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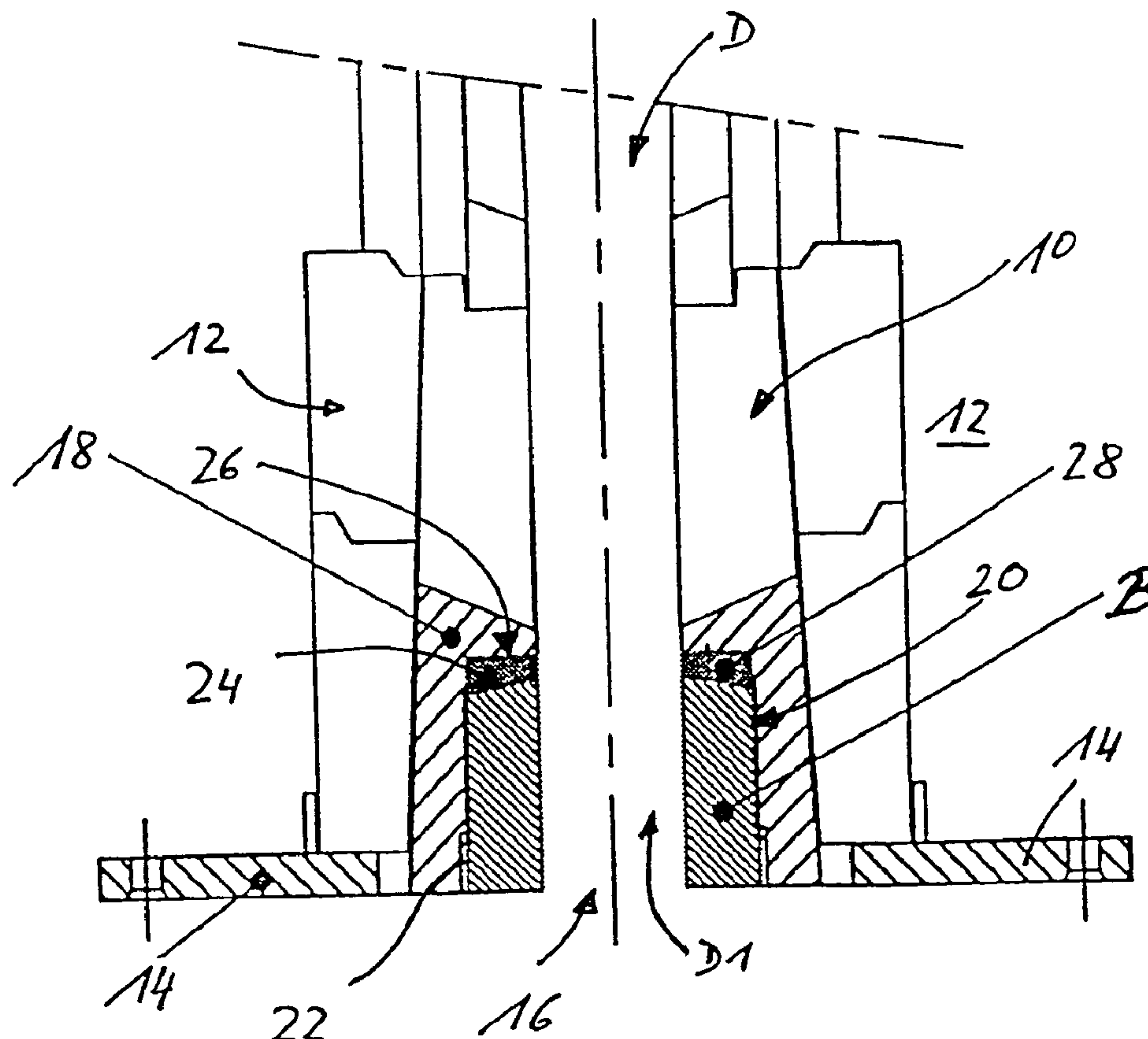
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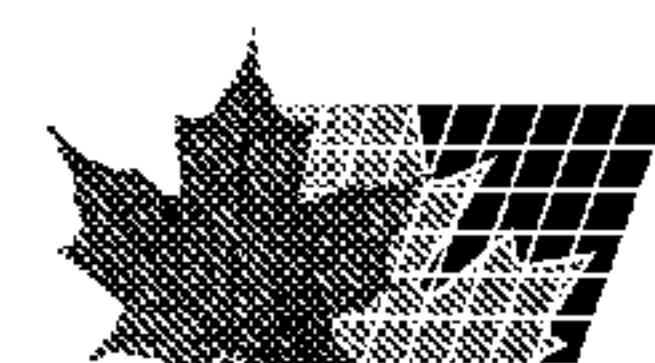
(54) Titre : TUBE DE PERCEE DESTINE A UNE CUVE DE FUSION METALLURGIQUE

(54) Title: TAPPING TUBE FOR A METALLURGICAL FUSION POT



(57) Abrégé/Abstract:

The invention relates to a tapping tube for a metallurgical fusion pot. The aim of the invention is to provide a tapping tube which minimises possible downtime and enables essentially identical tapping durations during the use of the tapping tube. To this end,



(57) **Abrégé(suite)/Abstract(continued):**

the tapping tube functionally divides into two parts, namely a first part embodied according to prior art, and a second part that can be connected to the first part in an easily exchangeable (replaceable) manner, thus forming a complete tapping tube. According to the invention, the section of the tapping tube relating to the flow is the outlet end. The cross-section of the outlet end determines the outflow quantity and thus the outflow duration (tapping duration) of the metal melt.

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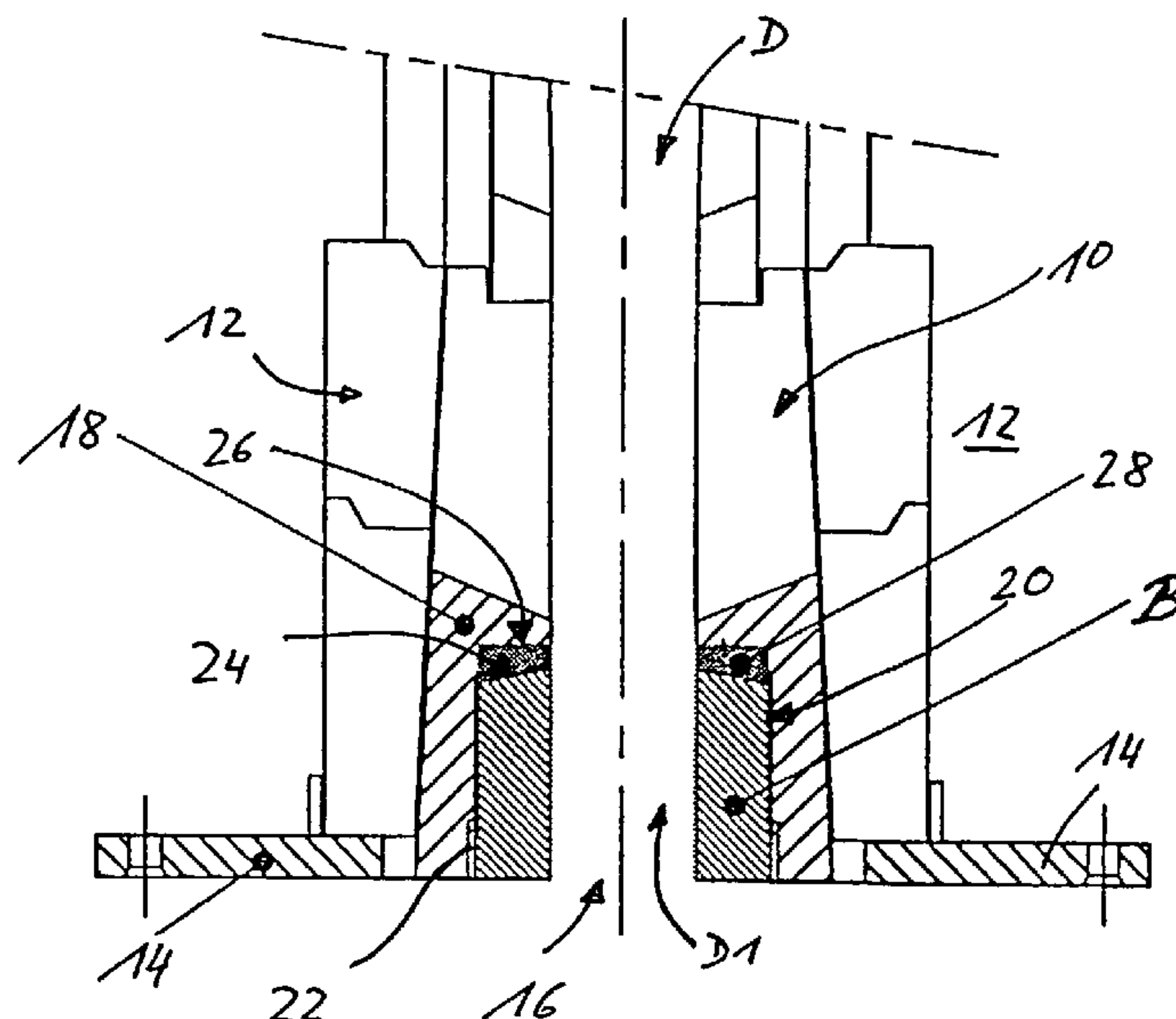
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(54) Title: TAPPING TUBE FOR A METALLURGICAL FUSION POT

(54) Bezeichnung: ABSTICHROHR FÜR EIN METALLURGISCHES SCHMELZGEFÄSS



(57) Abstract: The invention relates to a tapping tube for a metallurgical fusion pot. The aim of the invention is to provide a tapping tube which minimises possible downtime and enables essentially identical tapping durations during the use of the tapping tube. To this end, the tapping tube functionally divides into two parts, namely a first part embodied according to prior art, and a second part that can be connected to the first part in an easily exchangeable (replaceable) manner, thus forming a complete tapping tube. According to the invention, the section of the tapping tube relating to the flow is the outlet end. The cross-section of the outlet end determines the outflow quantity and thus the outflow duration (tapping duration) of the metal melt.

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(57) Zusammenfassung: Die Erfindung betrifft ein Abstichrohr für ein metallurgisches Schmelzgefäß. Der Erfindung liegt die Aufgabe zugrunde, ein Abstichrohr zur Verfügung zu stellen, welches bei Minimierung etwaiger Ausfallzeiten weitestgehend gleiche Abstichzeiten während der Nutzungsdauer des Abstichrohres ermöglicht. Kerngedanke der Erfindung ist, das Abstichrohr funktional in zwei Teile zu gliedern, nämlich einen ersten Teil, der gemäss Stand der Technik ausgebildet sein kann und einen zweiten Teil, der leicht wechselbar (austauschbar) mit dem ersten Teil verbunden werden kann, und zwar unter Ausbildung eines kompletten Abstichrohres. Dabei liegt der Erfindung die Erkenntnis zugrunde, dass der strömungstechnisch relevante Abschnitt des Abstichrohres das Auslaufende ist. Der Querschnitt am Auslaufende bestimmt die Auslaufmenge und damit die Auslaufzeit (Abstichzeit) der metallschmelze.

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DESCRIPTION

The invention relates to a tapping tube for a metallurgical melting vessel. A metallurgical melting vessel is defined as an apparatus in which a metallurgical melt is produced, treated, and/or transported, for example a converter or an arc furnace.

Metal melt in the melting vessel is fed to a downstream apparatus via the tapping tube. For example, steel is fed from the converter to a downstream continuous casting installation via a ladle.

The metal melt should be as free from impurities as possible when it is transported. For example, contact with the ambient atmosphere (oxygen, nitrogen) should be avoided as well as the inclusion of slag.

A converter tapping spout is known from EP 0 057 946 B1 which includes a plurality of fireproof blocks or discs, connected to each other axially. The converter tapping spout may also be monolithic with the same geometry. Figure 1 shows this prior art, which has proven its commercial value for a long time. The central through-flow channel for the metal melt material may be conical, cylindrical, or reduced in steps from the inflow end to the outflow end. In any case, when metal melt is passed through, it quickly causes erosion of the outer wall in the through-flow channel, so that its cross section is constantly being enlarged during operation, as is shown schematically in Figure 2.

It is evident that as the cross section of the through-flow channel changes, the quantity of metal melt flowing through the tapping tube per time unit also changes. This change is all but completely uncontrolled, since the removal of the refractory material is also largely uncontrolled.

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Attempts have therefore been made to repair the tapping tubes of the kind described after a certain tapping time, for example by introducing a cylindrical template into the through-flow channel that was enlarged by erosion and spraying a refractory mass behind the template. This method is time-consuming and is associated with considerable difficulties at the hot furnace unit.

The object of the invention is to provide a tapping tube (spout) that enables tapping times to remain as constant as possibly for the entire period of use, while minimising nonproductive times.

The main idea of the invention is to construct the tapping tube in two functional parts, a first part that may be configured in accordance with prior art, and a second part that may be connected to the first part thereby creating a complete tapping tube and which is easily replaceable (exchangeable).

The invention is based on the realisation that the section of the tapping tube that determines the nature of the flow is the outflow end. The cross section at the outflow end determines the outflow quantity and thus also the outflow time (tapping time) of the metal melt. This is the "outer" part, that is to say the part farthest from the melting bath in the metallurgical vessel, so that the relatively lowest temperatures occur here, which makes it easier to replace a corresponding tapping part.

The basic inventive concept is presented in Figure 3 based on Figures 1 and 2. It should be noted that the upper part of the tapping arrangement, starting from inflow end E, has been taken without changes from prior art, and an approximated condition of wear of Figure 2 is reflected in Figure 3.

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The essential difference compared with prior art consists in that an end A at the outflow side of the tapping tube is designed as a separate, replaceable assembly B, which is sealingly connected to the adjacent part of the tapping tube, as will be described in detail.

The replaceable component B, which is essentially cylindrical in shape, has a through-flow channel D1, the cross sectional area of which corresponds to a target cross sectional area of the through-flow channel without any wear.

Of course there will be as well a wear of the refractory material in the area of through-flow channel D1, and the cross section of this area will increase over time as well. But as soon as this cross section increase reaches a given value, assembly B is quickly replaced without making or having to make any changes to the upstream section in the direction of flow (referred to in the following as the upper section). When a new assembly B has been fitted, an annular shoulder S will be formed in the transition region to the upper part of the tapping tube, but this is deliberately accepted, because repairing of the upper part of the tapping tube is not acceptable for the reasons given, and is also not necessary from a technological point of view, because the tapping time and the mass flow of the tapped metal melt is determined only by the cross section of the through-flow channel at outflow end A.

Of course, the connection zone between replaceable component B and the fixed part of the tapping tube must be leak-proof, but it must also be designed such that component B is easily detachable. To this end, the following suggested solutions are described.

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It is also evident that the "loose" component B must be firmly secured in the position shown in Figure 3 to ensure that it does not become detached from the upper section of the tapping tube. To this end, the invention offers several different solutions, which are also presented in the following.

In its most general embodiment, the invention thus relates to a tapping tube for a metallurgical melting vessel having the following features:

- the tapping tube has a through-flow channel for a metal melt, which channel connects an inflow end and an outflow end,
- starting from the outflow end, the tapping tube encloses a cylindrical end section that is constructed as a separate, cylindrical part adjacent the through-flow channel,
- the first end of the part, the end that comprises the outflow end of the tapping tube, is constructed to ensure a fixed but detachable fitting of the part in a retaining device, the second end of the part has a front surface facing the inflow end, which surface being tightly arranged against an axially adjacent section of the tapping tube when the part is in a retained position.

The term cylindrical includes sections having a circular cross section, but also all other sectional geometries. This applies for both internal and external sections of the tube. In the axial direction (direction of flow of the metal melt), the tube may be cylindrical or conical in shape. Other shapes are also possible, for example a stepped surface. Besides a circular cross section, the

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internal and the external cross section may be polygonal or oval. Any polygonal shape is possible.

The most critical point for the tapping tube of the invention is that the replaceable part delimits through-flow channel D (D1) peripherally.

This includes embodiments, as shown in Figure 3, in which part B extends over the entire cross sectional area of the tapping tube. However, it also includes embodiments in which the part is implemented in the lower (outflow side) end section of the tapping tube, as will be illustrated in the following.

The cylindrical part may have any internal cross section. For example, the through-flow channel has a round or oval internal cross section in the area of the part. The cross sectional area should match the target cross section area for the purpose of assuring the desired mass flow and tapping time.

The through-flow channel in the area of the part may have a constant internal cross section when viewed from the top of the part but it may also be conformed to be slightly conical or stepped towards the outflow end.

As was indicated previously, the cylindrical component (part) may be fitted in an outer, cylindrical end section of the tapping tube. In this way, the target length of the tapping tube remains unchanged. Only a changing sleeve is disposed detachably on the outflow end.

However, as shown in Figure 3, this may also be shortened for a predetermined length of the tapping tube, in which case when the replaceable part is installed it restores the tapping tube to its original length.

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The replaceable component (part) may be fixed on or in the other part of the tapping tube in various ways. One possibility is to construct the part with an external thread, which cooperates with a corresponding internal thread. This internal thread may be arranged as a separate part in the outflow area of the tapping tube at the associated metallurgical melting vessel. It may also be an integral component of the outflow end of the tapping tube, particularly in the case of the inserted part as described.

A bayonet connection is also possible instead of a threaded connection.

According to one embodiment, the cylindrical replaceable part has buffers along its outer surface or at its outlet end for compression means acting in the direction of the inlet end onto said part.

The compression means may be springs, for example, that are disposed on a retaining mechanism, which in turn is fixed to the outside of the metallurgical melting vessel.

The determining feature is that the replacement component is biased towards the inflow end of the tapping tube in such a manner that a leak-proof joint is created with the remaining part of the tapping tube. The corresponding retaining means are therefore disposed particularly at the free lower front surface or on the outer periphery of the part.

The quality of the seal may be improved if the front face on the mounted end of the part has a contoured surface, i.e., it is not smooth. Such contouring may consist of individual, discrete knobs or ridges. The contouring may also comprise rib-like projections in a concentric or spiral arrangement.

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Alternatively or additionally, the surface of the tapping tube against which the front surface of the changing component is pressed may also be conformed in the same way.

A further alternative provides for placing a seal between the corresponding surfaces of the tapping tube and the component. Particularly if the corresponding surface sections of the fireproof material are more or less flat, it is sensible to conform the normally annular seal with surface contouring such as was described previously.

Regardless of whether these profiles are formed within the refractory material and/or being part of the sealing component, these profiling enable a certain elasticity and thus also deformability when the part is mounted onto the remaining section of the tapping tube.

A suitable sealing material is graphite, for example, since this also has the corresponding thermal resistance. The seal may also be produced from a sealing compound, for example as an emulsion of flake graphite and oil.

The contact surface (frontal surface) of the described part with the ceramic section of the other part of the tapping tube may be flat (in particular perpendicular to the central longitudinal axis of the tapping tube) or convex, particularly cambered, which is to say arched towards the inflow end.

At the same time, the part may include a temporary barrier for a "first slag". This first slag flows into the tapping tube (and subsequently into the downstream metallurgical melting vessel) when the converter is tipped, and this is undesirable. The invention therefore provides that the component be constructed with a blocking element that temporarily fills the entire internal cross section (through-flow channel). In this context, "temporary" means

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that the blocking effect only needs to be very short, a few seconds for example, before metal melt flows into the tapping channel in the tapping process.

Such a blocking element may be a thin metal panel, for example, or a type of cup, which are placed in the through-flow channel of the component (part), for example via spring arms (claws) on the peripheral surface thereof.

The component may generally be of any length. The most important is, as described above, the outflow cross section at the outflow end. However, the operating life of the part may be prolonged if it is at least 1.5 times as long as the smallest internal diameter, a ratio of 1.5 to 3 usually being sufficient. This length is also important for obtaining the desired characteristic of the outflowing melt. In particular, a uniform outflow of the melt is achieved.

Because the endpiece is easily exchanged, the tapping tube described enables highly constant tapping times to be achieved, and thus also improved availability of the melting unit. Replacement of the end component may be automated. Since it is replaced from the outside, this may be performed easily and quickly. It is fitted in such manner that the outflow end of the tapping tube lies more or less flush with the outer wall of the metallurgical melting vessel.

The end part may be made from the same material as the rest of the tapping tube. Or the two sections may also be produced from different materials. For example, the part may be constructed from a highly wear-resistant material grade.

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Different thermal expansions of different materials may be compensated by the sealing area described previously, and/or by an elastic retaining mechanism for the component.

Additional features of the invention are described in the dependent claims and in the other application documents.

In the following, the invention will be explained in greater detail with reference to various embodiments. The drawing shows, in schematic form:

Figure 4: a partial cross section of an end section of a tapping tube,

Figure 5: a top view of and a section through surface 24 of the replaceable component of the tapping tube of Figure 4,

Figure 6: a partial sectional view of another embodiment of a tapping tube, in which only the lower part is shown.

Identical or equivalent parts in the figures are identified with the same reference numbers.

Figure 4 shows the lower part of a tapping tube 10, which is fitted in a refractory lining of a converter 12 which shows an outer metal envelope 14. These features all represent prior art and will therefore not be described further.

Starting from outflow end 16 of flow-through channel D, an end section 18 of tapping tube 10 has an extended inner recess 20, in this case with a cylindrical wall surface. A metal ring 22 is adhered to the wall area of end section 18 directly adjacent outflow end 16, and has an internal thread.

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This internal thread cooperates with an external thread provided peripherally on a mounting component B. Component B is cylindrical. The external diameter of component B corresponds to the internal diameter of recess 20. This enables component B to be inserted into recess 20 along the described thread until it lies flush in closing manner with end section 18 and metal envelope 14 at outflow end 16. Component B has a central through-flow channel D1 which has a circular cross section, and which matches a target cross section of through-flow channel D at the outflow end of tapping tube 10.

A graphite seal 28 is situated between an upper frontal surface 24 of component B and the corresponding contact surface 26 of section 18, and is compressed into recess 20 when component B is screwed in, so that the size of seal 28 is exaggerated in the drawing.

When tapping tube 10 becomes worn, as shown in Figures 2, 3, component B is also susceptible to wear, but only component B is replaced, thereby creating an arrangement that essentially corresponds to that of Figure 3. In these circumstances, component B is unscrewed from recess 20 and a new component with a defined through-flow channel D1 is inserted instead.

Figure 5 shows a cross section (bottom) and a top view (top) of the conformation of frontal surface 24 of component B with concentric, raised ribs 24r, wherein seal 28 is advantageously able to be pressed into the depressions formed between ribs 24r, thus enhancing the sealing effect.

In the embodiment of Figure 6, Component B is not disposed in a recess 20 of end section 18 of tapping tube 10. The upper part of tapping tube 10 is shortened by the length

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(height) of component B, with the result that contact surface 26 for component B extends over the entire wall thickness of tube 10.

The exterior shape of component B with central through-flow channel D1 - which has a circular cross section - is a truncated cone and is disposed in a corresponding metal sleeve 30, which is furnished with a ridge 32 running radially.

Retaining arms 34 abut this ridge 32, and are biased towards the upper part of tapping tube 10 via compression springs 36. Springs 36 are supported on arms 38, which are fixed at the metal envelope 14 of the metallurgical melting vessel (not shown in detail). Projecting parts form a retaining mechanism for component B.

In this way, the upper frontal surface 24 of component B is forced under the effects of springs 36 against matching contact surface 26 of the upper part of tapping tube 10. A seal, for example a graphite foil, may also be disposed between surfaces 24, 26, which may also be contoured.

As wear occurs (shown by dashed line L) component B may be replaced quickly by detaching the retaining mechanism. The new component B (with through-flow channel D1) is then fixed with the retaining mechanism and then provides an outflow cross section with defined target diameter for subsequent tapping operations.

Even as the wear on tapping tube 10 becomes more advanced (shown by dotted line P), the upper part of tapping tube 10 remains unchanged. However, component B is replaced again as soon as it reaches the wear condition corresponding to the dashed line L again.

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Figure 6 also shows a schematic representation of a pot-shaped blocking element 40, produced from thin sheet metal, and the peripheral lip of which rests on the upper frontal surface 24 of component B when the component is pressed against corresponding contact surface 26. Blocking element 40 prevents the first slag from getting into a downstream melting vessel when the metal melt is tapped along through-flow channel D. Only a small amount of slag is able to advance through-flow channel D up to blocking element 40. As soon as the first slag has been transported past the inflow end of tapping tube 10 by tilting of the melting vessel, only molten metal remains at the top of the inflow end. Now the slag in the inflow part of tapping tube 10 can either float upwards or drain out as part of the slag when blocking element 40 has melted. Thereafter, only molten metal passes through tapping tube 10.

The illustrated blocking element represents just one possible design solution. The essential feature is that when component B is changed, a fresh blocking element with the same function is able to be installed at the same time, which then blocks through-flow channel D temporarily.

CLAIMS

1. A tapping tube (10) for a metallurgical melting vessel (12) with a through-flow channel D for a metal melt, which channel connects an inflow end E with an outflow end A, in which, starting from outflow end A, a separate, cylindrical part B is arranged adjacent the through-flow channel D within an associated cylindrical end section of the tapping tube (10), the first end of which part B, comprising the outflow end A of the tapping tube (10), is designed to create a fixed but detachable seating for part B in a retaining mechanism (22; 34), and the second end of which has a front surface (24) facing towards inflow end E, which surface being tightly arranged against an axially adjacent section (26) of the tapping tube (10) when part B is in a retained position wherein a seal (28) being provided between the front surface (24) at the second end of part B and the axially adjacent section (26) of the tapping tube (10) or the front surface (24) at the second end of part B has a surface contour (24r) or both.

2. The tapping tube according to claim 1, wherein the cylindrical part B has an internal cross section corresponding to a target cross section of through-flow channel D.

3. The tapping tube according to claim 1, wherein the internal cross section of part B is constant over the entire height.

4. The tapping tube according to claim 1, wherein part B is fitted with an outer, cylindrical end section of the tapping tube (10).

5. The tapping tube according to claim 1, wherein part B has an external thread extending adjacent outflow end A.

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6. The tapping tube according to claim 1, wherein part B has buffers (32) at its outer surface or at outflow end A for a compression means (34, 36), which biases component B towards inflow end E.

7. The tapping tube according to claim 1, in which the front surface (24) at the second end of part B has the surface contour (24r).

8. The tapping tube according to claim 7, in which the surface contour (24r) is made up of raised ridges extending concentrically with each other or in spiral formation.

9. The tapping tube according to claim 1, in which the frontal surface (24) at the second end of component B describes an annular section of an imaginary ball.

10. The tapping tube according to claim 1, having the seal (28) between the front surface (24) at the second end of part B and the axially adjacent section (26) of the tapping tube (10).

11. The tapping tube according to claim 10, in which the seal is made from a sealing compound.

12. The tapping tube according to claim 10, in which the seal is made of an annular sealing foil with a surface that is structured on one or both sides.

13. The tapping tube according to claim 1, in which the section (26) of the tapping tube (10) that is adjacent the frontal surface (24) on the second end of the component is flat in design.

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14. The tapping tube according to claim 1, having a blocking element (40) that temporarily fills the internal cross section of part B.

15. The tapping tube according to claim 1, in which part B has a length that is equivalent to 1.5 to 3 times the smallest internal diameter of the tapping tube (10).

Fig. 1
PRIOR ART

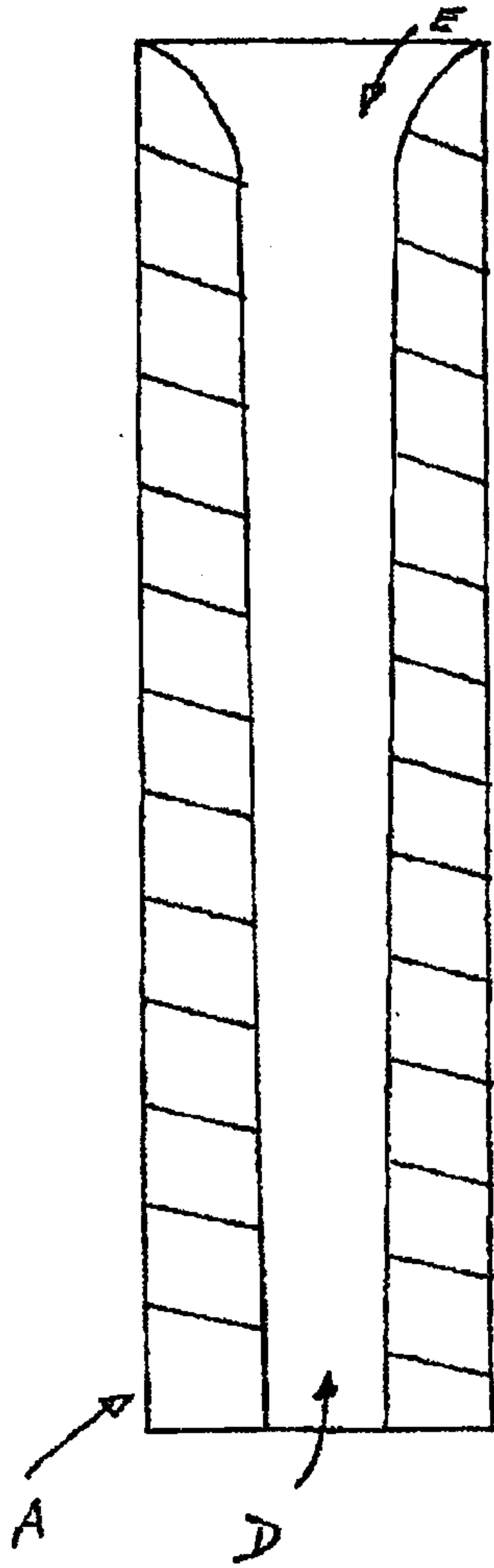


Fig. 2
PRIOR ART

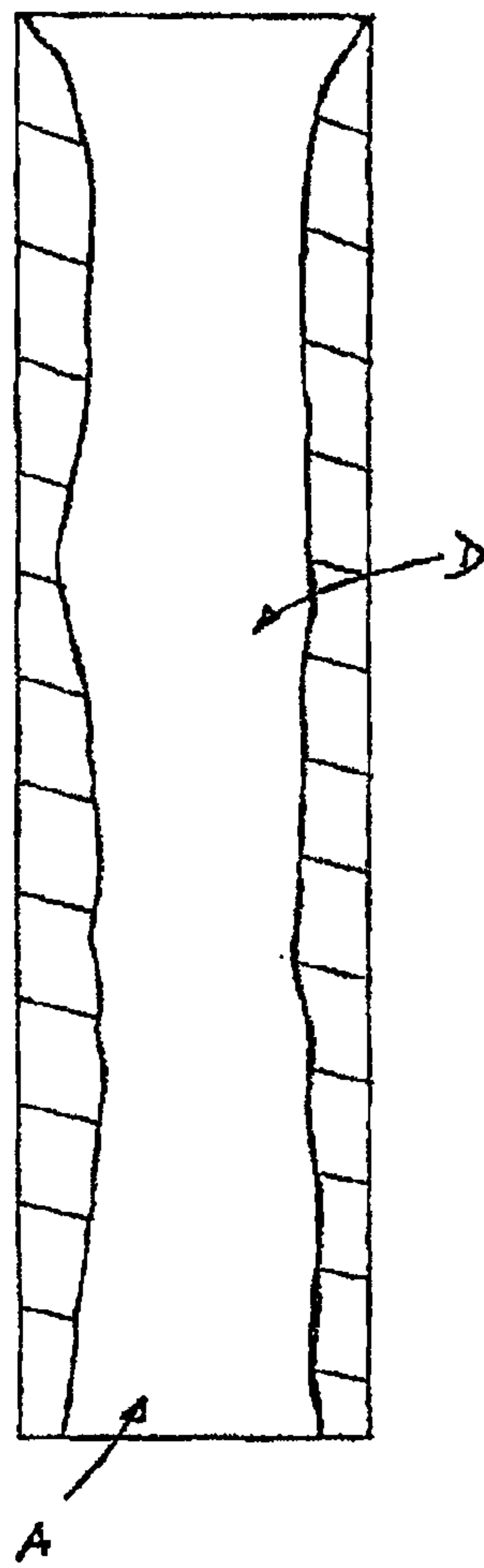


Fig. 3

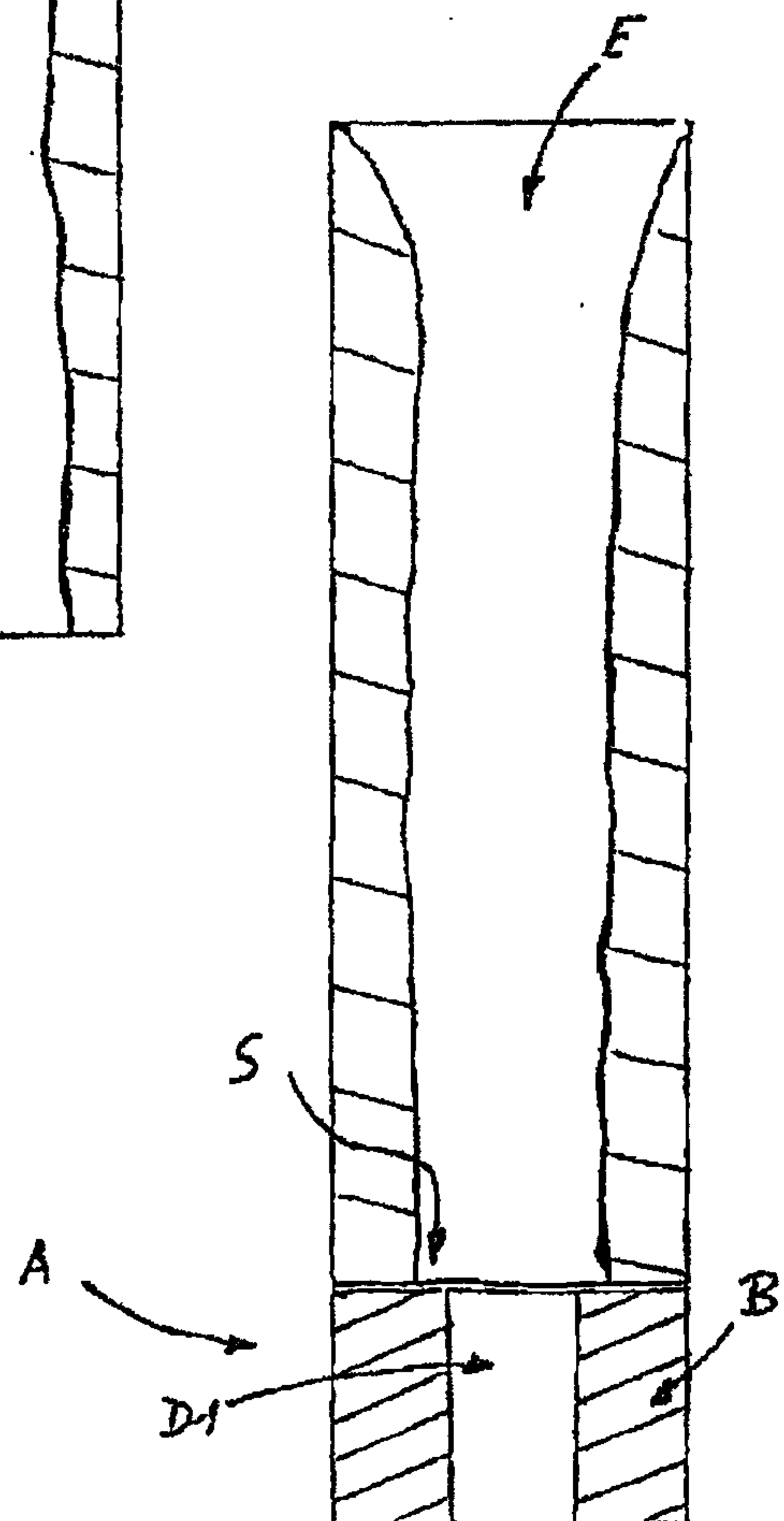


Fig. 4

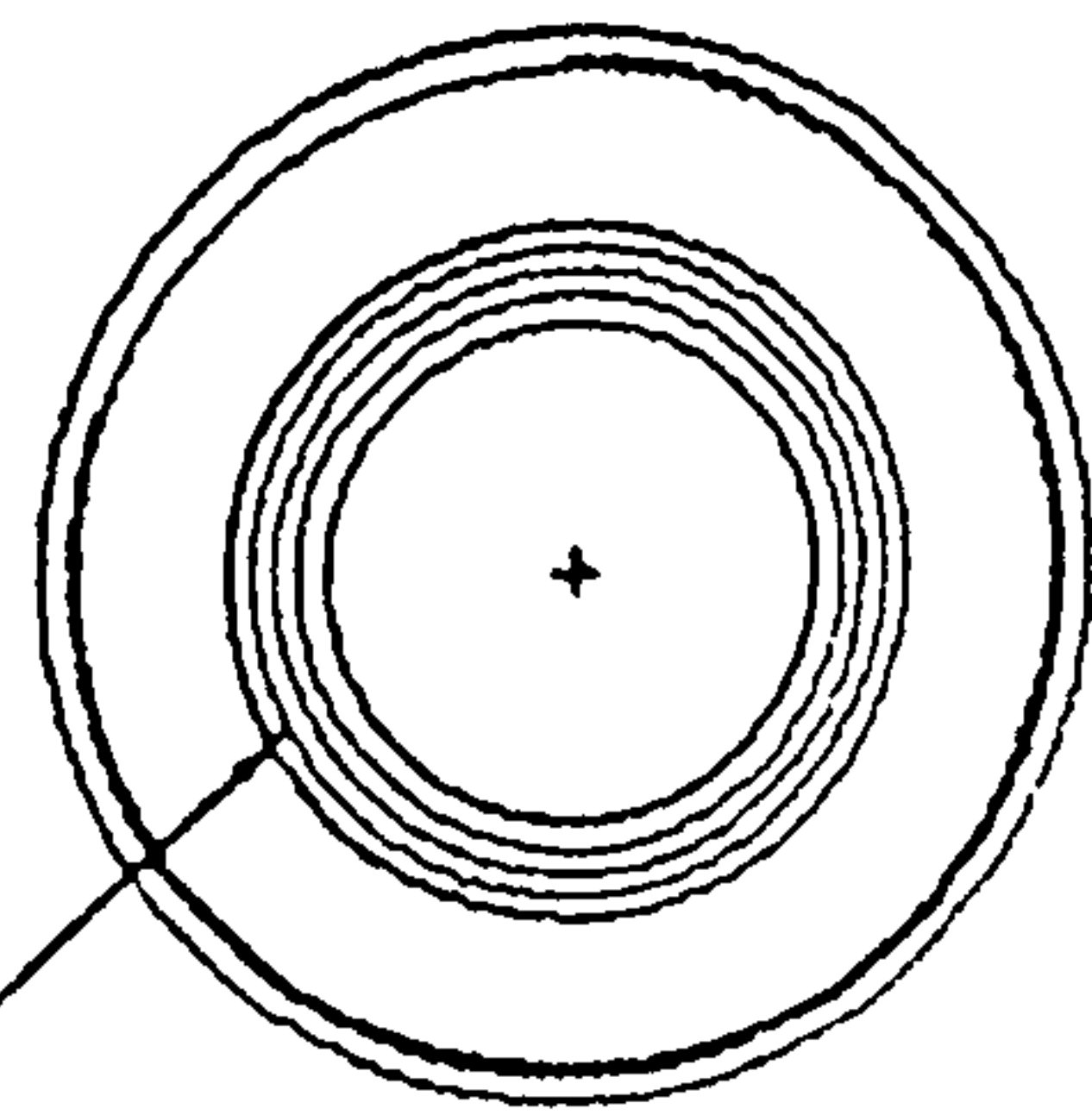
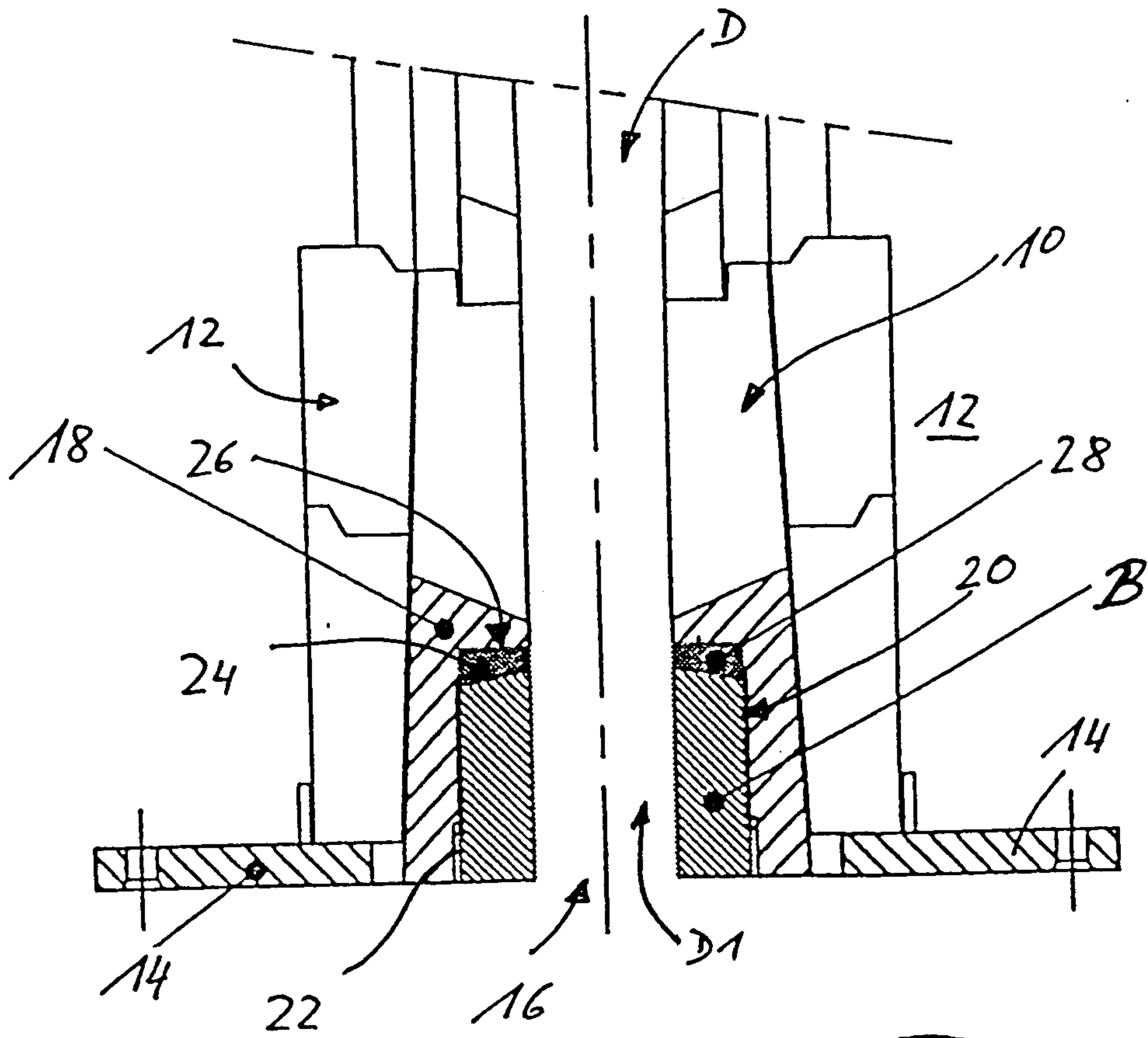


Fig. 5

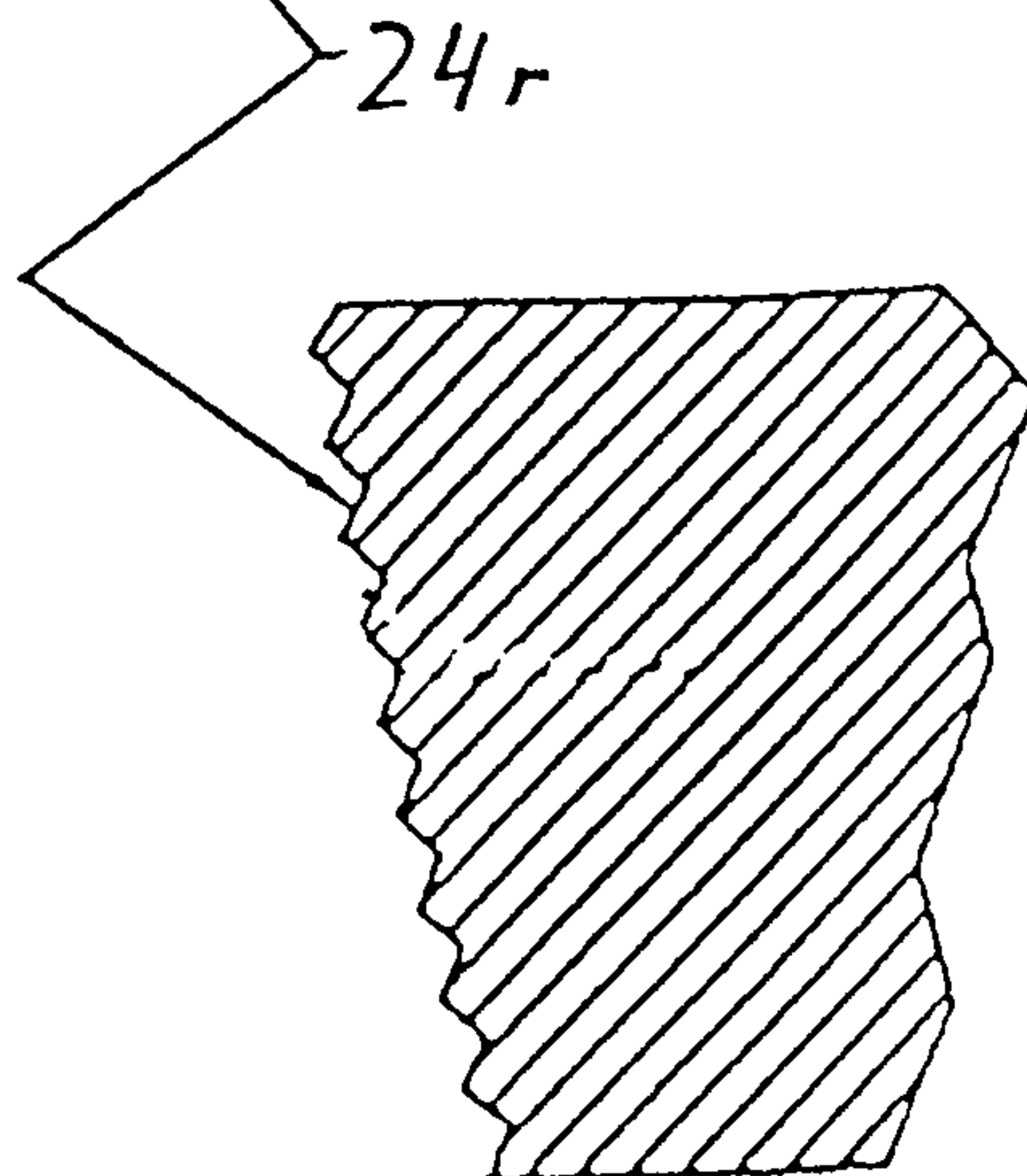


Fig. 6

