to 10, the document store being connectable to a dispense transport of a document dispenser.

14. An acceptor according to claim 13, wherein the document store is removably mounted in the storage
25 location.

15. A document handling device or document acceptor according to any of claims 11 to 14, comprising at least two of said document stores.

16. A document recirculator comprising a document acceptor
30 according to any of claims 13 to 15 connected to a document dispenser, part of the document store being located in a document store location of the dispenser with the first opening of the store communicating with a transport of the dispenser.

35 17. A document recirculator according to claim 16, wherein the document store is removably located in one or both of the acceptor and dispenser.

18. A method of operating a document handling device or recirculator according to any of claims 11, 12, 16 or 17, the method comprising operating the transport system so as simultaneously to deliver documents to the store and
5 disperse documents from the store.
19. A method according to claim 18, wherein the documents comprise banknotes.

Fig.1.

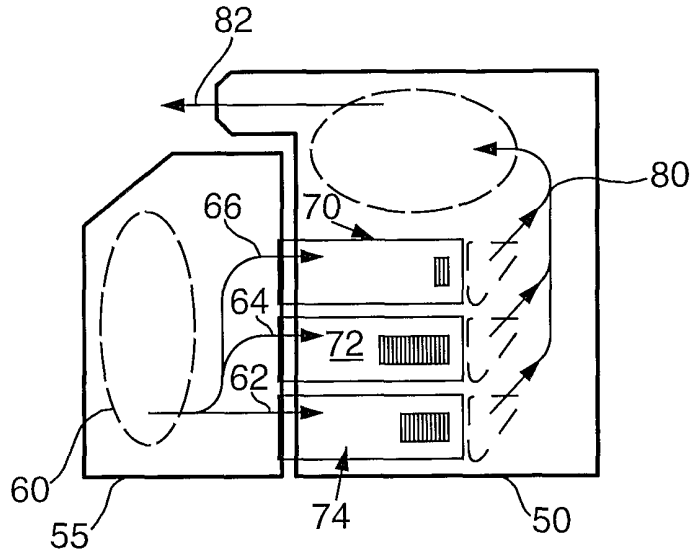


Fig.2.

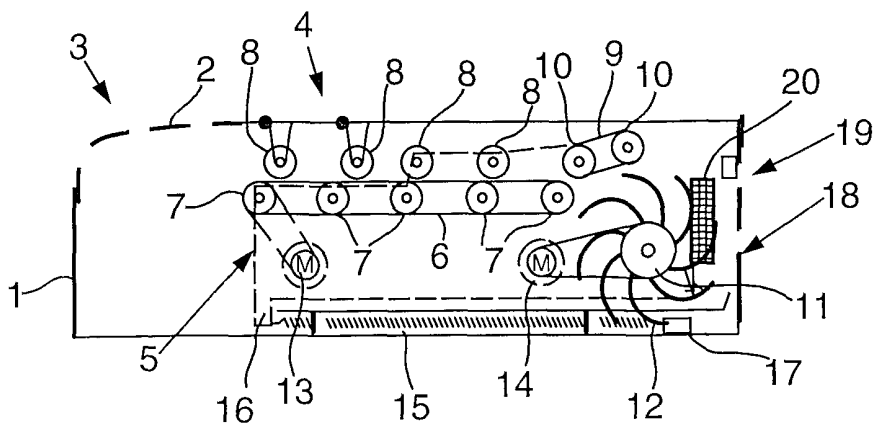


Fig.3.

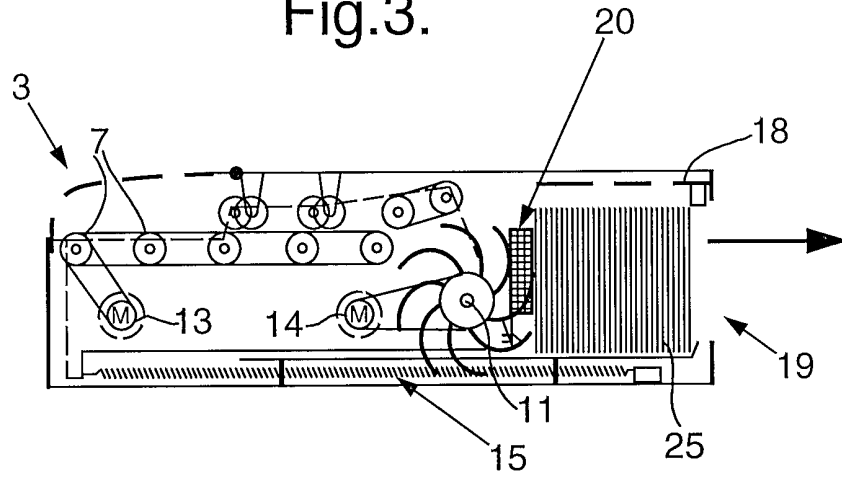


Fig.4.

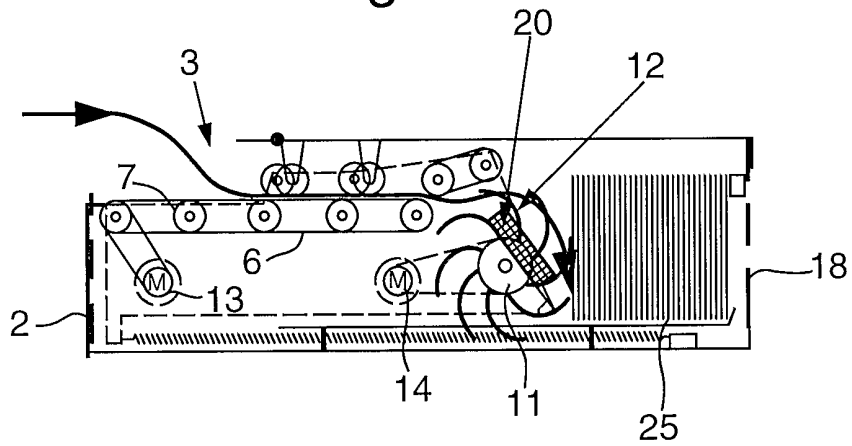
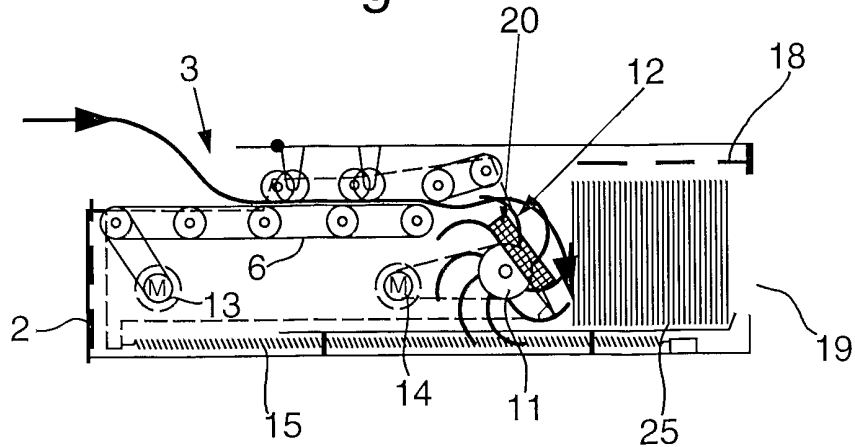
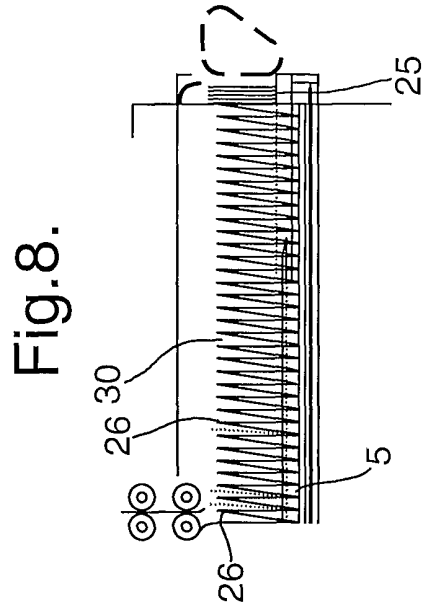
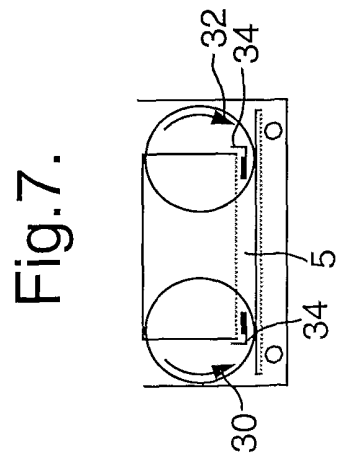
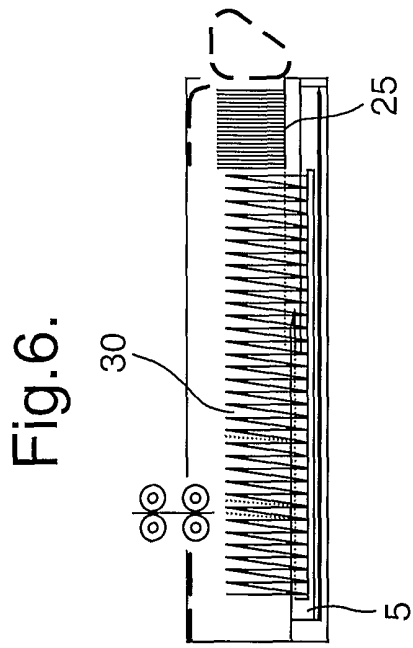
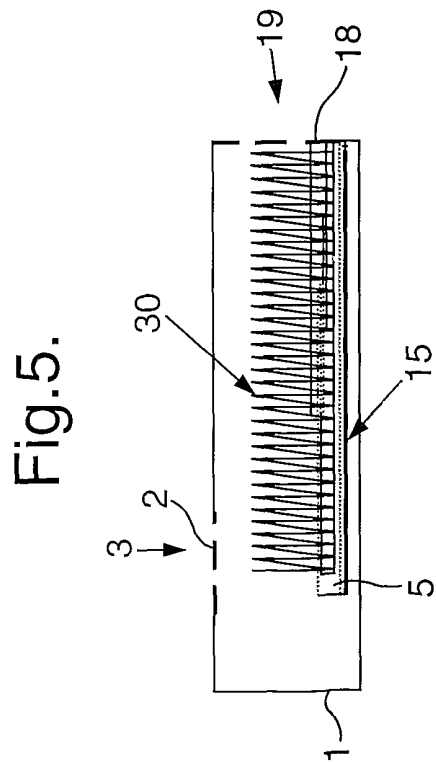


Fig.9.





INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 01/04683

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G07D11/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G07D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No
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A	US 4 662 623 A (NAKANISHI TOMOYUKI) 5 May 1987 (1987-05-05) abstract; claim 1; figure 1	1-8
A	US 4 890 824 A (UCHIDA SHINYA ET AL) 2 January 1990 (1990-01-02) abstract; claim 1; figure 2	1,11,12, 18,19
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Further documents are listed in the continuation of box C. Patent family members are listed in annex

* Special categories of cited documents

A document defining the general state of the art which is not considered to be of particular relevance	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
E earlier document but published on or after the international filing date	*X* document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*Y* document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
O document referring to an oral disclosure, use, exhibition or other means	*Z* document member of the same patent family
P document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 29 November 2001	Date of mailing of the international search report 06/12/2001
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Name and mailing address of the ISA European Patent Office P B 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel (+31 70) 340 2040 Tx 31 651 epo nl Fax (+31 70) 340 3016	Authorized officer Reule, D
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INTERNATIONAL SEARCH REPORT

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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