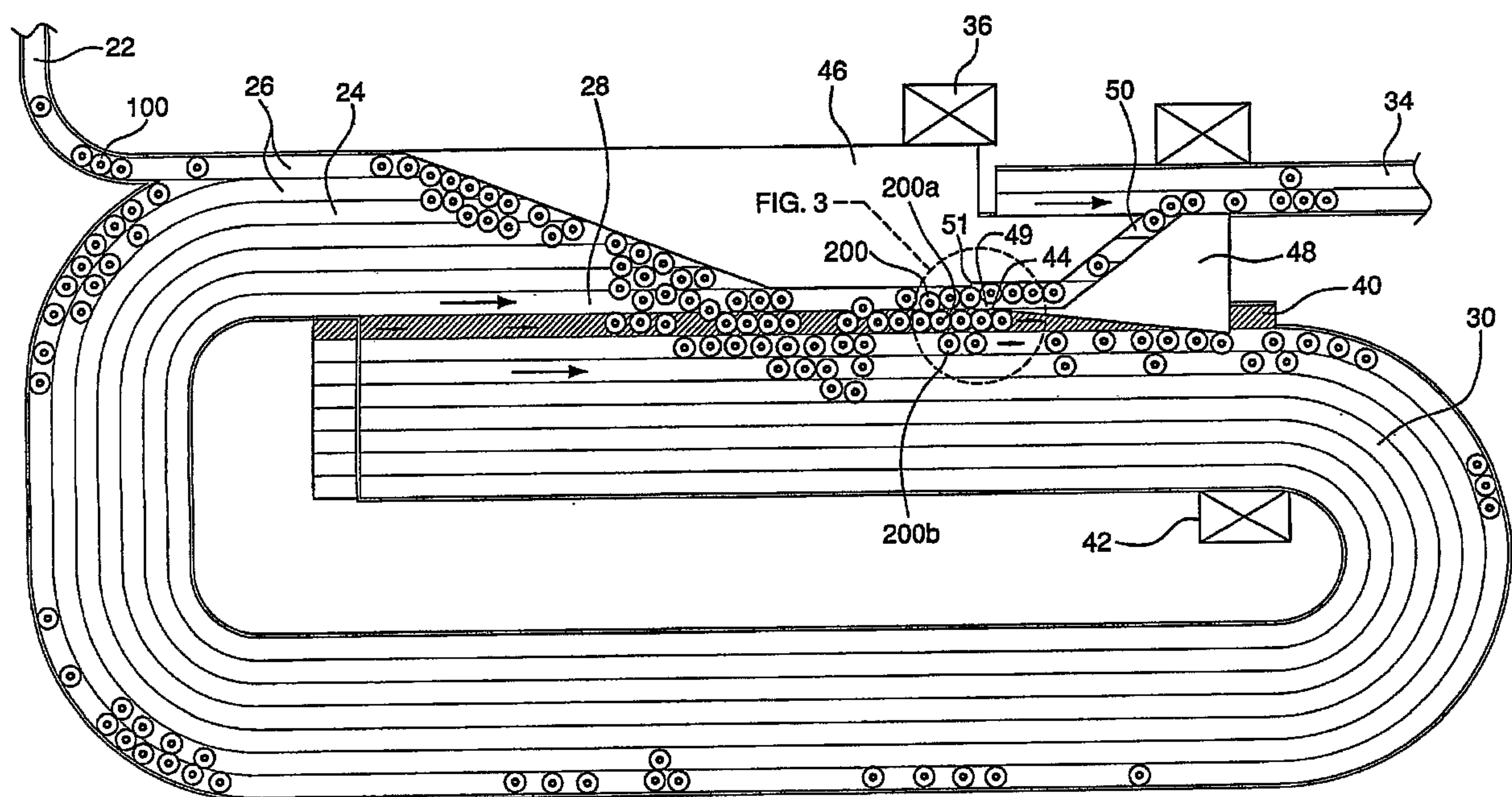




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(72) Inventeur/Inventor:
GARVEY, MARK C., US
(73) Propriétaire/Owner:
GARVEY CORPORATION, US
(74) Agent: PERRY + CURRIER

(54) Titre : SYSTEME ET METHODE D'ACCUMULATION POUR CONVOYEURS A VITESSES DIFFERENTIELLES
(54) Title: DIFFERENTIAL SPEED CONVEYOR ACCUMULATION SYSTEM AND METHOD



(57) Abrégé/Abstract:

A product conveying and accumulation system and method employs a primary product transporting conveyor with accumulation and re-circulating sections. The conveyor is configured to receive products from an upstream destination and discharge products to a downstream destination. A second conveyor, operable at a considerable slower speed than the first conveyor, is located in the same transverse plane as and is aligned adjacent to the first conveyor. Both conveyors travel in the same direction at the adjacent alignment. As products are discharged from the system, a wall of product is formed on the slower moving conveyor. As a result, products on the inner lane of the faster moving conveyor which would otherwise tend to move inward towards the discharge point, causing product turbulence and disruption, are urged back onto the inner lane by the product wall and then smoothly discharged from the system to the downstream destination. The use of this slower conveyor increases product stability by substantially eliminating product turbulence caused by the product bunching and nesting which normally occurs at the product discharge point. A substantially increased rate of product outfeed results.

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(72) Inventor; and

(75) Inventor/Applicant (for US only): **GARVEY, Mark, C.** [US/US]; 19 Beebetown Road, Cedarbrook, NJ 08010 (US).(74) Agent: **GOLDSTEIN, Stuart, M.**; Hollstein Keating Cattell Johnson & Goldstein P.C., Willow Ridge Executive Office Park, 750 Route 73 South, Suite 301, Marlton, NJ 08053 (US).

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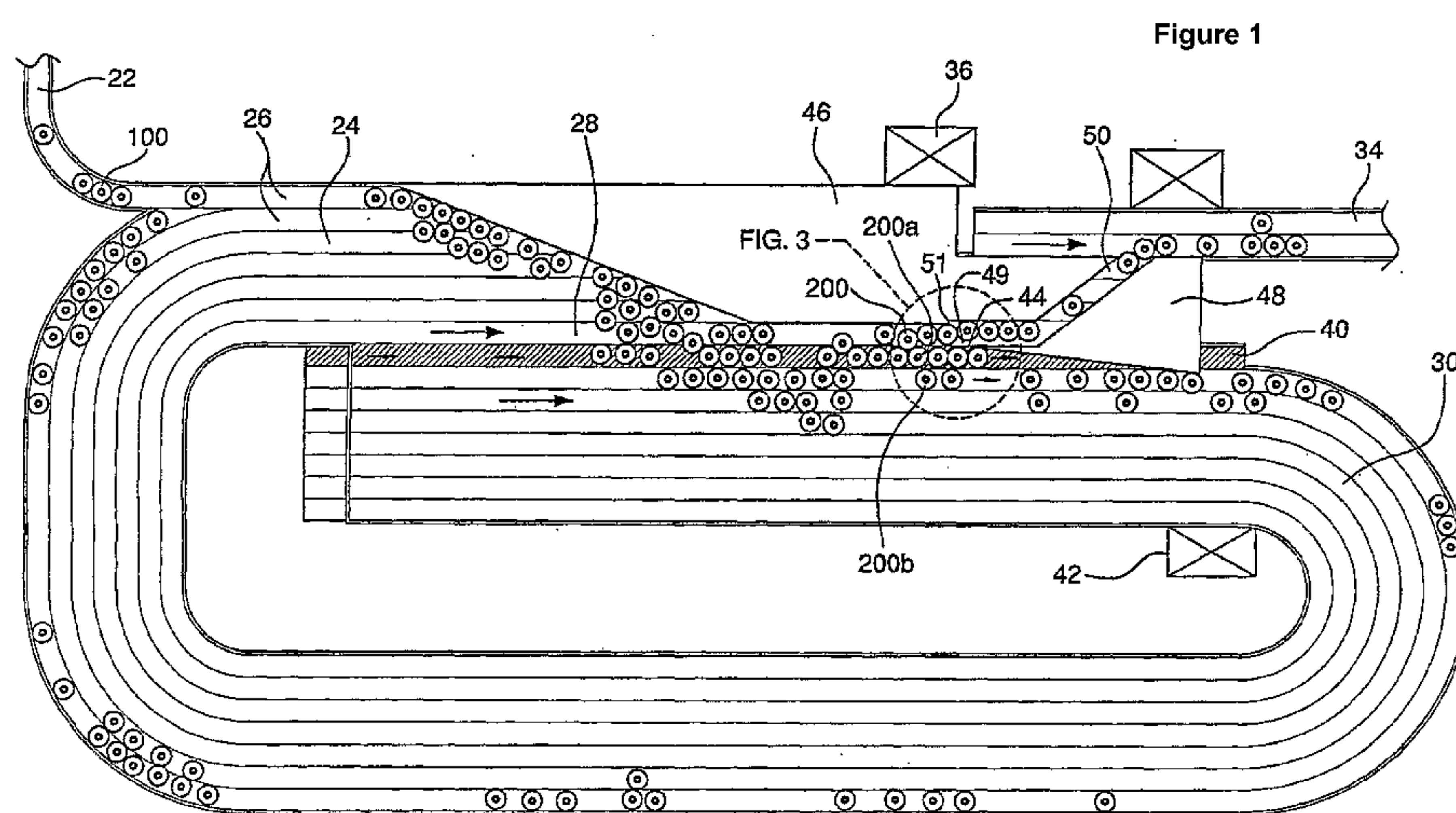
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(54) Title: DIFFERENTIAL SPEED CONVEYOR ACCUMULATION SYSTEM



(57) **Abstract:** A product conveying and accumulation system and method employs a primary product transporting conveyor with accumulation and re-circulating sections. The conveyor is configured to receive products from an upstream destination and discharge products to a downstream destination. A second conveyor, operable at a considerable slower speed than the first conveyor, is located in the same transverse plane as and is aligned adjacent to the first conveyor. Both conveyors travel in the same direction at the adjacent alignment. As products are discharged from the system, a wall of product is formed on the slower moving conveyor. As a result, products on the inner lane of the faster moving conveyor which would otherwise tend to move inward towards the discharge point, causing product turbulence and disruption, are urged back onto the inner lane by the product wall and then smoothly discharged from the system to the downstream destination. The use of this slower conveyor increases product stability by substantially eliminating product turbulence caused by the product bunching and nesting which normally occurs at the product discharge point. A substantially increased rate of product outfeed results.

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DIFFERENTIAL SPEED CONVEYOR ACCUMULATION SYSTEM AND METHOD

BACKGROUND OF THE INVENTION

Product accumulation systems are routinely used in conjunction with conveyors for the storage and accumulation of products which are fed from upstream sources onto conveyors. In the normal operation of a typical system, products are placed on a conveyor at the upstream location, for instance at one operational station, and then transported to a downstream location by a conveyor where the next step in the manufacture or distribution of the products is to be accomplished. When there is a disruption at a downstream location which prevents the downstream destination from accepting products, system products which would normally be transported to the area of the disruption can be received and temporarily stored by an accumulator which is integral to the system. Examples of effective product conveyor and accumulation systems are disclosed in U.S. Pat. Nos. 6,575,287 and 6,959,802.

As products with particular configurations, e.g. elongated bottles, circulate around such conveyor/accumulation systems and other conveyor systems where some products are discharged downstream while others remain in the system, they are subject to product disruptions within the system. These disruptions especially occur just prior to product discharge downstream. Discharge disruptions primarily involve the bunching and nesting of products, which result in product instability and fallen and misaligned products. The outfeed rate and hence the efficiency of the system decreases and, when the disruption blocks the discharge, the entire system usually must be stopped to address the problem.

This situation is most prevalent as products reach and contact the discharge location or discharge point, usually the front end of the product discharge guide. Upon reaching this discharge point, products may begin to bunch and nest. As additional products enter the system

from the upstream destination, they push the nested products which are ahead of them, causing product instability and exacerbating what may already be a clogged outfeed.

These problems are especially troublesome and are, in fact, exacerbated when the system is started up following a shutdown to address a downstream condition. Prior to such a shutdown, the system is routinely shifted, by a diverter gate-type element or similar means, from a product delivery mode to a product accumulating mode. As discussed in the above referenced patents, this allows for product accumulation while the downstream condition is being remedied. However, upon start-up, when the gate is opened and the system is returned to its product delivery mode, the immediate rapid influx of products at the discharge location results in increased nesting, bunching, and product turbulence, which, once again, creates the real threat of disruption of product flow.

While the systems in the U.S. Pat. Nos. 6,575,287 and 6,959,802 evidence significant, novel and effective systems in the conveying and accumulation of products, the systems disclosed and discussed therein do not specifically address the above stated problems of product instability at outfeed locations, under varying operating conditions..

SUMMARY OF THE INVENTION

It is thus an object of the present invention to overcome the disadvantages and limitations of prior product conveying and accumulation systems.

It is an object of the present invention to provide a product conveying and accumulation system to control and improve product stability at the system's discharge and thus substantially eliminate the disruptions which result from this instability.

It is a further object of the present invention to provide a product conveying and accumulation system which obtains smoother product outfeed by substantially eliminating disruptions at discharge.

It is an object of the present invention to provide a product conveying and accumulation system which controls and improves product stability at the system's discharge upon immediate start-up of the system, following a shutdown to address a downstream condition.

It is another object of the present invention to provide a product conveying and accumulation system which employs the use of a separate conveyor section or lane which is stationary or a conveyor specifically operable at a slower speed than the primary product transporting conveyor or conveyors in order to improve product stability, substantially eliminate disruptions and obtain markedly smooth and increased product outfeed.

It is still another object of the present invention to provide a product conveying and accumulation system method which employs the use of a separate conveyor section or lane which is stationary or specifically operable at a slower speed than the primary product transporting conveyor or conveyors, in order to improve product stability, substantially eliminate disruption and obtain markedly smooth and increased product outfeed.

These and other objects are accomplished by the present invention, a product conveying and accumulation system and method which employs a primary product transporting conveyor with accumulation and re-circulating sections. The conveyor is configured to receive products from an upstream destination and discharge products to a downstream destination. A second conveyor, operable at a considerably slower speed than the first conveyor, is located in the same transverse plane as and is aligned adjacent to the first conveyor. Both conveyors travel in the same direction at the adjacent alignment. As products are discharged from the system, products are positioned on the slower moving conveyor. These products form a temporary wall of products on the slower moving conveyor. As a result, products on the inner discharging lane or lanes of the faster moving conveyor which would otherwise tend to move inward towards the discharge point, causing product turbulence and disruption, are urged back outward onto the

inner lane or lanes by the product wall. This allows for increased separation between the discharging products and the discharge point, permitting the products to be smoothly discharged from the system to the downstream destination. A substantially increased rate of product outfeed results. The use of this slower conveyor increases product stability by substantially eliminating product turbulence caused by the bunching and nesting of products which normally occurs at the product discharge point, both during normal operation and upon start-up of the system following a shutdown. An alternate system employs the use of a stationary conveyor section or lane, in lieu of a slower moving conveyor.

Novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The invention, itself, however, both as to its design, construction and use, together with the additional features and advantages thereof, are best understood upon review of the following detailed description with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top view of a prior art product conveying and accumulation system.

FIG. 2 is a top view of a product conveying and accumulation system employing the present invention.

FIG. 3 is an isolated view of the product conveying and accumulation system taken from FIG. 2.

FIG. 4 is an isometric view of the product conveying and accumulation system shown in FIG. 2.

FIG. 5 is a top view of another product conveying and accumulation system showing another system arrangement employing the present invention.

FIG. 6 is a top view of the product conveying and accumulation system of the present invention, showing a two lane product discharge, isolated at the discharge with a product diverter gate retracted.

FIG. 7 is a top view showing the area in FIG. 6, with the diverter gate extended.

FIG. 8 is a top view showing the area in FIG. 7, depicting the flow of discharging product once the diverter gate is again retracted.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 is representative of a prior, popular conveying and accumulation systems. Products **100**, for example bottles, are typically transported from upstream destinations **2** and **3** to conveyor system **4** which ultimately moves the products to downstream destinations **6** and **7**. Accumulator section **8** is designed to accept and accumulate products which cannot yet be positioned for downstream transport. Such products are re-circulated via re-circulating section **10** for ultimate delivery to downstream destinations **6** and **7**. Particular reference is made to U.S. Pat. No. 6,575,287, which describes this novel system in detail.

However, such prior systems, while most effective in transporting and accumulating products, do not address certain difficulties which arise during the movement of particular products, like elongated bottles, which, as they approach discharge locations or discharge points **12** and **16** of guide members **14** and **18**, tend to bunch-up or nest at the discharge locations. This causes a crowding of products and turbulence at the discharge locations and results in a decrease in downstream outfeed delivery of products, overturned products **20** and loss of efficient

downstream transport of products, and a general disruption of the smooth delivery of products downstream.

FIGS. 2-4, show a system employing the present invention which alleviates these product delivery disruption problems. Products 200, delivered from upstream destination 22, are transported onto conveyor 24, having a plurality of outer product path lanes 26, inner product path lane 28 and accumulator section 30. Products are ultimately delivered to downstream destination 34. Conveyor 24, driven by motor or similar power means 36, is operated at a constant product delivery speed in, for example, the clockwise direction shown in FIGS. 2-4.

In accordance with the present invention, second conveyor 40 is a single, continuous looped path conveyor located in a single vertical plane, aligned adjacent to inner lane 28 of conveyor 24, preferably in the same transverse plane as the inner lane. Conveyor 40 is positioned intermediate between lane 28 and accumulation section 30. Motor or similar power means 42 drives conveyor 40 in the same direction as conveyor 24, at inner lane 28, i.e. at the adjacent alignment between conveyor 40 and inner lane 28, but at a considerably slower speed than conveyor 24 and its inner lane. The particular characteristics of the products being transported and the configuration of the system will dictate the difference in speed between slower moving conveyor 40 and conveyor 24 and this speed differential is not to be considered as a restrictive of the scope of the invention.

Product guide 48 has extension 47 which terminates at discharge point or location 44. Discharge location 44 is positioned between inner path lane 28 and conveyor 40.

Operation of conveyor systems in accordance with the present invention addresses the problems and disruptions resulting from the bunching and nesting of products at the discharge location. As products 200 move from upstream destination 22 towards discharge location 44, they are compelled by inboard surfaces 45 of guide 46 towards inner path lane 28 and slower

moving conveyor 40. Products 200 which remain positioned on lane 28 are delivered to downstream destination 34 through guide channel 50. Products 200a are pushed onto conveyor 40 and continue to move in the direction of conveyor 24, but since conveyor 40 is traveling at a slower speed than conveyor 24, products 200a on that conveyor also travel at that slow speed. A number of products 200b are pushed off conveyor 40 onto accumulator section 30, which recycles those products for eventual discharge to downstream destination 34.

Products 200a, traveling slowly in relation to the speed of conveyor 24, will tend to form a temporary, artificial "wall" 201 of products 200a on conveyor 40. Products 200 on fast moving inner lane 28 which would otherwise tend to move inward towards discharge location 44, causing bunching and nesting and the resulting turbulence, are urged back outward and realigned onto inner lane 28, towards inboard surfaces 45 of guide 46, by products 200a forming product wall 201. This allows for increased separation, at 49, between discharging products 200 and discharge location 44. This separation virtually eliminates contact between products 200 and discharge location 44, thus eliminating product nesting and the turbulence which results. Surface 51 of guide 46 is specifically indented in order to allow increased inward movement of products 200 as they are discharged from the system, to provide for additional separation 49 between products and discharge location 44.

The virtual elimination of turbulence at discharge location 44 results in tremendously enhanced product stability, achieving a substantially increased rate of smooth product outfeed.

FIG. 5 shows a second arrangement of the invention employed with another conveyor/accumulation system, a system with dual product feed and product outfeed. Products 200, delivered from upstream destinations 70 and 88 are transported onto conveyor 64, having outer product discharge path lanes 76 and 92 and inner product discharge path lanes 77 and 91, and accumulator sections 66 and 67. Conveyor 64 is operated at a constant product delivery

speed in, for example, the clockwise direction shown in FIG. 5. Products are directed and discharged to downstream destinations 72 and 90, by guides 80 and 82, and 95 and 96, via guide channels 84 and 94. Guides 80 and 96 have indented sections at 81 and 93 respectively.

In this embodiment, second conveyor 60 is a continuous single continuous looped path conveyor with two lower wrap-around sections. Conveyor 60 has four upper product path lanes moving in a single transverse plane, including path lanes 61 and 63, which are aligned adjacent to inner lanes 77 and 91 of conveyor 64, preferably in the same transverse plane as these inner lanes. Motor or similar power means 62 drives conveyor 60 and path lanes 61 and 63 in the same direction as conveyor 64, at inner lanes 77 and 91, i.e. the adjacent alignment between conveyor 60 and inner lanes 77 and 91, but at a slower speed than conveyor 64 and its inner lanes 77 and 91. As in the initially discussed embodiment, particular characteristics of the products being transported and the configuration of the system dictate the difference in speed between conveyor 60 and conveyor 64.

Similar to the operation described previously, as products 200 move from upstream destinations 70 and 88, towards discharge locations points 78 and 98, they are compelled by inboard surfaces 101 and 102 of guides 80 and 96 towards inner lanes 77 and 91. Products 200 which remain positioned on outer path lanes 76 and 92 are delivered to downstream destinations 72 and 90, through guide channels 84 and 94. Products 200a are pushed onto path lanes 61 and 63 of conveyor 60 and continue to move in the direction of conveyor 64, but since conveyor 60 is traveling at a slower speed, products 200a on the path lanes of that conveyor also travel at the slower speed. A number of products 200b are pushed off conveyor 60 onto accumulator sections 66 and 67, which recycles those products for eventual discharge to downstream destinations 72 and 90.

Products 200a, traveling very slowly in relation to the speed of conveyor 64, form temporary, artificial walls of products, as described previously in regard to the embodiment of FIGS. 2-4, as products 200 and 200a approach discharge locations 78 and 98. Products 200 on faster moving inner lanes 77 and 91 which would otherwise tend to move inward towards discharge locations 78 and 98, causing bunching and nesting and the resulting turbulence, are urged back outward and realigned onto inner lanes 77 and 91, and outer lanes 76 and 92, towards inboard surfaces 101 and 102 of guides 80 and 96, by products 200a forming the temporary product walls. This allows for increased separation at 79 and 99, between discharging products 200 and discharge locations 78 and 98. This separation virtually eliminates contact between products 200 and discharge locations 78 and 98, thus eliminating product nesting and the turbulence which results. Surfaces 81 and 93 of guides 80 and 96 are specifically indented in order to allow increased inward movement of products 200 as they are discharged from the system, to provide for additional separation 79 and 99 between products and discharge locations 78 and 98. Product stabilizing improvement at these discharge points, also previously described, again results in a smoother and increased outfeed of products to the downstream destinations; since the walls of products on the slow lanes inhibit the faster moving outfeed products from interacting with the discharge locations, creating separation between product and discharge locations.

Although the use of a slow lane product conveyor is shown employed with two specific product conveying and accumulation systems, the present invention should not be considered restricted to these two systems. The slow lane product conveyor is adaptable to any system which employs a primary product transport conveyor and where there is a desire to eliminate product turbulence at the point of discharge.

The bunching and nesting of products at discharge locations is especially problematic when a conveying system is started up following a shutdown to address a downstream condition. Prior to a shutdown, while normal product delivery operations are underway, the system will normally be shifted, by a diverter gate-type connection or similar means, from a product delivery mode to a product accumulation mode. As discussed in U.S. Pat. Nos. 6,575,287 and 6,959,802, this allows for product accumulation while the downstream condition is being remedied. However, upon start-up, when the system is returned to its product delivery mode, the immediate rapid influx of products at the discharge location results in increased nesting, bunching, and product turbulence, which creates a real problem of disruption of product flow. FIGS. 6-8 show how the present invention is particularly effective in addressing these system shut-down to start-up situations.

Referencing the system shown in FIG. 5, but isolating on the vicinity of discharge location 78, FIG. 6 shows the system in the product delivery mode, with path lanes 76 and 77 of conveyor 64 operating at a constant speed and path lane 61 of conveyor 60 operating at a slower speed. As previously discussed, products 200a on lane 61, forming temporary wall 201, serve to compel products 200 on paths 76 and 77 towards surface 101 and indented section 81 of guide 80. This creates separation, at 79, ahead of discharge location 78 at the end of extension 83 of guide 82, to eliminate product discharge turbulence.

However, when there is a disruption which must be addressed downstream and the flow of delivered products must temporarily be stopped, a gate connection, such as pivoted gate 100 shown in FIGS. 6-8, is pivoted down and extended across product delivery lanes 76 and 77 and past slow path lane 61. See FIG. 7. This causes products in all lanes to be shifted to accumulator section 66, which accumulates the products while the downstream condition is being addressed.

When the downstream condition has been remedied and product delivery is to start, gate **100** is pivoted back and retracted to once again open all lanes. If the differential speed conveyor system of the present invention is not employed, as gate **100** is pivoted back, products **200**, all traveling at the same high speed, will approach discharge location **78** at this high speed. This results in the bunching, nesting and turbulence, which the invention solves. FIG. 8 shows the movement of products after gate **100** is pivoted back, when slower conveyor **60** is employed. Products **200a** on slow lane **61** immediately form temporary wall **201**, which compels products **200** toward surface **101** and indented section **81** and away from discharge location **78**. Separation is created, at **79**, between products **200** and discharge location **78**, thus eliminating the ever-present product turbulence problems resulting from system start-up.

The concepts of differential speed conveyors of the present invention, will successfully work when the lane is operating at any slower speed in relation to the product delivery conveyors.

Certain novel features and components of this invention are disclosed in detail in order to make the invention clear in at least one form thereof. However, it is to be clearly understood that the invention as disclosed is not necessarily limited to the exact form and details as disclosed, since it is apparent that various modifications and changes may be made without departing from the spirit of the invention.

CLAIMS:

1. A product conveying and accumulating system comprising:

5 (a) first conveying means (22) for the movement of products (100) from an upstream location to the accumulating system;

(b) second conveying means (34) for receiving the products from the accumulating system and for delivery
10 of the products to a downstream destination;

(c) a continuous loop conveyor (24) comprising:

an outer product path lane (26) and an inner product path lane (28) adapted to move in the same direction;

15 a downstream straight conveyor run;

an upstream straight conveyor run adapted to move in the same direction as the downstream straight conveyor run and positioned such that the outer product path lane (26) of the upstream straight conveyor run of the continuous loop
20 conveyor (24) lies adjacent the inner product path lane (28) of the downstream straight

conveyor run of the continuous loop conveyor
(24);

an accumulation section (30) joining the
downstream end of the upstream conveyor run to
5 the upstream end of the downstream conveyor run;

a guide means (46) for guiding the products
from the outer product path lane (26) of the
downstream straight conveyor run of the
continuous loop conveyor (24) to the inner
10 product path lane (28) of the downstream straight
conveyor run of the continuous loop conveyor
(24); and

a second guide means (48) at a discharge
location (44) of the downstream straight conveyor
15 run for guiding the products from the inner
product path lane (28) of the downstream straight
conveyor run to the second conveying means (34);

wherein the first conveying means (22) is adapted to
deliver product to the outer product path lane (26) of
20 the downstream straight conveyor run of the continuous
loop conveyor (24);

and wherein:

5 a further conveyor lane (40) is positioned
between the inner product path lane (28) of the
downstream straight conveyor run of the continuous
loop conveyor (24) and the outer product path lane
10 (26) of the upstream straight conveyor run of the
continuous loop conveyor (24) and extends past the
discharge location (44) of the downstream straight
conveyor run, the further conveyor lane (40) being
adapted to be driven in the same direction as, and at
15 a speed less than, the upstream and downstream
straight conveyor runs.

2. A product conveying system according to claim 1,
further including a third guide means (47) positioned
15 between the discharge location (44) and the downstream
end of the further conveyor lane (40), for guiding
products from the further conveyor lane (40) to the
outer product path lane (26) of the upstream straight
conveyor run of the continuous loop conveyor (24).

20

3. A product conveying system according to claim 1
or claim 2, wherein the second guide means (48)

comprises a guide channel (50) for guiding products from the inner product path lane (28) of the downstream straight conveyor run to the second conveying means (34).

5

4. A product conveying system according to claim 1 or claim 2, further including a gate (100), the gate being selectively movable between a retracted position in which it permits the products to pass along the inner product path lane (28) of the downstream straight conveyor run to the second guide means (82) and an extended position in which the gate operates to guide the products from the inner product path lane (28) of the downstream straight conveyor run onto the further conveyor means (40).

10

15

5. A method of conveying products by a product conveying and accumulating system comprising:

(a) first conveying means (22) for the movement of products (100) from an upstream location to the accumulating system;

20

(b) second conveying means (34) for receiving

products from the accumulating system and for delivery of the products to a downstream destination;

(c) a continuous loop conveyor (24) comprising:

5 an outer product path lane (26) and an inner product path lane (28) adapted to move in the same direction;

a downstream straight conveyor run;

10 an upstream straight conveyor run adapted to move in the same direction as the downstream straight conveyor run and positioned such that the outer product path lane (26) of the upstream straight conveyor run of the continuous loop conveyor (24) lies adjacent the inner product path lane (28) of the downstream straight conveyor run of the continuous loop conveyor (24);

15 an accumulation section (30) joining the downstream end of the upstream conveyor run to the upstream end of the downstream conveyor run;

20 a guide means (46) for guiding the products from the outer product path lane (26) of the downstream straight conveyor run of the

continuous loop conveyor (24) to the inner product path lane (28) of the downstream straight conveyor run of the continuous loop conveyor (24); and

5 a second guide means (48) at a discharge location (44) of the downstream straight conveyor run for guiding the products from the inner product path lane (28) of the downstream straight conveyor run to the second conveying means (34);

10 wherein the first conveying means (22) is adapted to deliver the products to the outer product path lane (26) of the downstream straight conveyor run of the continuous loop conveyor (24);
and wherein:

15 a further conveyor lane (40) is positioned between the inner product path lane (28) of the downstream straight conveyor run of the continuous loop conveyor (24) and the outer product path lane (26) of the upstream straight conveyor run of the
20 continuous loop conveyor (24) and extends past the discharge location (44) of the downstream straight conveyor run, the further conveyor lane (40) being

adapted to be driven in the same direction as, and at a speed less than, the upstream and downstream straight conveyor runs;

said method comprising the steps of:

5 transporting products (100) on first conveying means (22) from an upstream location to the accumulating system;

 delivering the products from the first conveying means (22) on to the outer product path (26) of the downstream straight conveyor run of the continuous
10 loop conveyor (24);

 transferring the products from the outer product path lane (26) of the downstream straight conveyor run to the inner product path lane (28) of the downstream
15 straight conveyor run;

 guiding the products, at the discharge location (44), from the inner product path lane of the downstream straight conveyor run toward the second conveying means (34); and

20 transferring the products to the second conveying means (34) for delivery of products to the downstream destination; and

guiding the products, by means of the third guide means (47), from the further conveyor lane (40) to the outer product path lane (26) of the upstream straight conveyor run of the continuous loop conveyor (24).

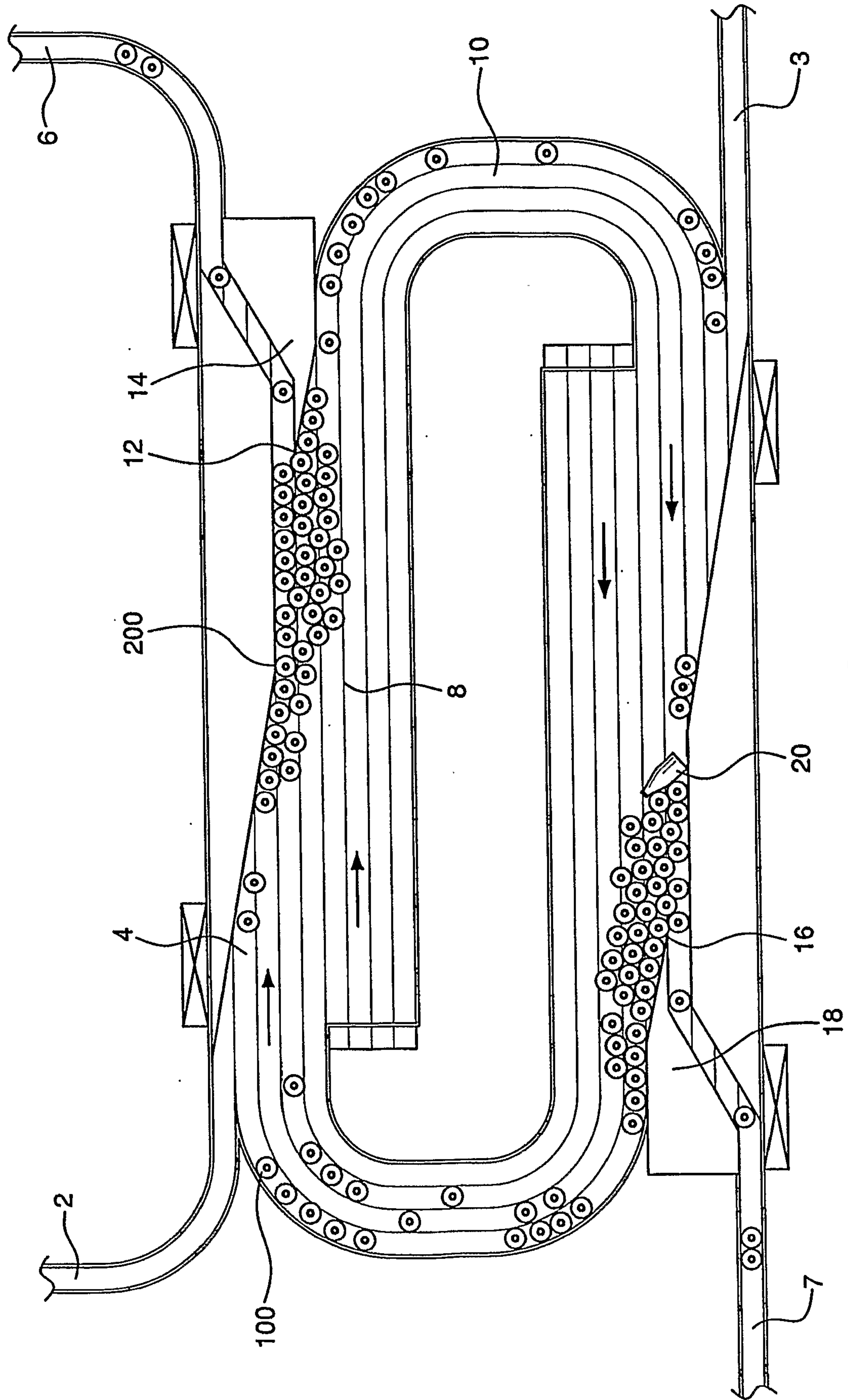


FIG. 1

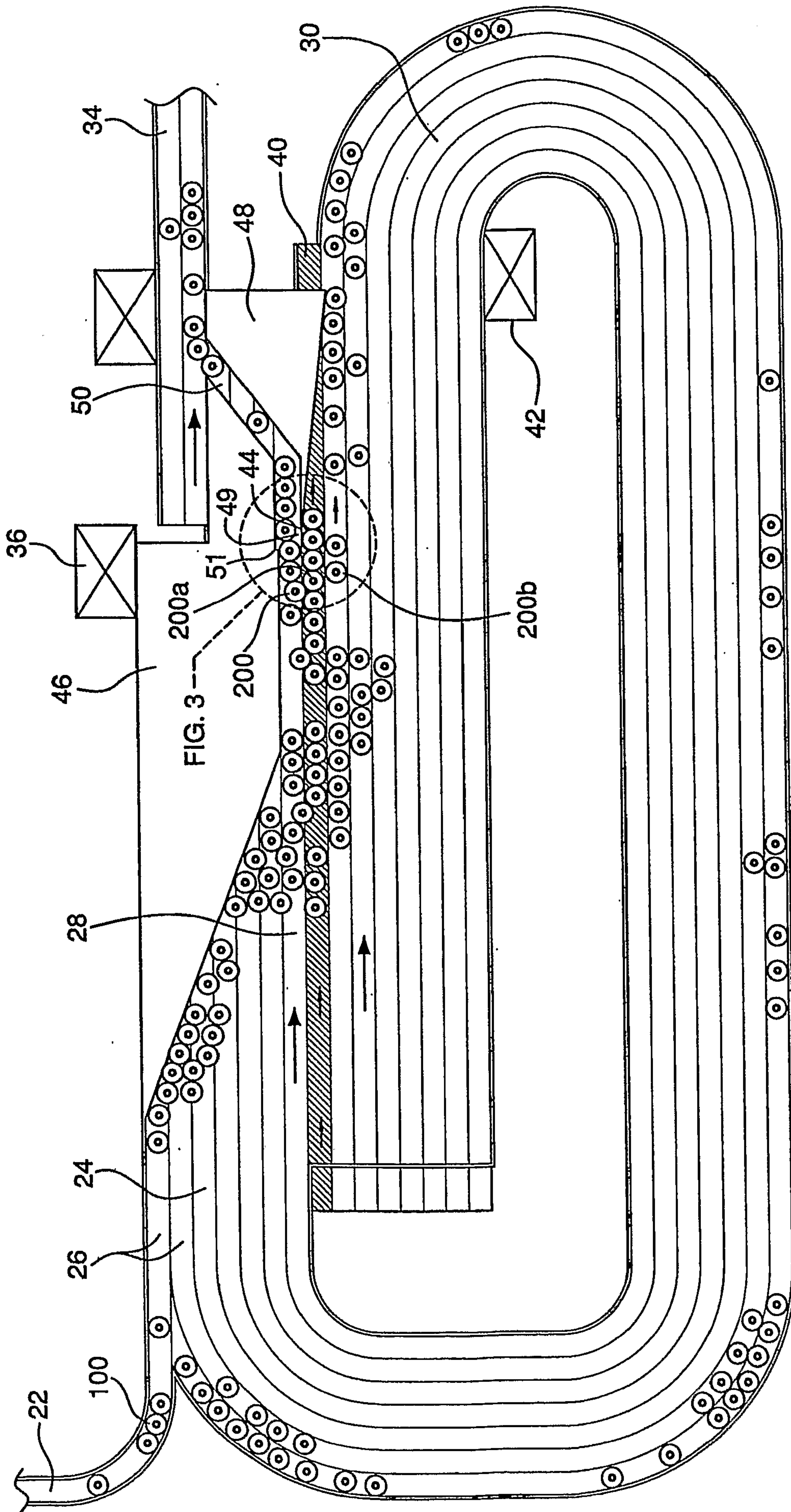


FIG. 2

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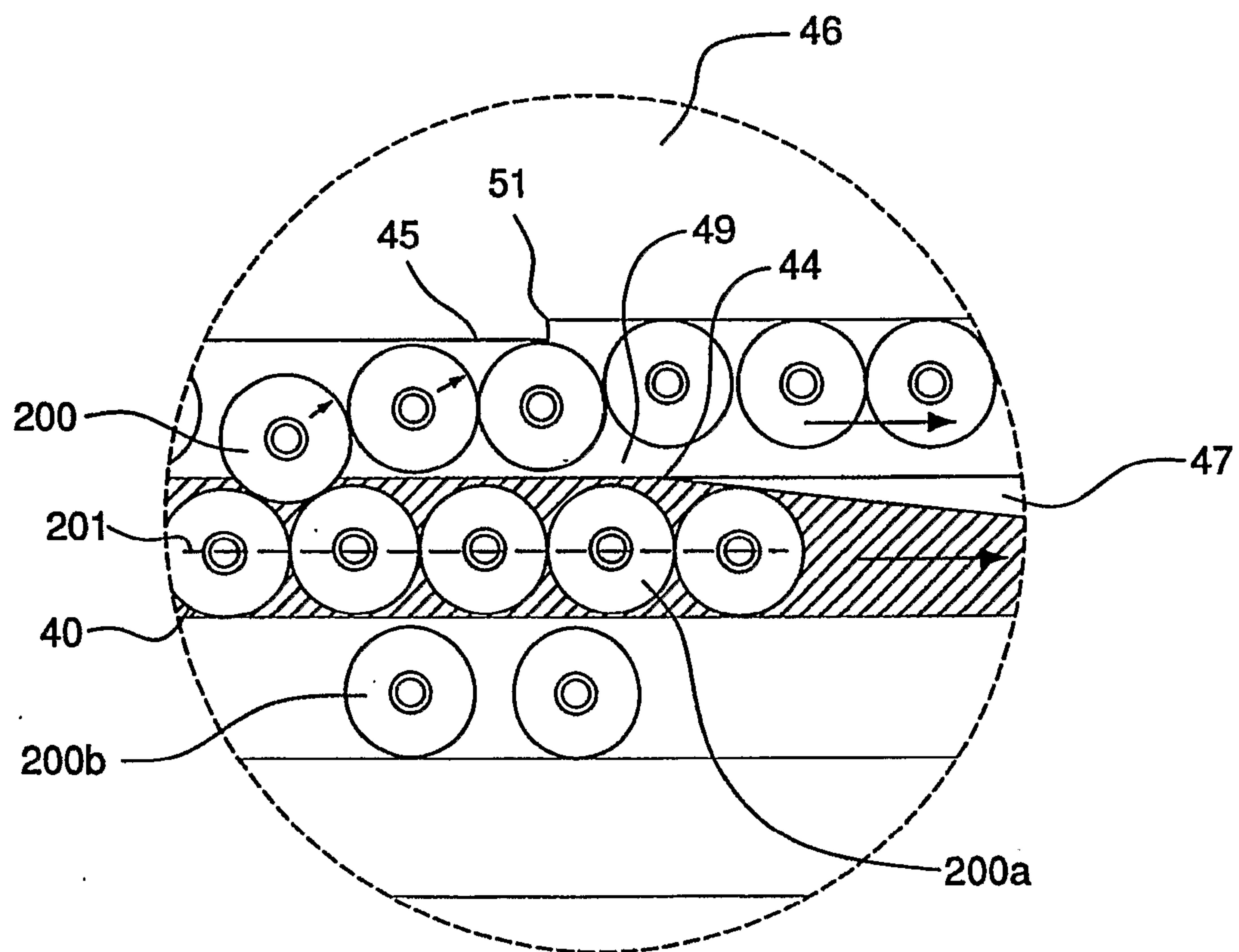


FIG. 3

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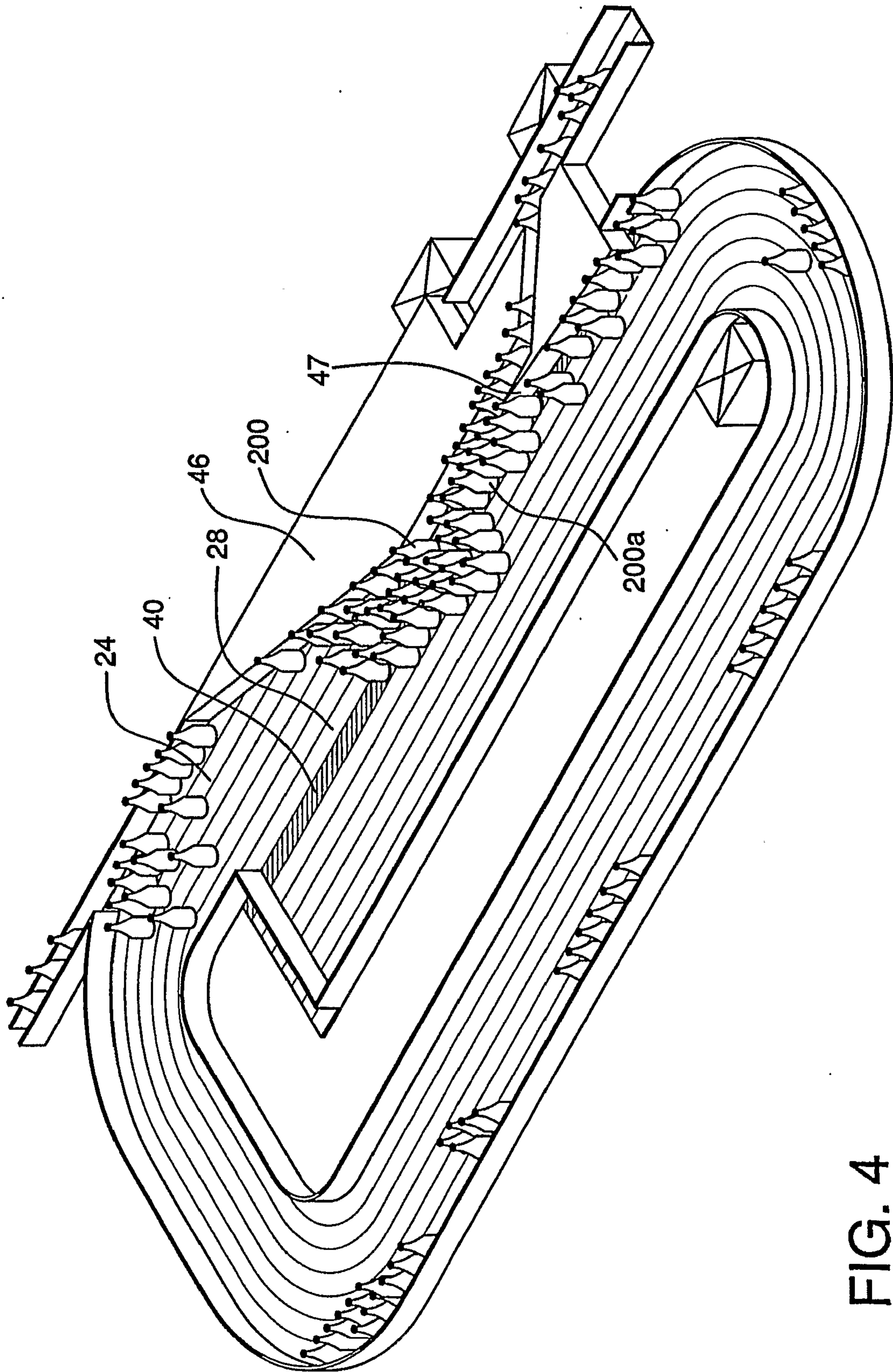


FIG. 4

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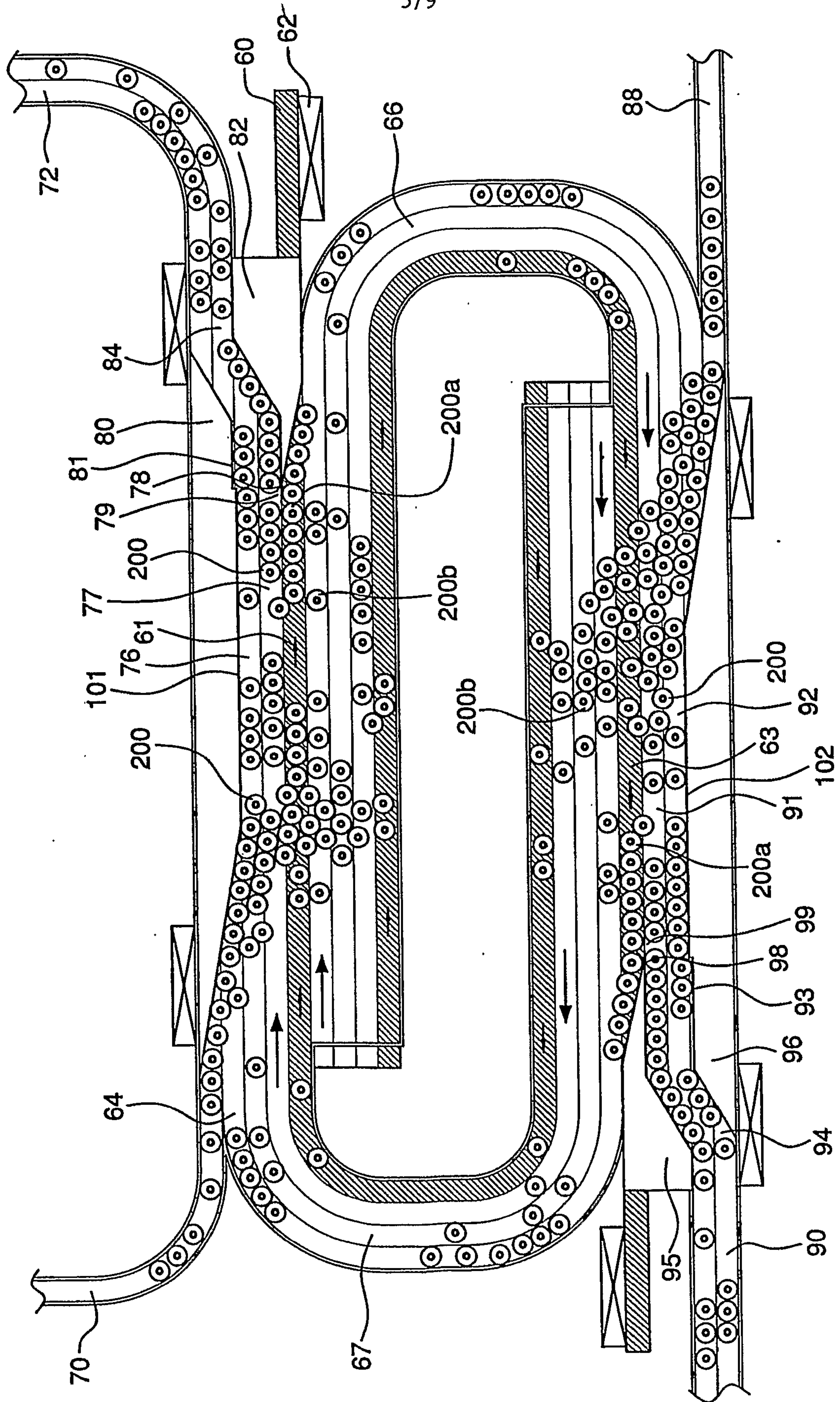


FIG. 5

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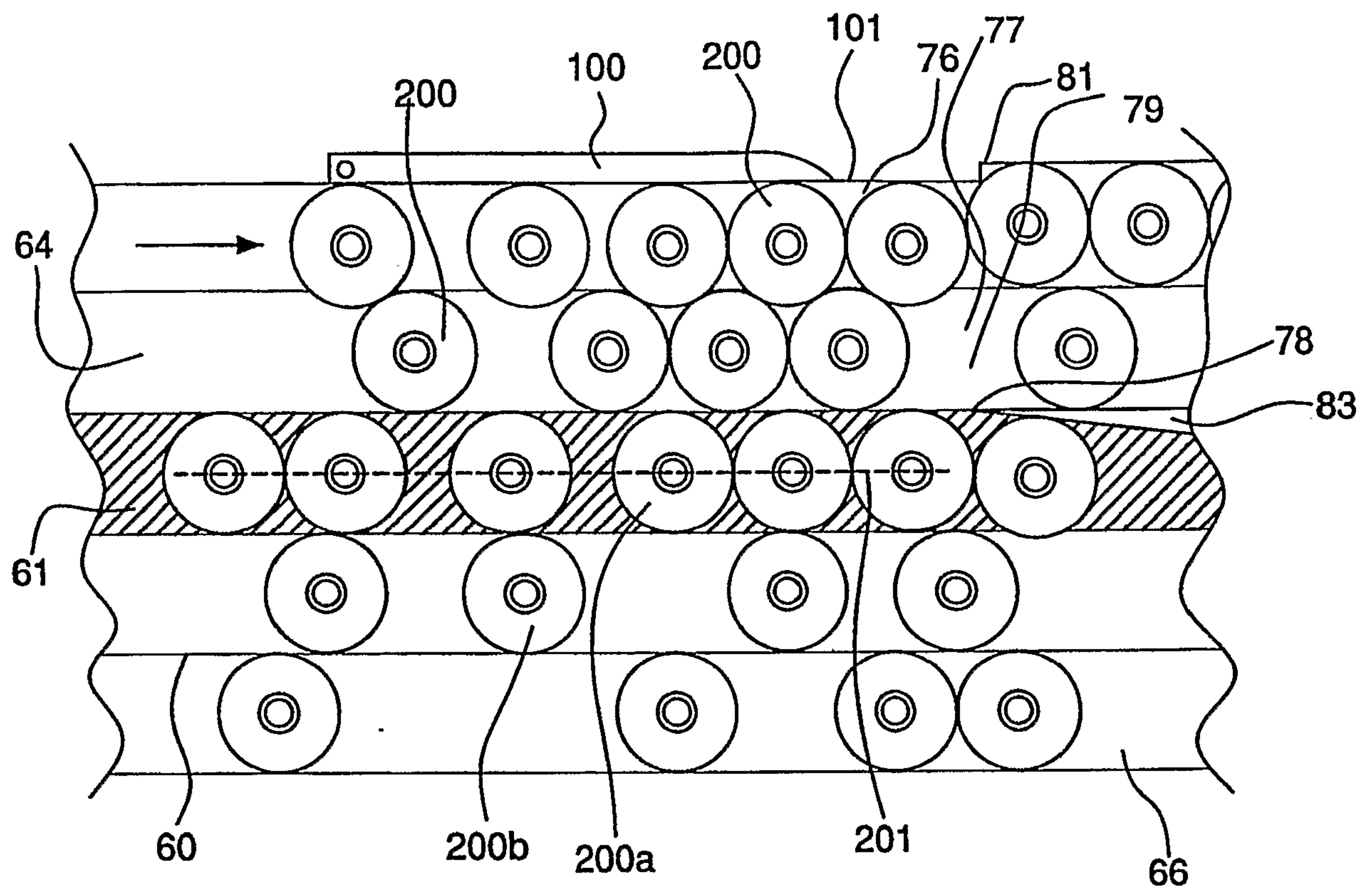


FIG. 6

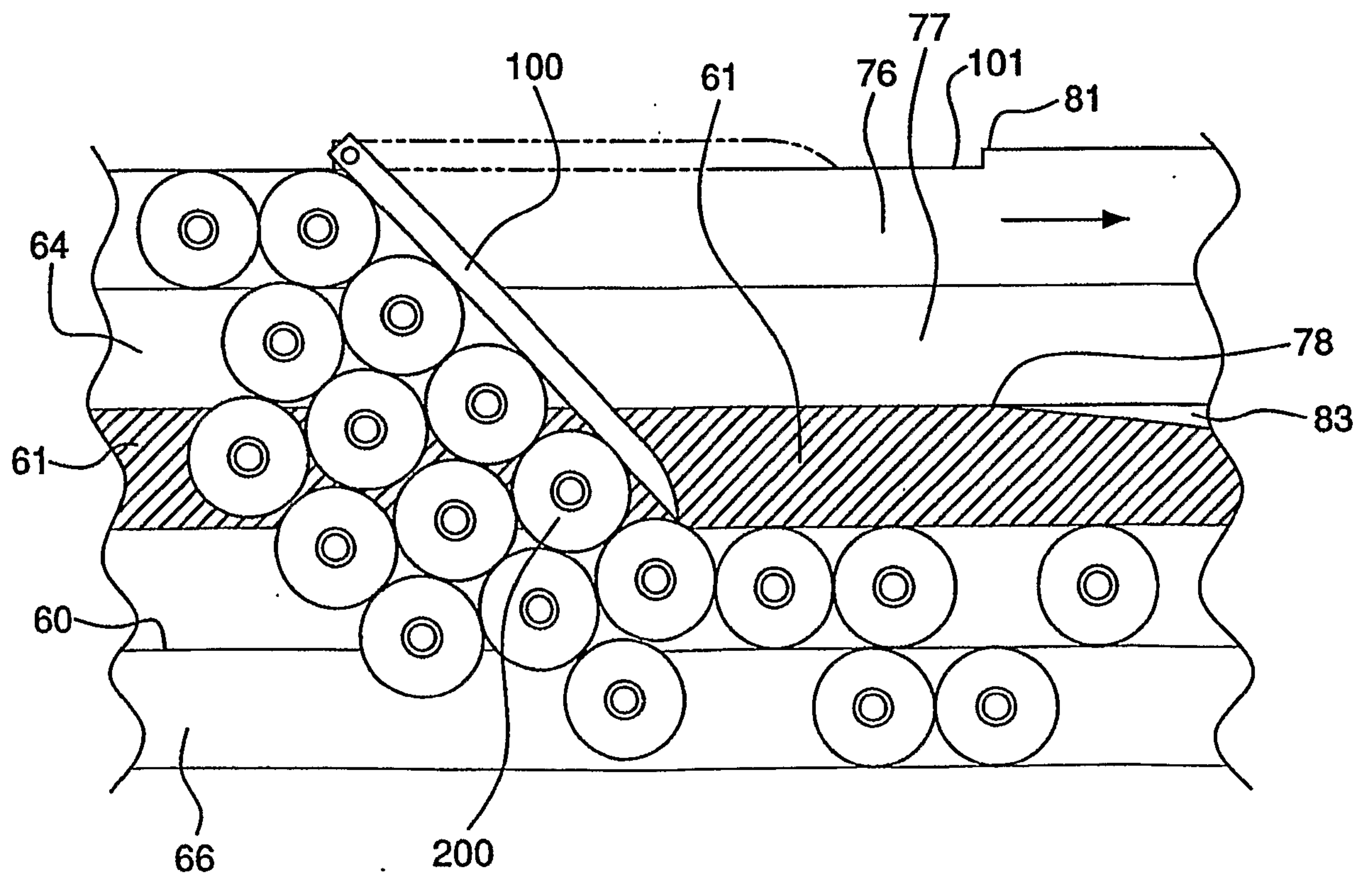


FIG. 7

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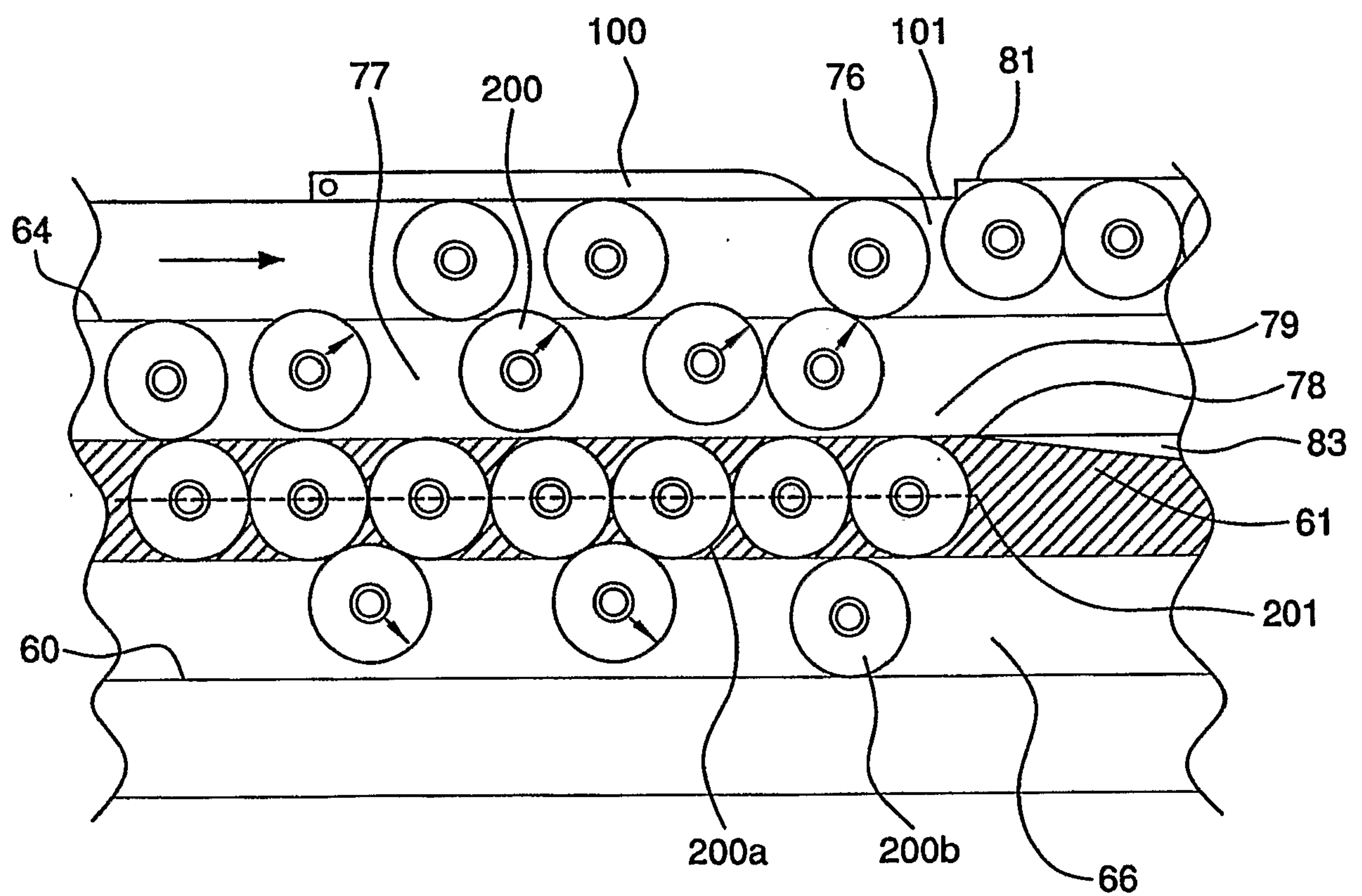


FIG. 8

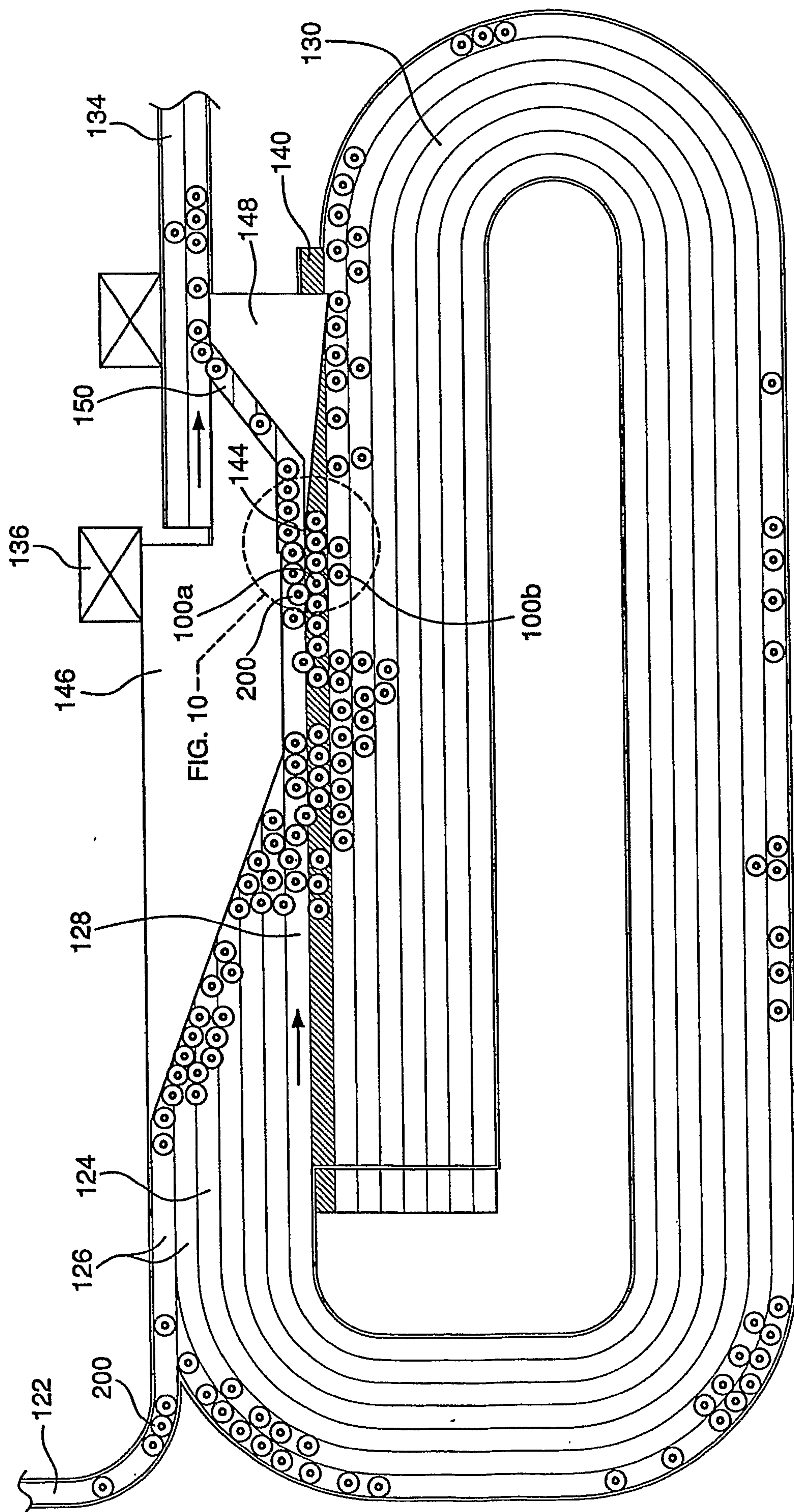


FIG. 9

