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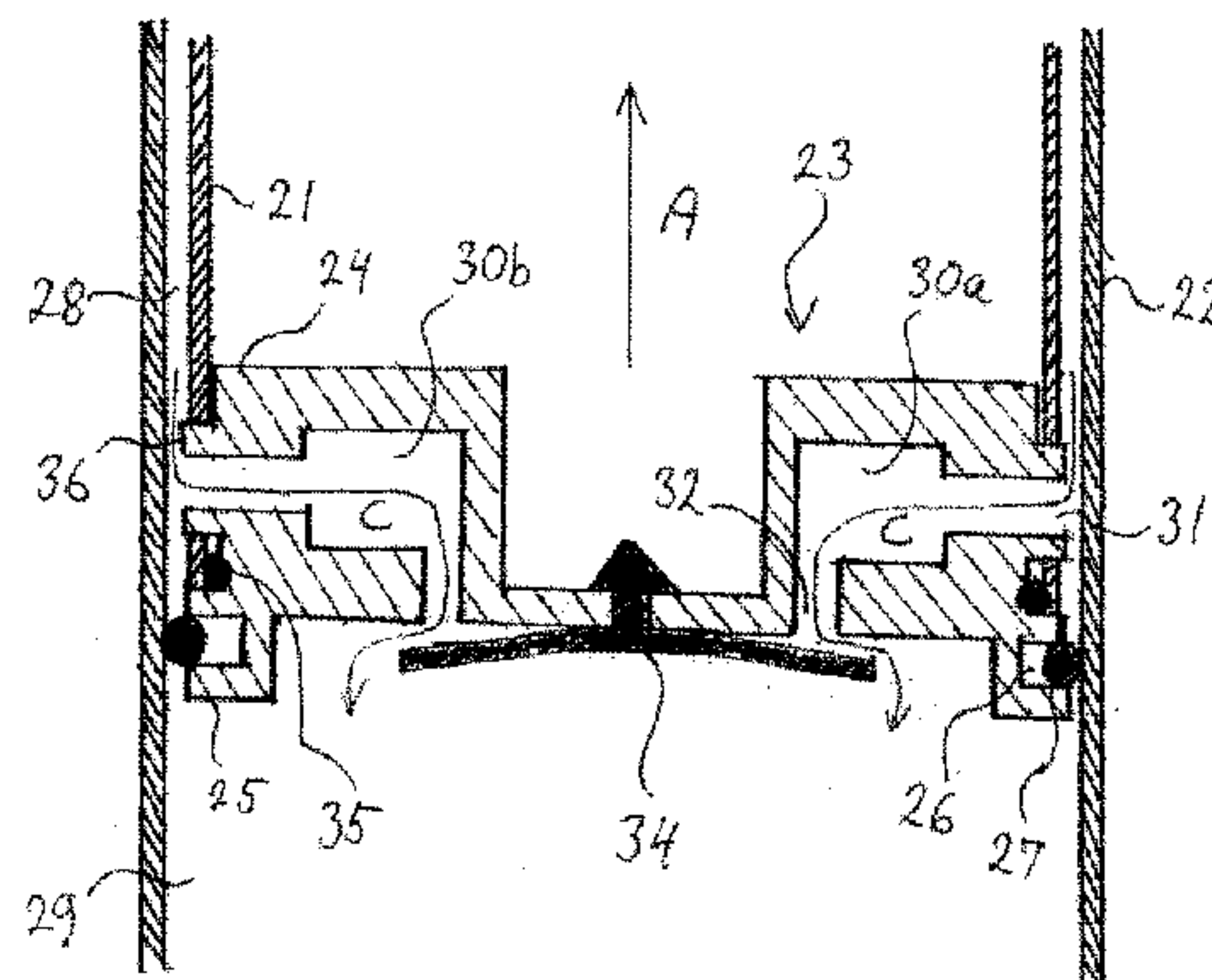


Fig. 2a

(57) **Abrégé/Abstract:**

The invention relates to a collapsible ladder comprising two vertical stiles with a plurality of rungs (6) each stile is formed by a plurality of telescopically collapsible columns (1a, 1b, 21, 22). In a first aspect of the invention at least a part of the collapsible columns has an inner wall and a bottom opening receiving a cover (23) having both a large cylindrical portion (25) with a peripheral, annular groove (26) with a sealing ring (27) and a small cylindrical portion (24) inserted into the bottom opening such that the large cylindrical portion is exposed outside of the column and inserted inside of a next lower column; the sealing ring dividing the next lower column into an upper part and a lower part; the cover has at least one air duct having a first and second (31, 32) opening, with the first air opening arranged above the large cylindrical portion and in correspondence with an opening in a lower wall part of the column receiving the cover, whereby the first air opening faces the interior of the upper part of the next lower column, and with the second air opening facing a bottom part of the cover and the interior of the lower part of the next lower column, thereby enabling air to exit from the upper part to the lower part of the next lower column. In a second aspect of the invention at least one protruding ring part (9a, 9b) is formed in at least part of the collapsible columns, wherein the outer diameter of the ring part is larger than the outer diameter of the column in which the ring part is formed, and smaller than the inner diameter of a next lower column.

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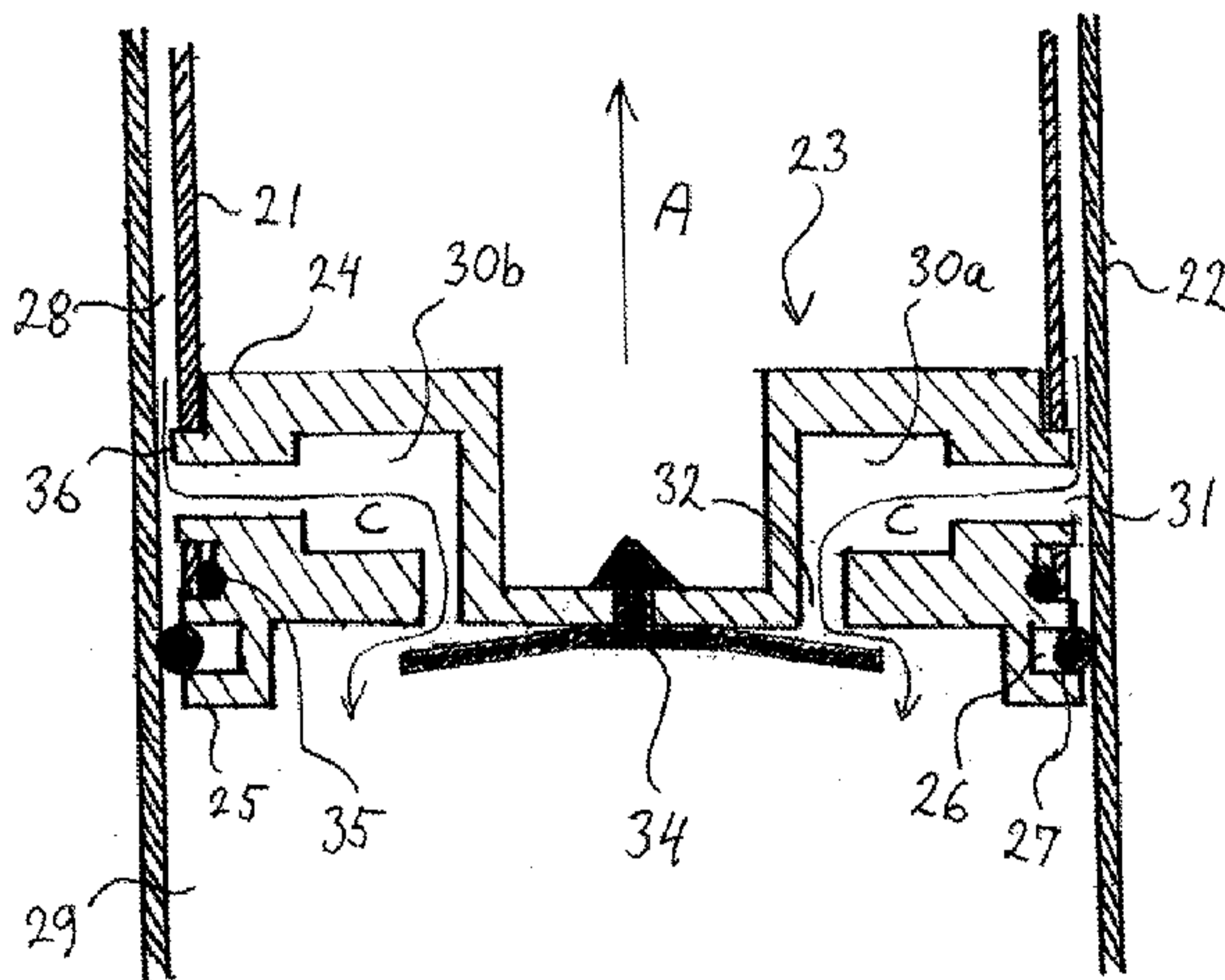


Fig. 2a

(57) Abstract: The invention relates to a collapsible ladder comprising two vertical stiles with a plurality of rungs (6) each stile is formed by a plurality of telescopically collapsible columns (1a, 1b, 21, 22). In a first aspect of the invention at least a part of the collapsible columns has an inner wall and a bottom opening receiving a cover (23) having both a large cylindrical portion (25) with a peripheral, annular groove (26) with a sealing ring (27) and a small cylindrical portion (24) inserted into the bottom opening such that the large cylindrical portion is exposed outside of the column and inserted inside of a next lower column; the sealing ring dividing the next lower column into an upper part and a lower part; the cover has at least one air duct having a first and second (31, 32) opening, with the first air opening arranged above the large cylindrical portion and in correspondence with an opening in a lower wall part of the column receiving the cover, whereby the first air opening faces the interior of the upper part of the next lower column, and with the second air

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opening facing a bottom part of the cover and the interior of the lower part of the next lower column, thereby enabling air to exit from the upper part to the lower part of the next lower column. In a second aspect of the invention at least one protruding ring part (9a, 9b) is formed in at least part of the collapsible columns, wherein the outer diameter of the ring part is larger than the outer diameter of the column in which the ring part is formed, and smaller than the inner diameter of a next lower column.

## COLLAPSIBLE LADDER

### FIELD OF INVENTION

- 5 The present invention relates to a collapsible ladder of the type comprising U-shaped ladder sections being telescopically inserted in each other.

### BACKGROUND OF THE INVENTION

- 10 Extendable ladders are ladders, which may be extended for use and folded for storage when not used. In the European patent EP-B1-0 527 766 a collapsible ladder is described comprising ladder bars divided into sections interconnected by rungs. In each ladder section is provided retaining or locking mechanisms, designed to automatically release the upper ladder sections, when a rung reaches a lower rung. This means, that
- 15 subsequent to the release of the lowermost ladder section, the following ladder sections are automatically released, whereby the ladder collapses. However, when collapsing the ladder, the rungs are collapsing on top of each other, thereby generating a safety problem for the user's hands and fingers.
- 20 Thus, there is a need for a collapsible ladder, which allows the ladder sections to be automatically released by release of the lowermost ladder section, but which provides a safety distance between the rungs to avoid injuries of a users hands or fingers.

- US Patent No. US7048094 also discloses an extendable ladder, which ladder comprises:
- 25 a first stile, a second stile and a plurality of rungs disposed between the first stile and the second stile, the first stile being composed of a first column assembly including a first column and a second column assembly including a second column, the first column having an internal surface, and the second column being connected with the first column in a nested arrangement to form a telescopic mechanism capable of movement
- 30 lengthwise; a locking mechanism for selectively locking the second column with respect to the first column; a button operably connected to the locking mechanism for controlling the locking mechanism; a ring is coupled to the first column proximate a distal end thereof, and the second column includes a sleeve coupled to the second column proximate a proximal end thereof. The sleeve includes an external guiding surface for contacting the
- 35 internal surface of the first column and the ring includes an internal guiding surface for

contacting an exterior surface of the second column. The columns are made of Aluminium while the ring and the sleeve are made of a plastic material.

However, the sleeve is made of a relatively thin plastic material and may be worn out during use, whereby its function for providing a guiding surface is reduced. Thus, there is a need for a collapsible ladder, for which a first collapsible column is provided with a guiding part for guiding the first column into a next lower, second column, and for which the guiding part is not easily worn out.

## 10 SUMMARY OF THE INVENTION

According to a first aspect of the invention there is provided a collapsible ladder comprising:

two vertical stiles with a plurality of rungs disposed between two stiles, each stile being formed by a plurality of telescopically collapsible columns;

wherein each or at least part of the collapsible columns has a bottom opening and an inner wall and receives a cover at the bottom opening to cover the bottom opening; wherein

the cover has a small cylindrical portion and a large cylindrical portion with a peripheral surface located under the small cylindrical portion;

the small cylindrical portion is inserted into the bottom opening of a column and is positioned inside the column, while the large cylindrical portion is exposed outside of the column and inserted inside of a next lower column;

an annular groove is formed on the peripheral surface of the large cylindrical portion;

a sealing ring is disposed inside the annular groove, with the sealing ring touching the inner wall of the next lower column when the stile is extending or collapsing, said sealing ring forming a frictional seal for the next lower column and dividing the next lower column into an upper part above the sealing ring and a lower part below the sealing ring; and wherein

one or more air ducts are provided in the cover, each air duct having a first air opening and a second air opening, with the first air opening arranged above the large cylindrical portion and in correspondence with an opening in a lower wall part of the column receiving the cover, whereby the first air opening faces the inside or the interior of the upper part of the next lower column, and with the second air opening facing a bottom

part of the cover and the inside or the interior of the lower part of the next lower column, thereby enabling air to exit from the upper part to the lower part of the next lower column.

It is preferred that an elastic or elastomeric seal or film is provided at the bottom of the  
5 cover and secured to a bottom part of the cover, said seal extending beneath the second air openings facing the bottom of the cover. The elastic or elastomeric seal or film may be secured to the bottom part of the cover and extend beneath the second air openings so as to cover the second air openings.

10 It is preferred that the elastic or elastomeric seal or film is secured to the bottom part of the cover for sealing the second air openings when the stile is collapsed by having the upper column being collapsed into the next lower column, and for unsealing the second air openings when the stile is extended by extending the upper column outwards or upwards from the next lower column.

15

It is within one or more embodiments of the first aspect of the invention that an auxiliary sealing ring is disposed between the bottom of the small cylindrical portion of the cover and the inner wall of the column.

20 It is also within one or more embodiments of the first aspect of the invention that at least one protruding ring part is formed in each or at least part of the collapsible columns, wherein the outer diameter of the ring part is larger than the outer diameter of the column in which the ring part is formed, and smaller than the inner diameter of a next lower column.

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According to a second aspect of the invention there is provided a collapsible ladder comprising:

two vertical stiles with a plurality of rungs disposed between two stiles, each stile being formed by a plurality of telescopically collapsible columns;

30 wherein at least one protruding ring part is formed in at least part of the collapsible columns, wherein the outer diameter of the ring part is larger than the outer diameter of the column in which the ring part is formed, and smaller than the inner diameter of a next lower column.

For the second aspect of the invention it is preferred that at least part of the collapsible columns have a bottom opening and an inner wall and receives a cover at the bottom opening to cover the bottom opening. It is preferred that the outer diameter of the cover is smaller than the outer diameter of the protruding ring part. It is also preferred that the cover has a small cylindrical portion and a large cylindrical portion with a peripheral surface located under the small cylindrical portion, and that the small cylindrical portion is inserted into the bottom opening of a column and is positioned inside the column, while the large cylindrical portion is exposed outside of the column and inserted inside of a next lower column. An auxiliary sealing ring may be disposed between the bottom of the small cylindrical portion of the cover and the inner wall of the column.

For both the first and second aspects of the invention it is preferred that at least two protruding ring parts are formed in each or at least part of the collapsible columns.

It is within one or more embodiments of the first and second aspects of the invention that one or more columns having a protruding ring part have a locking hole for receiving a locking pin, and wherein a first protruding ring part is formed above said locking hole. It is preferred that a second protruding ring part is formed below said locking hole. It is also preferred that protruding ring part(s) is/are formed in a column by a rolling process. Here the column may be made of Aluminium with the protruding ring part(s) being formed in the Aluminium.

For embodiments of the first and second aspect of the invention having a bottom cover, it is preferred that the bottom cover has a sloped nose or protruding part extending from the bottom of the cover and arranged so as to push a locking pin received in a locking hole of the next lower column.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of an extendable ladder in accordance with an embodiment of the present invention when the columns are extended,

Fig. 2a is a sectional perspective view of parts of an extendable ladder in accordance with an embodiment of the present invention when the columns are extending,

Fig. 2b is a sectional perspective view of the ladder parts illustrated in Fig. 2a when the columns are collapsing, and

Fig. 3 illustrates the arrangement of a cover at the bottom of a column according to an embodiment of the invention.

#### DETAILED DESCRIPTION OF EMBODIMENTS

Figs. 1 to 3 show preferred embodiments of the present invention. The extendable ladder of Fig. 1 comprises two vertical stiles with a plurality of rungs 6 disposed between two stiles, each stile being formed by a plurality of telescopically collapsible columns 1a, 1b, each column 1a, 1b being connected to the corresponding rung 6 via a connecting sleeve 7; a plug or locking pin is disposed inside the connecting sleeve 7, which can move horizontally and transversely with respect to the connection sleeve 7 and be exposed outside to lock the column 1a together with the next lower column 1b; a spring disposed inside the connection sleeve 7, which can keep the plug pin in the trend of being exposed outside; a locking hole 10 is provided in the column 1a, 1b for receiving the plug or locking pin, and a push button 8 or release lever may be provided which can drive the plug pin to move transversely to lock or unlock a column 1a, 1b into a next lower column 1a, 1b.

20

The foregoing shows the conventional structure of an extendable ladder. According to an embodiment of the present invention and illustrated in Figs. 1, 2a, 2b and 3, there is provided an extendable ladder for which: each or at least part of the collapsible columns 1a, 1b, 21, 22 has a bottom opening and an inner wall and receives a cover 23 at the bottom opening to cover the bottom opening; the cover 23 has a small cylindrical portion 24 and a large cylindrical portion 25 with a peripheral surface located under the small cylindrical portion 24; the small cylindrical portion 24 is inserted into the bottom opening of a column 21 and is positioned inside the column 21, while the large cylindrical portion is exposed outside of the column and inserted inside of a next lower column 22; an annular groove 26 is formed on the peripheral surface of the large cylindrical portion 25; a sealing ring 27 is disposed inside the annular groove 26, with the sealing ring 27 touching the inner wall of the next lower column 22 when the stile is extending or collapsing, whereby the sealing ring 27 forms a frictional seal for the next lower column 22 and dividing the next lower column 22 into an upper part 28 above the sealing ring and a lower part below the sealing ring 29; one or more, such as two air ducts 30a, 30b are provided in the cover

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23, where each air duct 30a, 30b has a first air opening 31 and a second air opening 32, with the first air opening 31 arranged above the large cylindrical portion 25 and in correspondence with an opening 36 in a lower wall part of the column 21 receiving the cover 23, whereby the first air opening 31 faces the inside or the interior of the upper part 5 28 of the next lower column 22, and with the second air opening 32 facing a bottom part of the cover 23 and the inside or the interior of the lower part 29 of the next lower column 22, thereby enabling air to exit from the upper part 28 to the lower part 29 of the next lower column 22.

10 It is preferred that an elastic or elastomeric seal or film 34 is provided at the bottom of the cover 23 and secured to a bottom part of the cover, where the seal 34 extends beneath the second air openings 32 facing the bottom of the cover 23. The elastic or elastomeric seal or film 34 may be secured to the bottom part of the cover 23 and extend beneath the second air openings 32 so as to possible cover the second air openings 32. The elastic or 15 elastomeric seal or film 34 is secured to the bottom part of the cover for sealing the second air openings 32 when the stile is collapsed by having the upper column 21 being collapsed into the next lower column 22, and for unsealing the second air openings 32 when the stile is extended by extending the upper column 21 outwards or upwards from the next lower column 22. An auxiliary sealing ring 35 may be disposed between the 20 bottom of the small cylindrical portion 24 of the cover 23 and the inner wall of the column 21.

For ladders of the present invention having columns 21 provided with a bottom cover 23, then Fig. 2a shows a sectional cut through view of parts of the extendable ladder, when 25 the columns 1a, 1b, 21, 22 are extending, and Fig. 2b shows the same cut through view when the columns 1a, 1b, 21, 22 are collapsing. Fig. 3 is not a cut through view of the bottom cover 23, but illustrates the arrangement of the cover 23 at the bottom of a column 1a, 21. The bottom cover of Fig. 3 is also provided with a sloped nose or protruding part 37 extending from the bottom of the cover 23 and arranged so as to push a locking pin 30 received in a locking hole 10 of the next lower column 1b, 22.

During the collapsing of the upper column 21 into the next lower column 22, the seal 34 is moved slides upward relatively to the bottom of the cover 23, thereby closing the second air openings 32 of the air ducts 30a, 30b, and air is not passed through the air ducts 30a, 35 30b, so the collapsing of the column 21 is slowed down due to resistance of air inside the

closed spaced at the interior 29 of the next lower column 22. Due to the slowed collapsing, a person may have enough reaction time to withdraw his/her fingers in time even through the fingers are just in an inappropriate position. In addition, since the speed of the collapsing of the ladder is slowed down, the force applied to the fingers is quite  
5 small even if the fingers are crushed. Therefore, the purposes of preventing finger injury and eliminating potential safety hazards are achieved. In addition, when the columns move upward while the extendable ladder is extending for use, the seal 34 is moved downwards thereby opening the second air openings 32, and air can exit without resistance through the air ducts 30a, 30b from the upper part 28 to the lower part 29 of  
10 the next lower column 22.

The present invention also covers embodiments of a collapsible ladder, wherein at least one protruding ring part 9a, 9b is formed in each or at least part of the collapsible columns 1a, 1b, 21, 22, wherein the outer diameter of the ring part 9a, 9b is larger than the outer  
15 diameter of the column 1a, 1b, 21, 22 in which the ring part 9a, 9b is formed, and smaller than the inner diameter of a next lower column. This is illustrated in Fig.1 where two protruding ring parts 9a, 9b are shown on the next lower column 1b. A lowermost protruding ring part 9b is also shown on the inner column 21 in Fig. 3. It is preferred that at least part of the collapsible columns 1a, 1b, 21 provided with one or more protruding  
20 ring parts 9a, 9b have a bottom opening and an inner wall and receives a cover 23 at the bottom opening to cover the bottom opening. The present invention also covers embodiments for which the outer diameter of the cover 23 is smaller than the outer diameter of the protruding ring part 9a, 9b. The cover 23 may have a small cylindrical portion 24 and a large cylindrical portion 25 with a peripheral surface located under the  
25 small cylindrical portion 24, and the small cylindrical portion may be inserted into the bottom opening of a column 21 and positioned inside the column, while the large cylindrical portion may be exposed outside of the column and inserted inside of a next lower column 22. Here, an auxiliary sealing ring 35 may be disposed between the bottom of the small cylindrical portion 24 of the cover and the inner wall of the column 21. One or  
30 more of the collapsible columns 1a, 1b, 21, 22 having a protruding ring part 9a, 9b have a locking hole 10 for receiving a locking pin, and it is preferred that a first protruding ring part 9a is formed above the locking hole 10. It is also preferred that a second protruding ring part 9b is formed below the locking hole 10, and the second protruding ring part 9b may be arranged with a distance to the locking hole 10 being larger than the distance to

the bottom of the column 1b. The column 1a, 1b may be made of Aluminium and the protruding ring part(s) 9a, 9b may be formed in the Aluminium by a rolling process.

The present invention also covers embodiments of a collapsible ladder wherein one or  
5 more columns 1a, 1b have a locking hole 10 for receiving a locking pin, and wherein the bottom cover 23 has a sloped nose or protruding part 37 extending from the bottom of the cover 23 and arranged so as to push a locking pin received in a locking hole of the next lower column. Such a sloped nose or protruding ring part 37 is shown at the cover 23 of Fig. 3.

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By having one or more, such as two, protruding rings parts 9a, 9b formed in the collapsible columns 1a, 1b there is provided a solution for a collapsible ladder having guiding parts for guiding the a first upper column into a next lower, second column, which guiding part is not easily worn out.

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## CLAIMS

1. A collapsible ladder comprising:  
two vertical stiles with a plurality of rungs disposed between two stiles, each  
5 stile being formed by a plurality of telescopically collapsible columns;  
wherein each or at least part of the collapsible columns has a bottom  
opening and an inner wall and receives a cover at the bottom opening to cover the bottom  
opening; wherein  
the cover has a small cylindrical portion and a large cylindrical portion with a  
10 peripheral surface located under the small cylindrical portion;  
the small cylindrical portion is inserted into the bottom opening of a column  
and is positioned inside the column, while the large cylindrical portion is exposed outside  
of the column and inserted inside of a next lower column;  
an annular groove is formed on the peripheral surface of the large cylindrical  
15 portion;  
a sealing ring is disposed inside the annular groove, with the sealing ring  
touching the inner wall of the next lower column when the stile is extending or collapsing,  
said sealing ring forming a frictional seal for the next lower column and dividing the next  
lower column into an upper part above the sealing ring and a lower part below the sealing  
20 ring; and wherein  
one or more air ducts are provided in the cover, each air duct having a first  
air opening and a second air opening, with the first air opening arranged above the large  
cylindrical portion and in correspondence with an opening in a lower wall part of the  
column receiving the cover, whereby the first air opening faces the inside or the interior of  
25 the upper part of the next lower column, and with the second air opening facing a bottom  
part of the cover and the inside or the interior of the lower part of the next lower column,  
thereby enabling air to exit from the upper part to the lower part of the next lower column.
2. A collapsible ladder according to claim 1, wherein an elastic or elastomeric  
30 seal or film is provided at the bottom of the cover and secured to a bottom part of the  
cover, said seal extending beneath the second air openings facing the bottom of the  
cover.

3. A collapsible ladder according to claim 2, wherein the elastic or elastomeric seal or film is secured to the bottom part of the cover and extending beneath the second air openings so as to cover the second air openings.
- 5 4. A collapsible ladder according to claim 2 or 3, wherein the elastic or elastomeric seal or film is secured to the bottom part of the cover for sealing the second air openings when the stile is collapsed by having the upper column being collapsed into the next lower column, and for unsealing the second air openings when the stile is extended by extending the upper column outwards or upwards from the next lower  
10 column.
5. A collapsible ladder according to any one of the claims 1-4, wherein an auxiliary sealing ring is disposed between the bottom of the small cylindrical portion of the cover and the inner wall of the column.  
15
6. A collapsible ladder according to any one of the claims 1-5, wherein at least one protruding ring part is formed in each or at least part of the collapsible columns, wherein the outer diameter of the ring part is larger than the outer diameter of the column in which the ring part is formed, and smaller than the inner diameter of a next lower  
20 column.
7. A collapsible ladder comprising:  
two vertical stiles with a plurality of rungs disposed between two stiles, each stile being formed by a plurality of telescopically collapsible columns;  
25 wherein at least one protruding ring part is formed in at least part of the collapsible columns, wherein the outer diameter of the ring part is larger than the outer diameter of the column in which the ring part is formed, and smaller than the inner diameter of a next lower column.
- 30 8. A collapsible ladder according to claim 7, wherein at least part of the collapsible columns has a bottom opening and an inner wall and receives a cover at the bottom opening to cover the bottom opening.
9. A collapsible ladder according to claim 8, wherein the outer diameter of the  
35 cover is smaller than the outer diameter of the protruding ring part.

10. A collapsible ladder according to claim 8 or 9, wherein the cover has a small cylindrical portion and a large cylindrical portion with a peripheral surface located under the small cylindrical portion;

5 the small cylindrical portion is inserted into the bottom opening of a column and is positioned inside the column, while the large cylindrical portion is exposed outside of the column and inserted inside of a next lower column.

11. A collapsible ladder according to claim 10, wherein an auxiliary sealing ring  
10 is disposed between the bottom of the small cylindrical portion of the cover and the inner wall of the column.

12. A collapsible ladder according to any one of the claims 6-11, wherein at  
15 least two protruding ring parts are formed in each or at least part of the collapsible columns.

13. A collapsible ladder according to any one of the claims 6-12, wherein one or  
more columns having a protruding ring part have a locking hole for receiving a locking pin,  
and wherein a first protruding ring part is formed above said locking hole.  
20

14. A collapsible ladder according to claim 13, wherein a second protruding ring  
part is formed below said locking hole.

15. A collapsible ladder according to any one of the claims 6-15, wherein the  
25 protruding ring part(s) is/are formed in a column by a rolling process.

16. A collapsible ladder according to any one of the claims 1-15, wherein one or  
more columns have a locking hole for receiving a locking pin, and wherein the bottom  
cover has a sloped nose or protruding part extending from the bottom of the cover and  
30 arranged so as to push a locking pin received in a locking hole of the next lower column.

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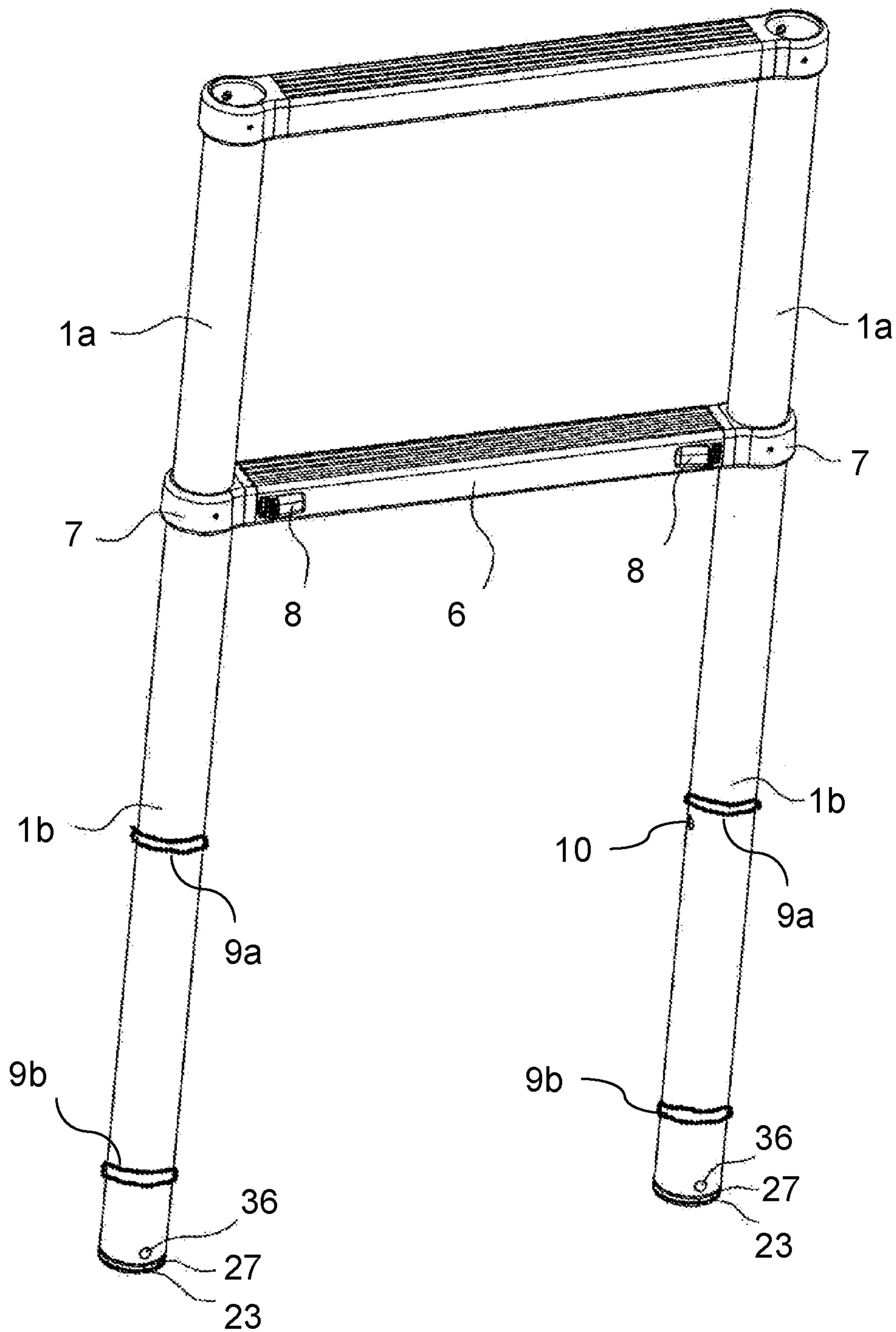


Fig. 1

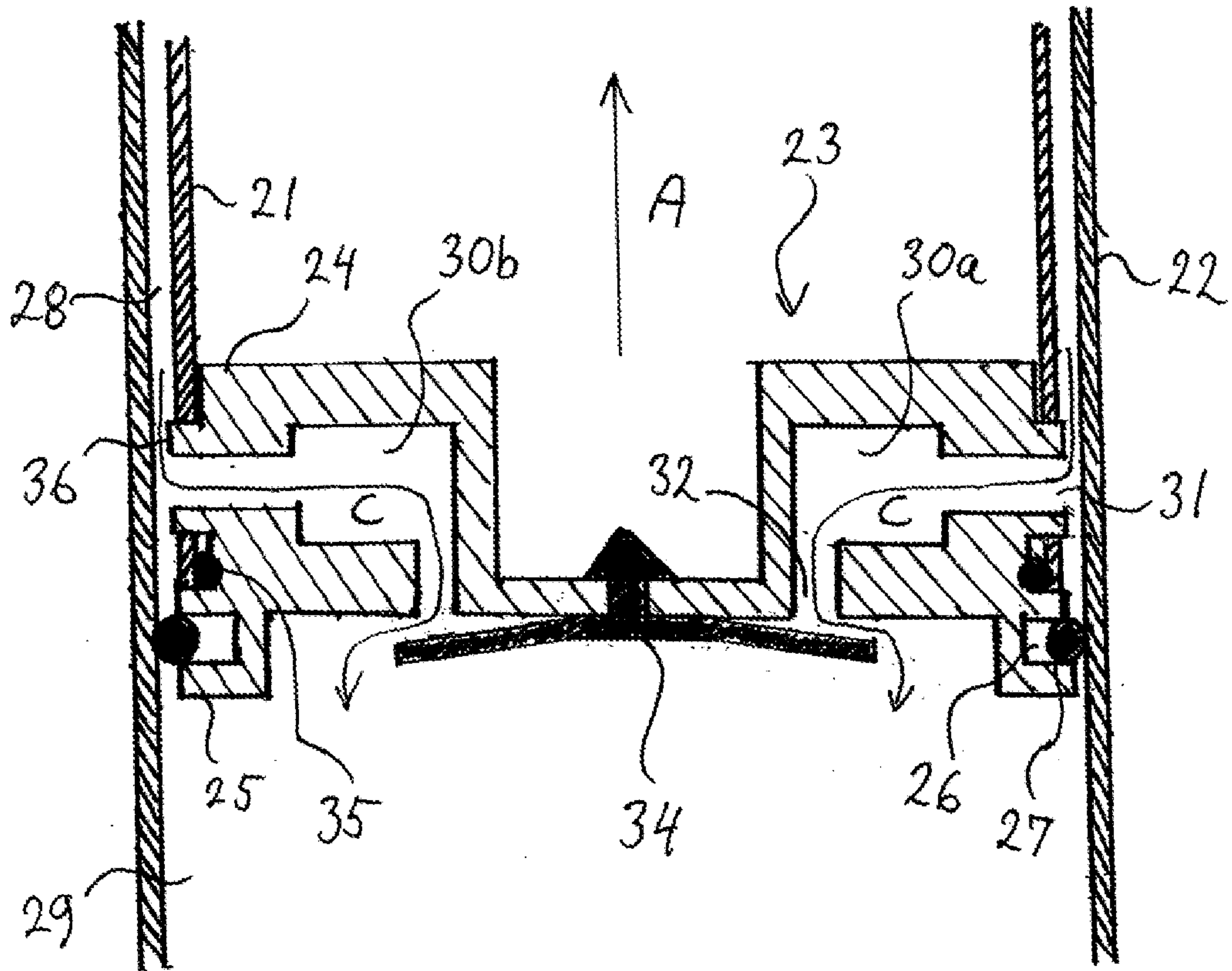


Fig. 2a

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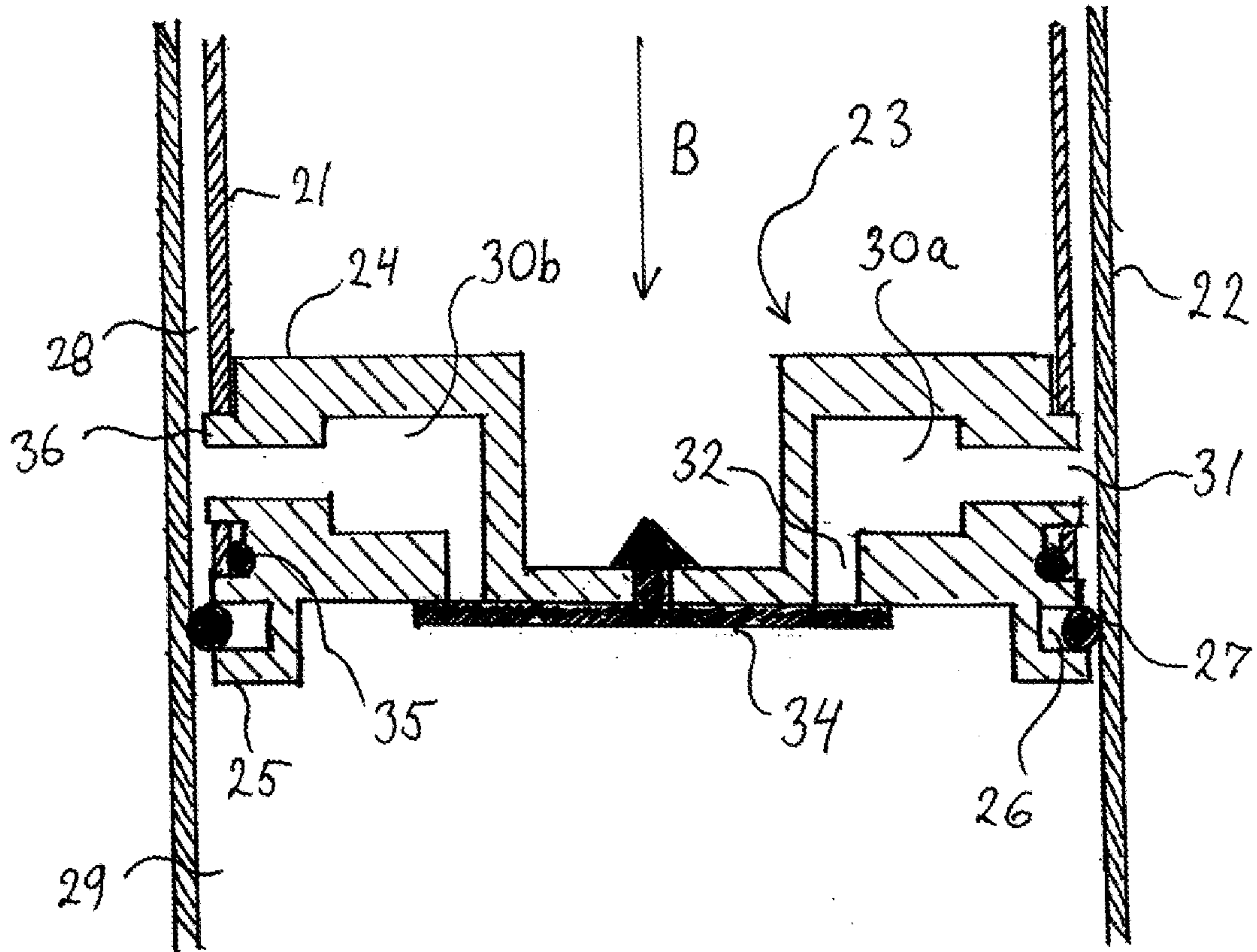


Fig. 2b

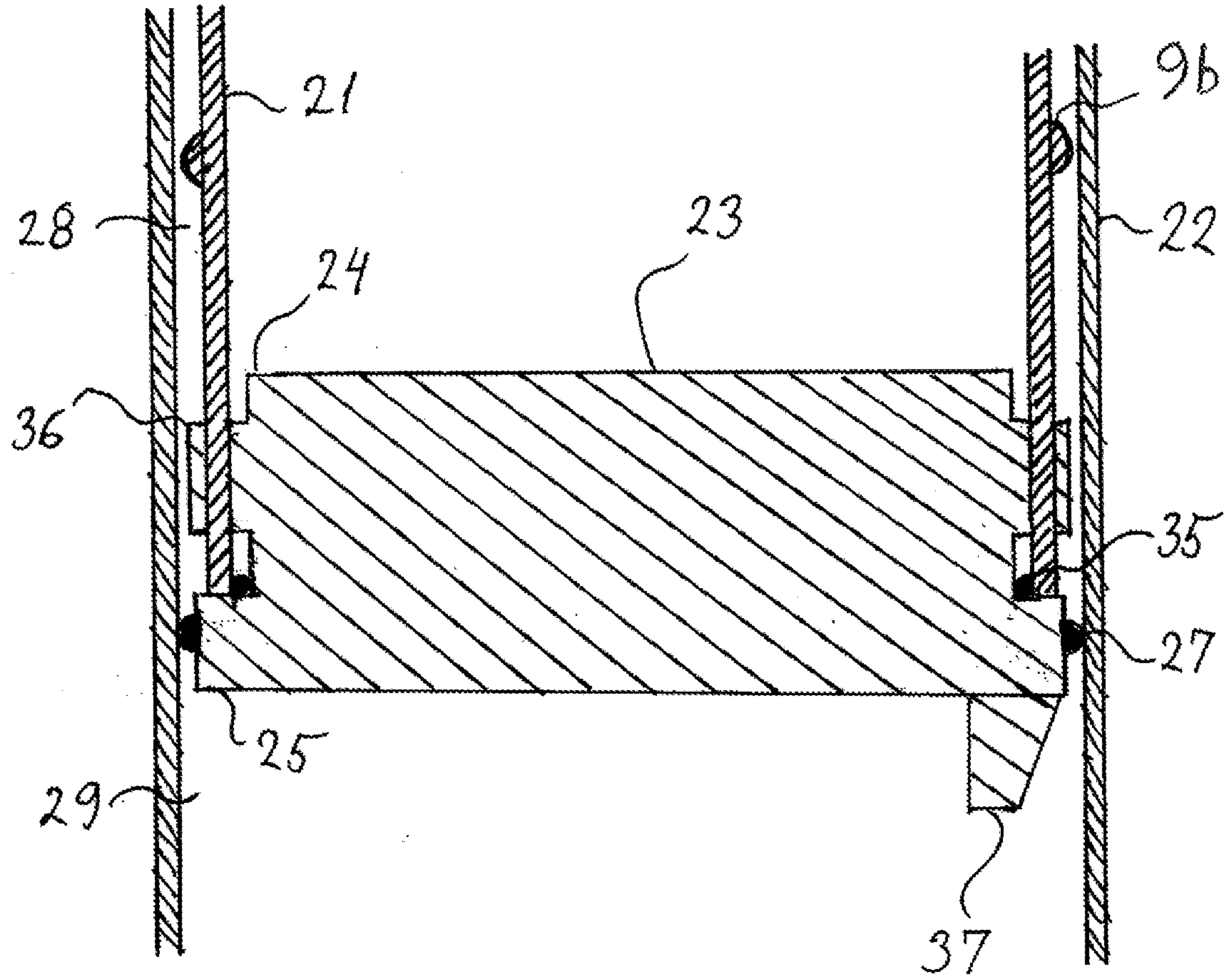


Fig. 3

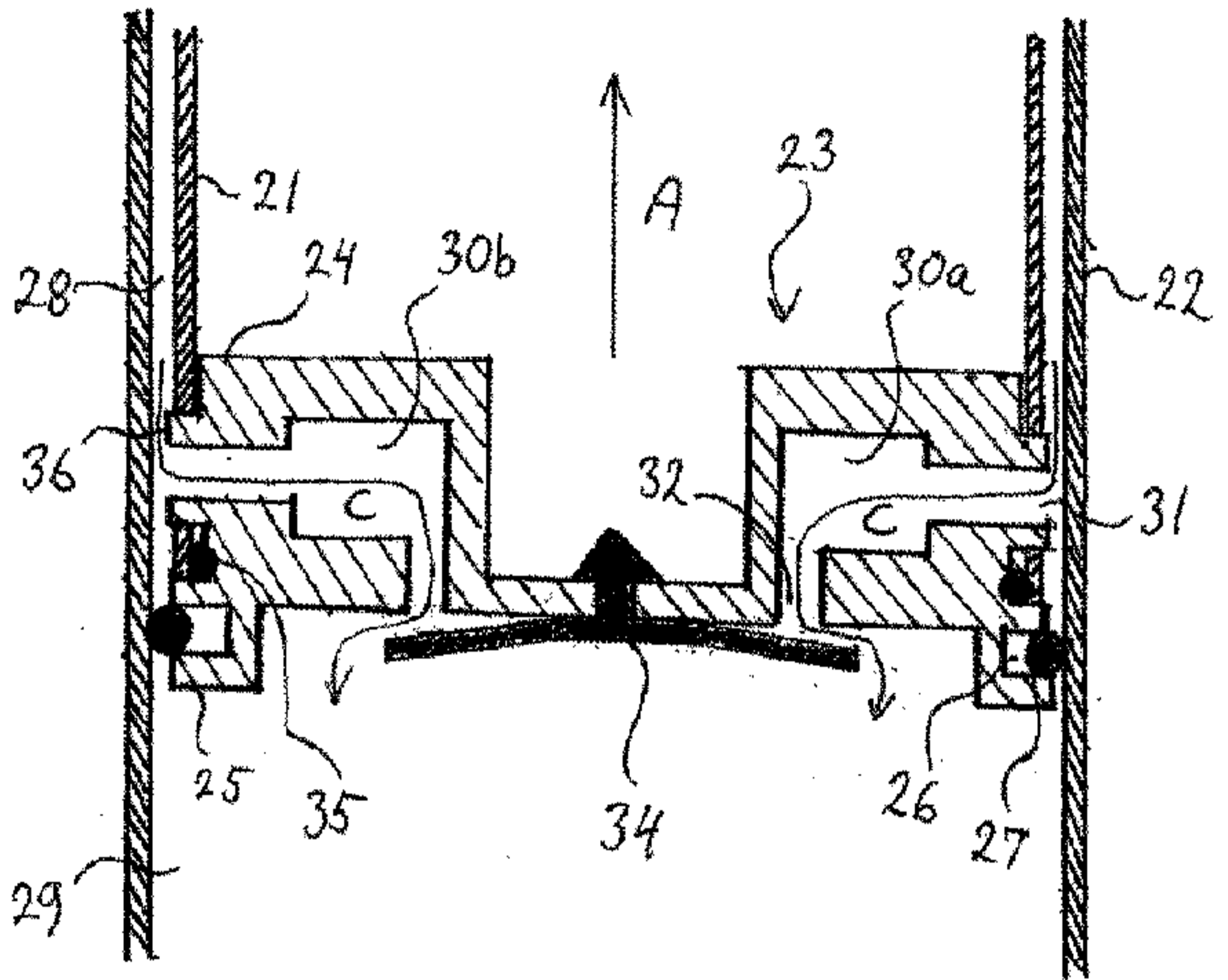


Fig. 2a