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(54) **BANKNOTE VALIDATOR WITH CASHBOX**

(57) A banknote drive arrangement of a banknote validator includes a combination roller drive and belt drive to improve the passage of banknotes from a validating head to a banknote stacking position where a banknote is pushed and stacked in a cashbox. The invention is also directed to a cashbox and a banknote validating head that cooperates to define a curved transition in a banknote processing channel linking an outlet of the validating head to a banknote stacking position associated with a connected cashbox.

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to banknote validators having an associated cashbox and in particular to the connection between the cashbox and the banknote validator allowing banknotes to pass from the validator to the cashbox.

BACKGROUND OF THE INVENTION

[0002] Banknote validators with locking banknote cassettes or non locking cashboxes are well known and have particular application for standalone payment systems where there may or may not be security personnel present.

[0003] Banknote validators and associated cashboxes for gaming machines and other applications where the value of the accumulated banknotes is relatively high, typically use a locking banknote cassette. In lower value applications such as vending machine applications, the value of accumulated banknotes received as part of the payment process is significantly less and a more cost effective arrangement of the banknote validator and cashbox is often required. For vending machine applications, it is known to use a plastic cashbox and it is also known to use a plastic cashbox with an open port. This simplified plastic cashbox is significantly less secure relative to a locked banknote cassette however it provides a low cost system. The open port plastic cashbox is typically used where the denomination of the currency being accumulated is relatively low and/or the operator demands a price point for the combination banknote validator and cashbox that is particularly aggressive.

[0004] The present invention relates to a banknote validator having a cashbox of the open port type that has improved properties reducing the possibility of banknote jamming when passed from the validator to the cashbox.

[0005] In banknote validators and plastic cashboxes, the cashbox is generally connected to the banknote validator for feeding of the banknote along one face of the cashbox to overlap with the open port. The banknote is appropriately positioned by the banknote validator in front of the open port and a stacking mechanism forces the banknote through the port and into the cashbox. Typically a banknote validator has an initial banknote evaluating channel of a first generally straight orientation connected to a curved transition followed by a second generally straight segment having a direction generally perpendicular to the first direction. The curved transition is normally a smooth curve defined entirely by the banknote validator and guides the banknote through the change in direction of travel and connecting with an outlet of the validator. The cashbox is then positioned adjacent the outlet and the banknote is moved or passed along a front face of the banknote receiving port in the cashbox.

[0006] With the prior art arrangement described above, a banknote can become jammed in the banknote validator or at the junction of the cashbox and the banknote validator. Banknote validators can include various arrangements including software arrangements for controlling the drive of the banknote validator to assist in clearing of jammed banknotes, however jamming of banknotes remains a significant problem as the banknote validator is forced to a service required condition. This outage in service typically reduces sales and can frustrate both customers and the service providers.

[0007] It is desired to provide an improved arrangement for processing of banknotes and stacking of the banknotes in a cost efficient and reliable arrangement.

SUMMARY OF THE INVENTION

[0008] A banknote validator according to the present invention comprises a validating head having a banknote processing channel for assessing the authenticity of banknotes and a releasable cashbox connected to the validating head for stacking authenticated banknotes. The validating head includes a banknote inlet at one end of the banknote processing channel and a banknote outlet at an opposite end of the banknote channel. The banknote outlet cooperates with an end of the cashbox to collectively define a curved transition guiding an authenticated banknote through an angle of at least 90° leading to a stacking port in a side of the cashbox. The cashbox and validating head have interfitting surfaces collectively defining an outside guide structure of the curved transition when the cashbox is secured to the validating head. A drive arrangement drives banknotes through the banknote processing channel, and if authenticated, through the curved transition to the stacking port. A stacking mechanism is provided for selectively pushing a banknote through the stacking port and into the cashbox.

[0009] In a preferred aspect of the invention the banknote validator has a particular drive arrangement that includes two lead drive rollers located in the validating head and defining a portion of the curved transition.

[0010] The drive arrangement further includes cooperating responsive rollers on opposite sides of the processing channel on a front side of the curved transition and a pair of downstream responsive rollers supported in the cashbox adjacent a discharge of the curved transition. Each of these responsive rollers cooperate with the associated lead drive rollers to engage and guide a banknote towards the stacking port of the cashbox.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Preferred embodiments of the invention are shown in the drawings wherein:

Fig. 1 is a vertical sectional view through a banknote validating head and the connected cashbox showing the cooperation of these components and in particular the cooperation defining the curved transition

for the banknote drive path;

Fig. 2 is a partial perspective view showing the open port of a cashbox in combination with a top member of the validating head illustrating the guide surface at the curved transition;

Fig. 3 is a partial perspective view showing further details of the particular cooperation of the components shown in Fig. 2;

Fig. 4 is a partial sectional view showing the outer components and their cooperation to form the curved transition;

Fig. 5 is a front view showing the portion of the validating head opposite the port in the cashbox;

Fig. 6 is a partial perspective view showing the interior surface of the curved transition;

Fig. 7 is a perspective view of the lead drive roller; and

Fig. 8 is a perspective view of the responsive roller.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0012] The sectional view of Fig. 1 shows a banknote validator 2 having a banknote validating head 4, and a cashbox 6 where banknotes enter through the banknote inlet 8, pass through the processing channel 10 to the curved transition 12, and if authenticated, are driven to overlap with the stacking port 40 of the cashbox 6. The arrangement of Fig. 1 has a particular drive arrangement and banknote processing pathway which distinguishes it from the prior art. It can be seen from a review of Figures 2 and 3 that the curved transition 12 which forms part of the banknote processing channel is defined between a portion of the validating head 4 and an end portion of the cashbox 6. This curved transition allows an authenticated banknote to be driven and positioned in front of a port of a cashbox. The curved transition essentially joins the two straight segments that have a generally 90° orientation.

[0013] The curved transition is defined by a portion of the cashbox and a portion of the validating head. This is in contrast to prior art arrangements where the curved transition is entirely formed within the validating head and the cashbox abuts with an offset discharge from the validating head after the banknote has been processed through the curved transition.

[0014] It has been found that banknotes may become jammed or lodged at a curved transition in the banknote processing path and/or at the connection to the cashbox. In contrast to the prior art arrangement, the curved transition of the present system is collectively defined between the cashbox and the validating head and thus the separate interface between the cashbox and the validating head is avoided. This reduces the number of locations where a banknote may become jammed and the arrangement has been found to be more reliable.

[0015] As seen in Fig. 2, the validating head 4 includes an outside portion 5 that defines part of the exterior of the curved transition 12. The one end 15 of the cashbox 6 defines a second portion of the curved transition. Basically the cashbox includes a series of interfitting or overlapping surfaces 62 as shown in Fig. 3 which cooperate with the interfitting surfaces 60 of the outside portion 5 of the validating head 4. These interfitting surfaces form stationary parts of the exterior surface of the curved transition.

[0016] It can also be seen in Fig. 3 that the outside portion 5 of the validating head 4 includes two cooperating responsive rollers 24 that engage the drive roller 22 shown in Fig. 1. Basically there are 2 drive rollers on either side of the validating head and positioned within the curved transition as best shown in Fig. 1. A banknote passing through the banknote channel and the curved transition is engaged by each of the drive rollers 22 and the cooperating responsive rollers 24 as part of the validating head and the cooperating responsive rollers 48 that are supported in the cashbox. As illustrated in the sectional view of Fig. 1, the drive roller 22 is engaged by the responsive roller 24 and the responsive roller 48 of the cashbox. With this arrangement, a banknote that is approaching the curved transition is initially engaged in the gap between the responsive roller 24 and the drive roller 22 and the associated drive belt. The banknote is driven through the curved transition and subsequently engaged between the responsive roller 48 and the drive roller 22. This arrangement for controlling of the banknote as it passes through the curved transition has proven to be very effective. With this arrangement the cashbox forms the second portion of the curved transition in combination with an inner surface of the validating head 4.

[0017] The drive roller 22 is oversized relative to the responsive rollers and preferably is of a diameter at least twice the diameter of the responsive rollers. With this arrangement the drive belts and the drive rollers drive the banknote throughout the curved transition.

[0018] Figures 5 and 6 show a further feature of the present invention. The drive roller 22 is actually a combination drive roller having a drive roller segment 34 which engages roller segment 26 of the cooperating responsive rollers 24 and 48. The drive roller 22 also includes a belt drive gear segment 36 shown in Fig. 7 that cooperates and drives the drive belt 30. With this structure, both the drive belt 30 (and there are a pair of drive belts 30 provided either side of the banknote channel) and the drive roller segment 34 control the banknote as it passes through the curved transition. At the discharge side of the curved transition, the drive belts 30 continue to drive the banknote downwardly as these drive belts are positioned either side of the stacking port 40 in the banknote cassette. It can also be appreciated that the drive roller segments of the drive rollers also force a banknote downwardly so that it can assume an overlapped position with the stacking port 40 of the cashbox 6 to allow stacking therein. With banknotes of different widths, this has been effective in reducing jamming events. The outside position of the banknote drive belts is preferred as they extend either side of the port 40. A return roller

for each drive belt is generally shown as 49.

[0019] Fig. 5 shows a pusher plate 70 that includes its own motor for forcing of the pusher plate through the stacking port 40 and any banknote in front of the stacking port to push a banknote into the cashbox.

[0020] With the present structure, the curved transition is formed between the cashbox and the banknote validating head. The inner portion of the curved transition is defined in the validating head by the banknote channel and the drive rollers 22 and the drive belts. The outer portion of the curved transition is partially defined by the validating head (i.e. the outside portion 5) and the one end of the cashbox such that a banknote is only prone to jamming in the curved transition and the cashbox and validating head have a pass off point that is collectively defined within the curved transition. By positioning the drive roller 22 in the curved transition and of a diameter to allow it to engage the banknote as it enters the curved transition as well as when it leaves the curved transition, the drive roller maintains control over the banknote and provides an effective hand off as the processing channel of the banknote on the exterior thereof changes from the banknote validating head to the cashbox.

[0021] The particular cooperation of the elements in the interlapping surfaces or fingers at the curved transition to collectively form the curved transition reduces jamming and effectively controls the banknote as it passes between the validating head and the cashbox. This arrangement, particularly in combination with the double drive arrangement (rollers and drive belts), provides increased reliability.

[0022] Figures 7 and 8 show additional details of the drive roller and the cooperating responsive roller. Fig. 7 is a perspective view of the drive roller 22 which includes the gear drive segment 36 for engaging teeth on the back surface of the drive belts as well as a drive roller segment 34. This drive roller segment can be of an appropriate rubber material or other suitable material for engaging the banknote as it passes through the curved transition.

[0023] The responsive roller 34 and the responsive roller 48 are preferably of the same design as shown in Fig. 8. A drive roller segment 34 engages the opposite roller segment 26 and a spaced belt drive gear segment 36. These elements cooperate with the outer surface of the belt drive to appropriately drive the banknote with rotation of the roller. It can be seen that the two segments 34 and 36 are separated by a center recessed portion 35. This is preferred to allow each of the segments 34 and 36 to respectively function independently of one another although tied to the rotation of the roller.

[0024] Although various preferred embodiments of the present invention have been described herein in detail, it will be appreciated by those skilled in the art, that variations may be made thereto without departing from the invention as defined in the appended claims.

EMBODIMENTS

[0025] Although the present invention is defined in the attached claims, it should be understood that the present invention can also (alternatively) be defined in accordance with the following embodiments:

1. A banknote validator comprising a validating head having a banknote processing channel for assessing the authenticity of banknotes and a releasable cashbox connected to said validating head for stacking authenticated banknotes; said validating head including a banknote inlet at one end of said banknote processing channel and a banknote outlet at an opposite end of said banknote channel, said banknote outlet cooperating with an end of said cashbox to collectively define a curved transition guiding an authenticated banknote through an angle of at least 60 degrees leading to a stacking port in a side of said cashbox;
said cashbox and said validating head have interfitting surfaces collectively defining an outside guide structure of said curved transition when said cashbox is secured to said validating head; a drive arrangement driving banknotes through said banknote processing channel and if authenticated through said curved transition to said stacking port; and a stacking mechanism for selectively pushing a banknote through said stacking port and into said cashbox.

2. A banknote validator as claimed in embodiment 1 wherein said drive arrangement includes two lead drive rollers located in said validating head defining a portion of an inside surface of said curved transition, and wherein each of said lead drive rollers include a cooperating responsive roller on an opposite side of said processing channel and each of said downstream drive rollers include a cooperating responsive roller supported in said cashbox adjacent said curved transition.

3. A banknote validator as claimed in embodiment 2 wherein each of said cooperating responsive rollers supported in said cashbox are located to form part of said curved transition.

4. A banknote validator as claimed in embodiment 3 wherein said angle of said curved transition is approximately 90 degrees.

5. A banknote validator as claimed in embodiment 2 wherein each of said downstream rollers additionally includes a drive belt positioned to engage and drive an authenticated banknote at least from said curved transition to a position in front of said stacking port of said cashbox.

6. A banknote validator as claimed in embodiment 5 wherein each drive belt is positioned to engage and drive an authenticated banknote through said curved transition to the position in front of said stacking port.

7. A banknote validator wherein each drive belt includes a drive gear connected to and rotated with rotation of the associated downstream roller.

8. A banknote validator as claimed in embodiment 7 wherein each responsive roller in said cashbox is a double roller with a first roller segment cooperating with said drive belt and a second roller segment cooperating with said downstream roller to engage and drive an authenticated banknote.

9. A banknote validator as claimed in embodiment 8 wherein each double roller includes an inwardly recessed portion separating said first and second roller segments.

10. A banknote validator as claimed in embodiment 9 wherein said first and second roller segments and said inwardly recessed portion of each double roller are an integral component.

11. In a banknote validator having a banknote processing passageway through which banknotes are driven for authentication and if authenticated are driven to a stacking position by a banknote drive arrangement wherein said banknote drive arrangement comprises a combination roller and belt drive arrangement on one side of said banknote processing passageway, said combination roller and belt drive arrangement includes a motor connected to a drive roller partially projecting into said banknote processing passageway and cooperating with a responsive roller on an opposite side of said banknote processing passageway to define a banknote engaging position between said drive roller and said responsive roller arrangement, said responsive roller arrangement being spring biased to move relative to said drive roller to accommodate the thickness of a banknote therebetween;
said drive roller having associated therewith a belt drive gear rotatable with rotation of said drive roller and positioned on one side thereof, said belt drive gear driving a drive belt that cooperates with said drive roller to drive a banknote to said stacking position, and wherein said drive belt extends along said one side of said banknote processing passageway to said stacking position, and wherein said drive roller is located upstream of said stacking position; and
wherein said responsive roller arrangement engages and cooperates with each of said drive roller and said drive belt to engage and drive a banknote to said stacking position.

12. In a banknote validator as claimed in embodiment 11 wherein said responsive roller arrangement is a responsive roller having two spaced roller segments with one roller segment cooperating with said drive belt and the other roller segment cooperating with said drive roller.

13. In a banknote validator as claimed in embodiment 12 wherein said responsive roller arrangement is a single roller and said roller segments include a recessed portion therebetween that connects said two spaced roller segments.

14. In a banknote validator as claimed in embodiment 11. including two banknote drive arrangements with one of said banknote drive arrangements positioned adjacent one side edge of said banknote processing passageway and the other banknote drive arrangement positioned adjacent an opposite side edge of said banknote processing passageway.

15. In a banknote validator as claimed in embodiment 14 wherein including a common drive motor connected to each of said banknote drive arrangements.

16. In a banknote validator as claimed in embodiment 14 wherein said drive belts are positioned on either side of a banknote stacker push plate.

17. In a banknote validator as claimed in embodiment 14, including a cashbox forming a side portion of said banknote processing passageway positioned to include said stacking position; said cashbox having a banknote port open to said passageway and opposite a banknote pusher plate operable to push a banknote in said stacker position through said banknote port and into said cashbox.

18. In a banknote validator as claimed in embodiment 17, wherein said cashbox includes a series of spaced protrusions either side of said banknote port extending towards and cooperating with said drive belts to engage and drive a banknote with movement of said drive belts.

Claims

1. A banknote validator having a banknote processing passageway through which banknotes are driven for authentication and if authenticated are driven to a stacking position by a banknote drive arrangement wherein said banknote drive arrangement comprises a combination roller and belt drive arrangement on one side of said banknote processing passageway, said combination roller and belt drive arrangement includes a motor connected to a drive roller partially

projecting into said banknote processing passageway and cooperating with a responsive roller on an opposite side of said banknote processing passageway to define a banknote engaging position between said drive roller and said responsive roller arrangement, said responsive roller arrangement being spring biased to move relative to said drive roller to accommodate the thickness of a banknote therebetween;

said drive roller having associated therewith a belt drive gear rotatable with rotation of said drive roller and positioned on one side thereof, said belt drive gear driving a drive belt that cooperates with said drive roller to drive a banknote to said stacking position, and wherein said drive belt extends along said one side of said banknote processing passageway to said stacking position, and wherein said drive roller is located upstream of said stacking position; and
wherein said responsive roller arrangement engages and cooperates with each of said drive roller and said drive belt to engage and drive a banknote to said stacking position.

2. The banknote validator as claimed in claim 1 wherein said responsive roller arrangement is a responsive roller having two spaced roller segments with one roller segment cooperating with said drive belt and the other roller segment cooperating with said drive roller.

3. The banknote validator as claimed in claim 2 wherein said responsive roller arrangement is a single roller and said roller segments include a recessed portion therebetween that connects said two spaced roller segments.

4. The banknote validator as claimed in claim 1 including two banknote drive arrangements with one of said banknote drive arrangements positioned adjacent one side edge of said banknote processing passageway and the other banknote drive arrangement positioned adjacent an opposite side edge of said banknote processing passageway.

5. The banknote validator as claimed in claim 4 wherein including a common drive motor connected to each of said banknote drive arrangements.

6. The banknote validator as claimed in claim 4 wherein said drive belts are positioned on either side of a banknote stacker push plate.

7. The banknote validator as claimed in claim 4, including a cashbox forming a side portion of said banknote processing passageway positioned to include said stacking position;

said cashbox having a banknote port open to said passageway and opposite a banknote pusher plate operable to push a banknote in said stacker position through said banknote port and into said cashbox.

8. The banknote validator as claimed in claim 7, wherein said cashbox includes a series of spaced protrusions either side of said banknote port extending towards and cooperating with said drive belts to engage and drive a banknote with movement of said drive belts.

9. The banknote validator as claimed in claim 1, comprising a validating head including the banknote processing passageway and a releasable cashbox connected to the validating head for stacking authenticated banknotes;
the validating head including a banknote inlet at one end of the banknote processing passageway and a banknote outlet at an opposite end of the banknote passageway, the banknote outlet cooperating with an end of the cashbox to collectively define a curved transition guiding an authenticated banknote through an angle of at least 60 degrees leading to a stacking port in a side of said cashbox.

10. The banknote validator as claimed in claim 9, wherein the cashbox and the validating head have interfitting surfaces collectively defining an outside guide structure of said curved transition when the cashbox is secured to the validating head.

11. The banknote validator as claimed in claim 9 or claim 10, comprising a stacking mechanism for selectively pushing a banknote through the stacking port and into the cashbox.

12. The banknote validator as claimed in any one of claims 9 to 11, wherein the angle of the curved transition is approximately 90 degrees.

13. The banknote validator as claimed in any one of claims 1 to 12 wherein the responsive roller is a double roller with a first roller segment cooperating with the drive belt and a second roller segment cooperating with a downstream roller to engage and drive an authenticated banknote.

14. The banknote validator as claimed in claim 13, wherein each double roller includes an inwardly recessed portion separating said first and second roller segments.

15. The banknote validator as claimed in claim 14, wherein the first and second roller segments and the inwardly recessed portion of each double roller are an integral component.

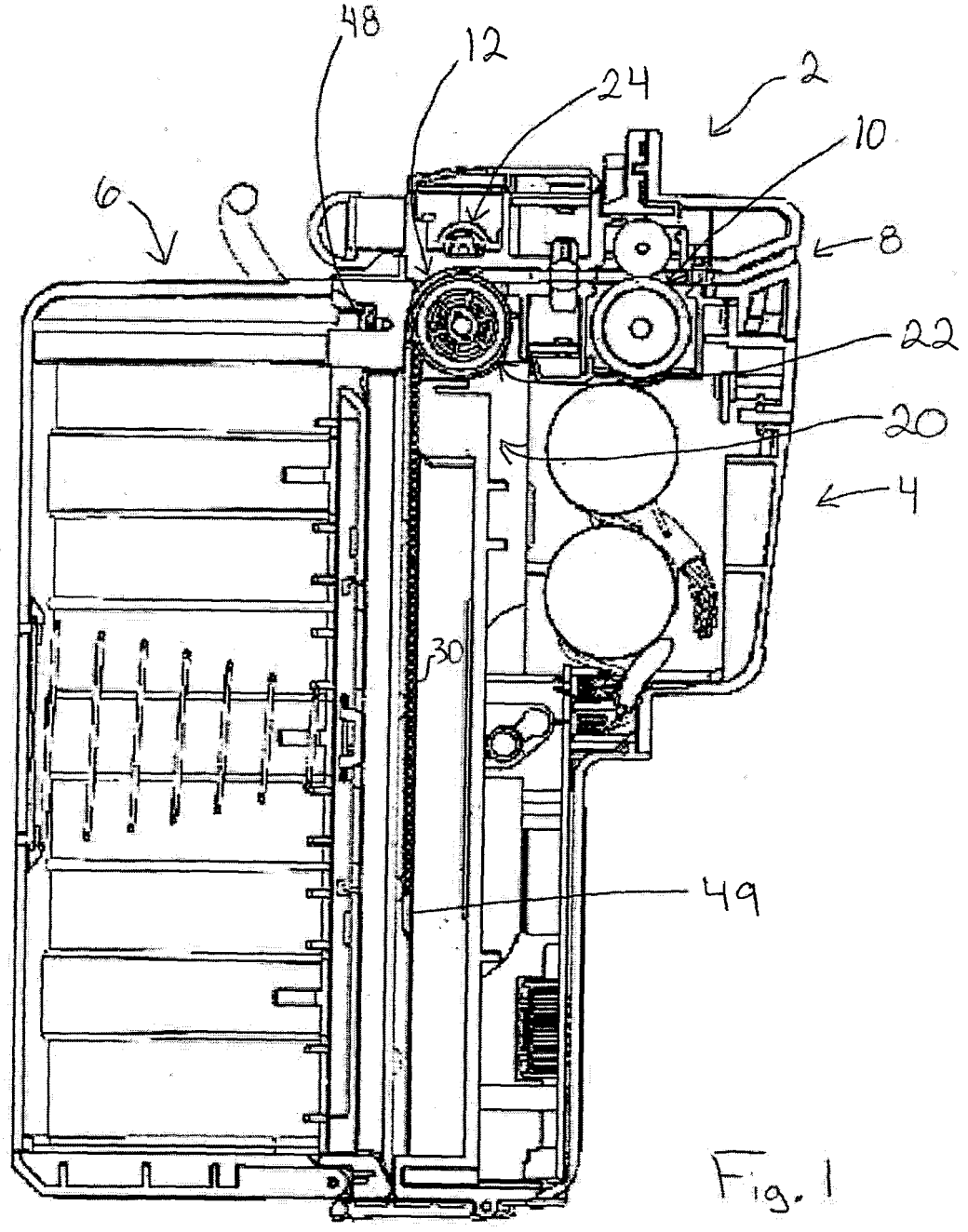

Fig. 1

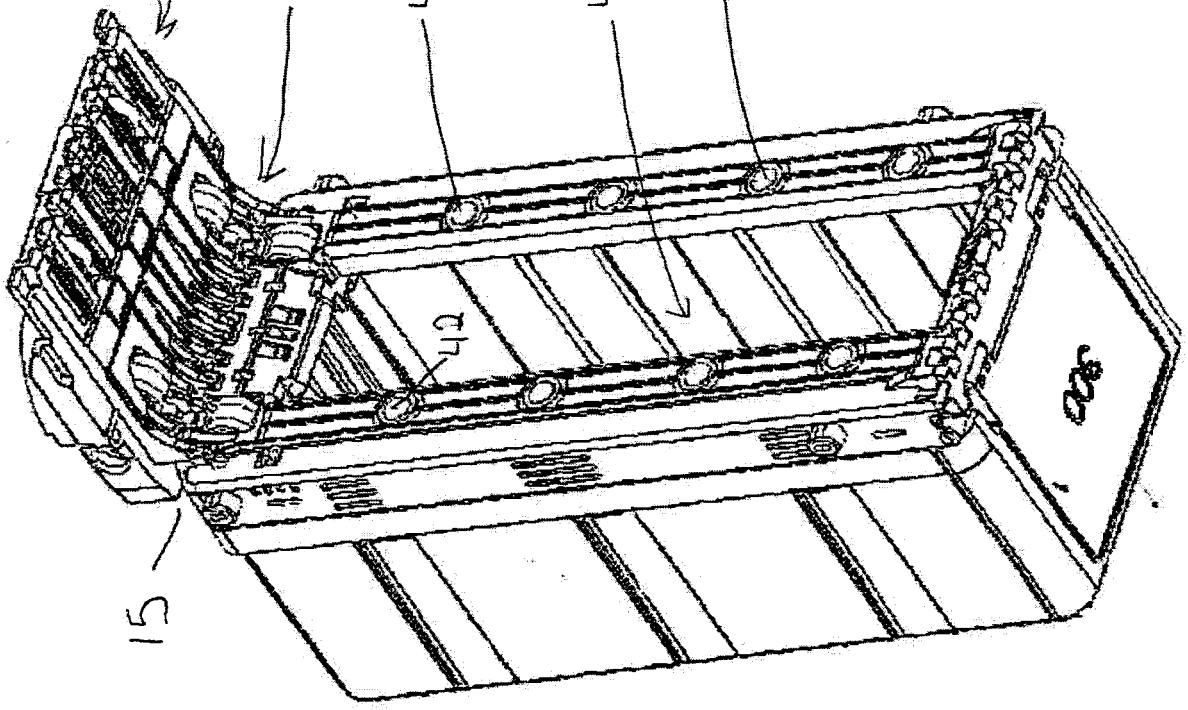

Fig. 2

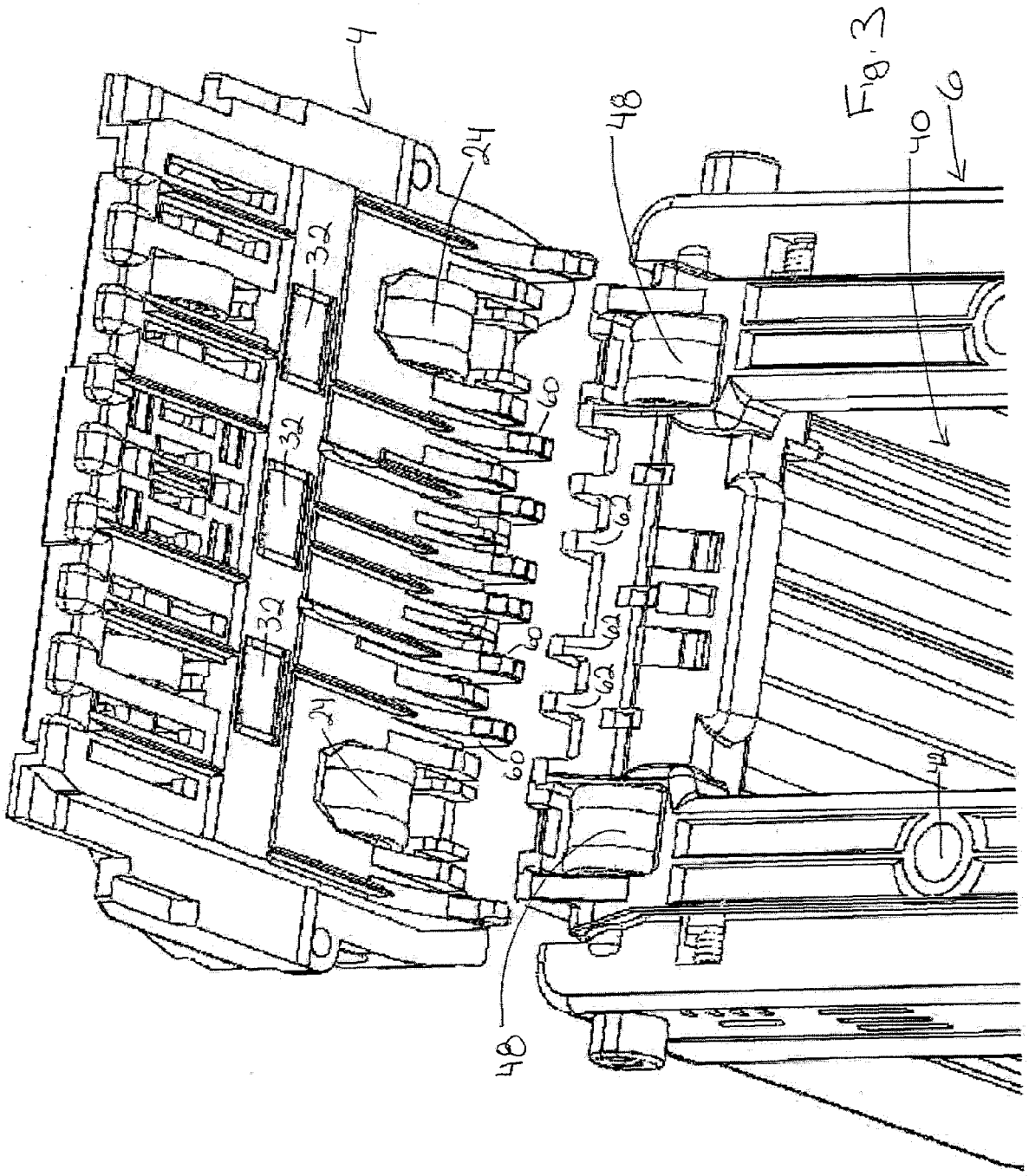

Fig. 3

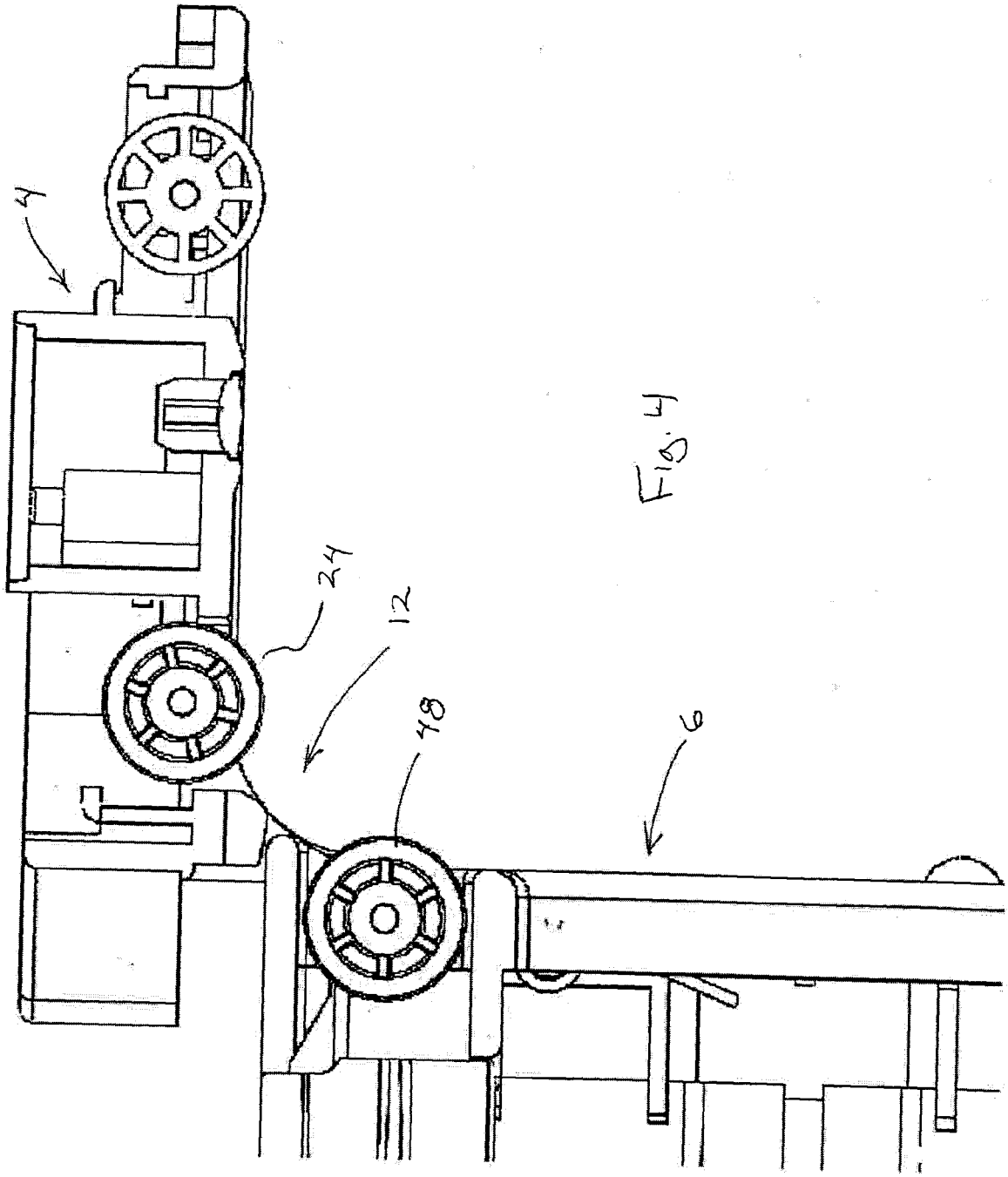

FIG. 4

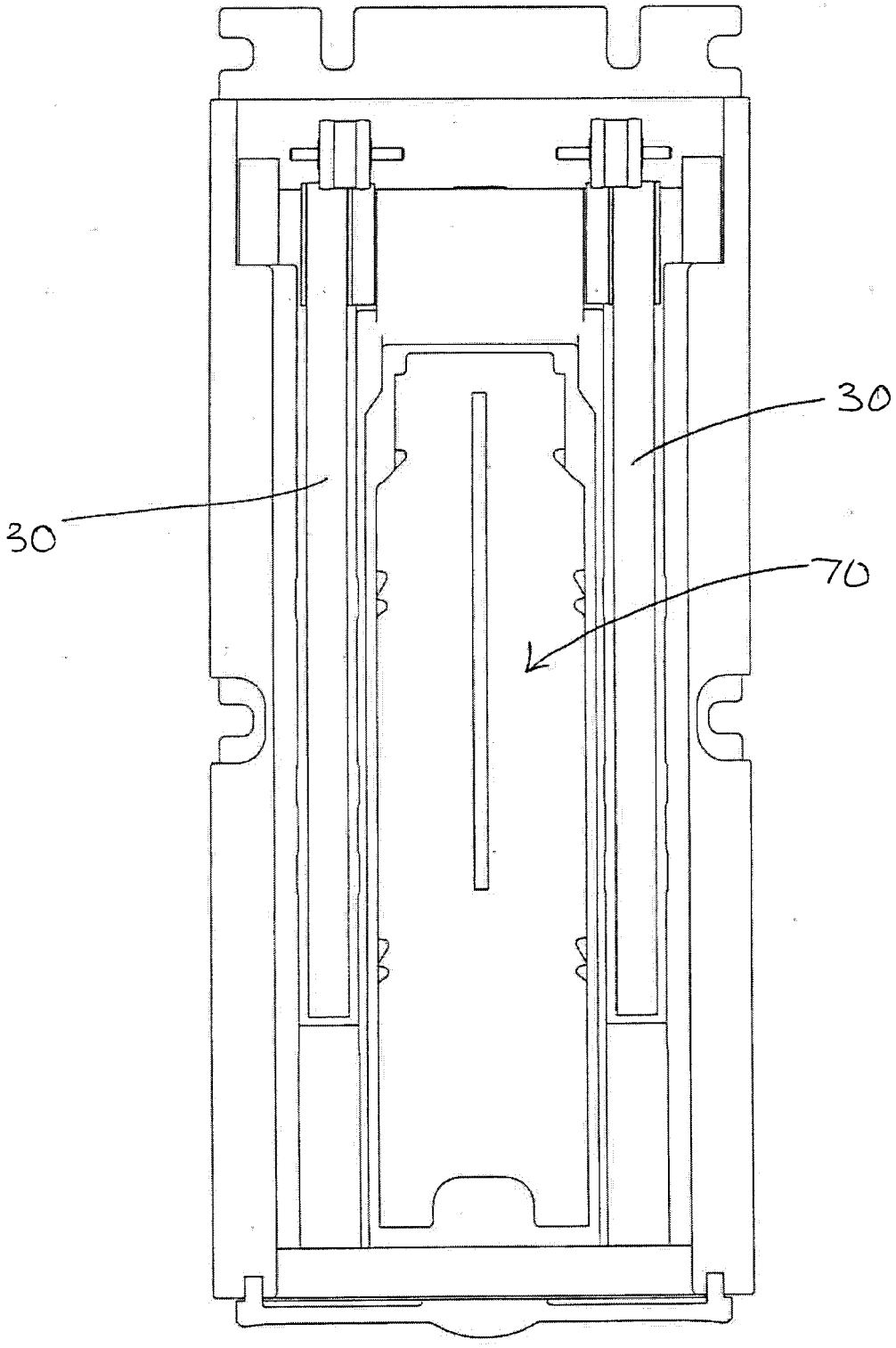

Fig. 5

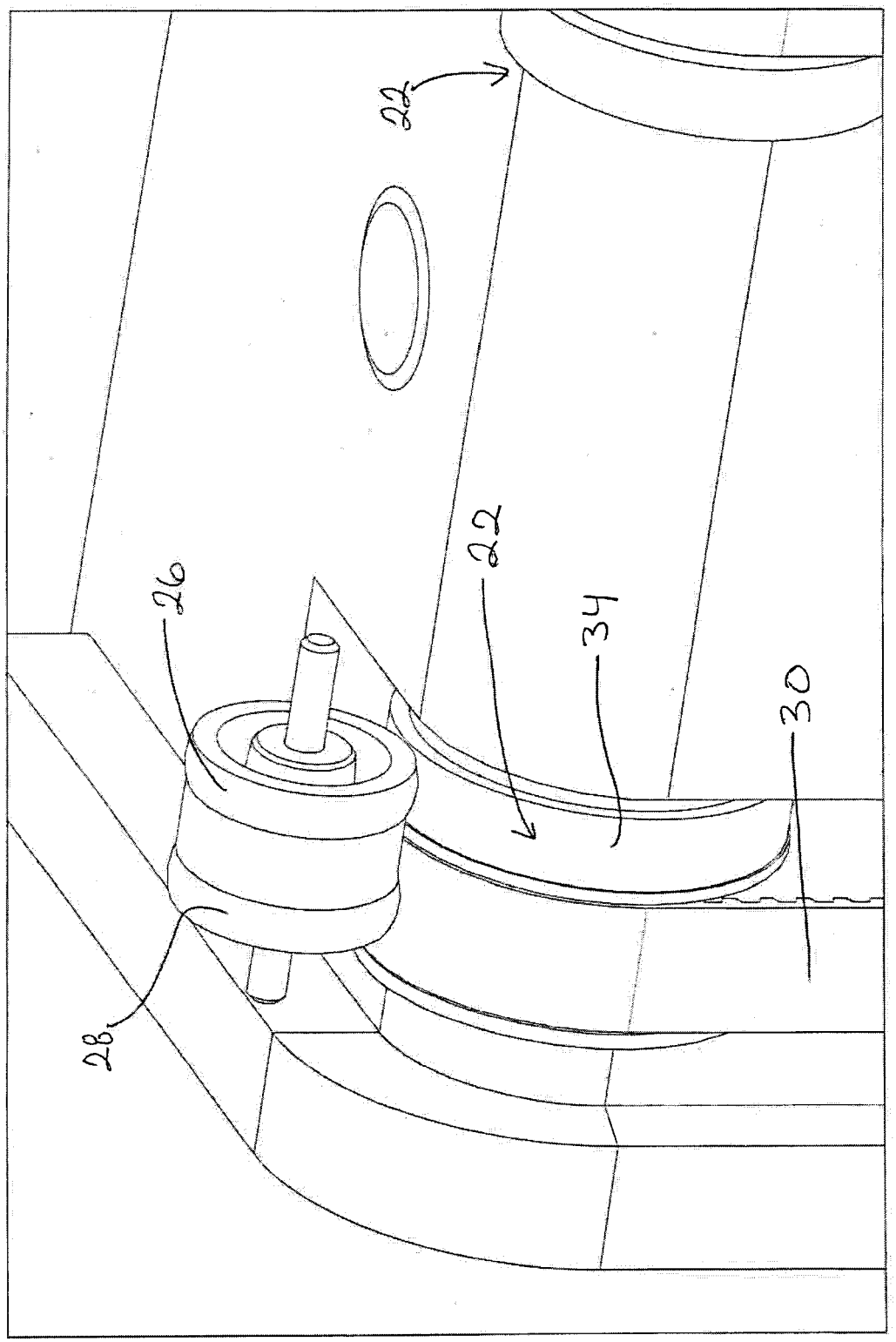

Fig. 6

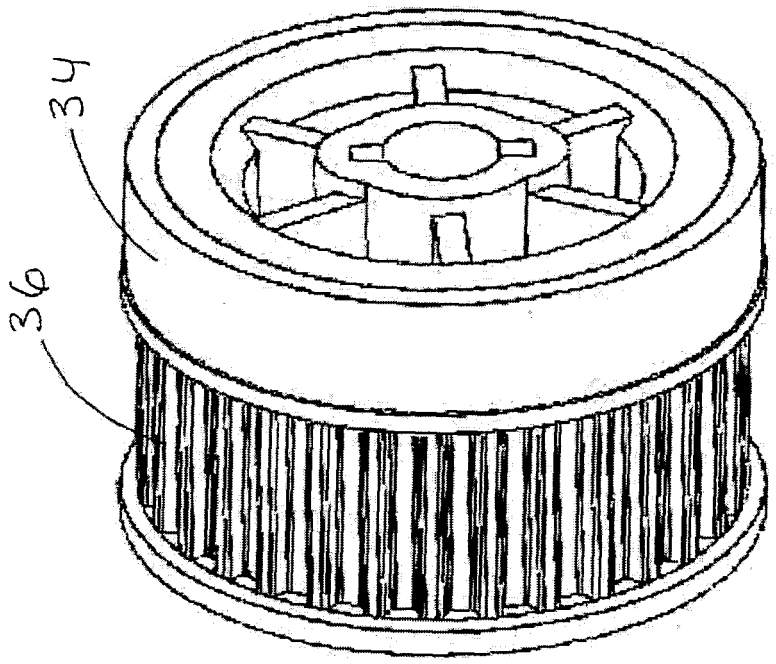

Fig. 7

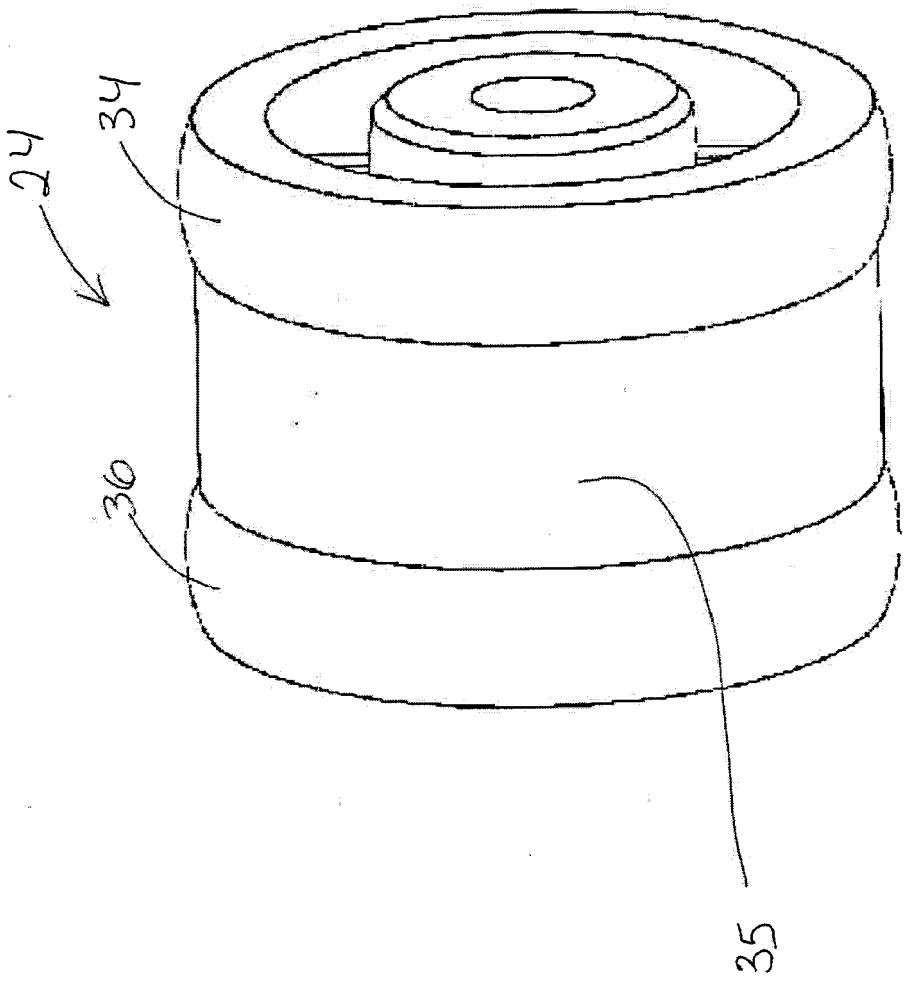

Fig. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 21 20 9305

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 519 331 A2 (MARS INC [US]) 30 March 2005 (2005-03-30) * paragraphs [0017] - [0019]; figures 1,2,13-17 *	1-15	INV. G07D7/00 G07D11/00 G07D11/16 G07D11/40
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TECHNICAL FIELDS SEARCHED (IPC)
G07D

1 The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	4 March 2022	Mirza, Anita

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 21 20 9305

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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