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INVERSION CASTING DEVICE WITH CRYSTALLIZER

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(56) Prior Art Documents
US 5063989
EP 131263

(57) Claim

1. An inversion casting device, including:

a crystallizer vessel having a base in which a slit-shaped passage is provided through which a substrate strip is guidable;

a collecting tank arranged to pass horizontally about the crystallizer vessel; and

nozzles arranged in a region of the passage and being in fluid communication with the collecting tank, the nozzles having orifices arranged so that melt flowing out of the orifices from the collecting tank strikes the substrate strip at a flat angle of inclination in a strip take-off direction.

2. An inversion casting device as claimed in claim 1, wherein the nozzles are arranged so that the angle of inclination from the substrate strip is < 30°.

3. An inversion casting device as claimed in either claims 1 or 2, wherein the nozzles are slit-shaped and have a thickness that is less than 1/3 of an exit thickness of the substrate strip, and a thickness/length ratio of 1/10 to 1/30.

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4. An inversion casting device as claimed in any one of the preceding claims, wherein a plurality of slit-shaped nozzles are arranged along a breadth of the strip, and further including supporting walls arranged to separate the nozzles.

5. An inversion casting device as claimed in claim 1, wherein the nozzles are tubular and have a diameter of 20 to 40mm.

7. An inversion casting device as claimed in any one of the preceding claims, wherein the collecting tank if configured as a sleeve, and further including a shield arranged in the vessel so as to separate the sleeve from an interior of the vessel, the nozzles being provided in the shield.

8. An inversion casting device as claimed in claim 7, wherein the shield has a head region provided with an overflow that communicates with the collecting tank.

10. An inversion casting device as claimed in any one of the preceding claims, wherein the vessel has outer walls, and further comprising electric coils provided in the outer walls of the vessel so as to increase a flow velocity of the melt.

12. An inversion casting device as claimed in any one of the preceding claims, wherein the crystallizer vessel has at least one horizontal separating cut above the collecting tank.

17. An inversion casting device as claimed in claim 8, wherein the collecting tank has an outlet, and further including emergency stopper means for bringing the collecting tank in fluid communication with an exit ladle.

18. An inversion casting device as claimed in any one of the preceding claims, and further including sealing means for closing the passage in the base of the vessel.

19. An inversion casting device as claimed in claim 18, wherein the sealing means is an electromagnetic brake.

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(81) Bestimmungsstaaten: AM, AU, BB, BG, BR, BY, CA, CN, CZ, EE, FI, GE, HU, IS, JP, KG, KP, KR, KZ, LK, LR, LT, LV, MD, MG, MN, MX, NO, NZ, PL, RO, RU, SG, SI, SK, TJ, TM, TT, UA, US, UZ, VN, europäisches Patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI Patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO Patent (KE, MW, SD, SZ, UG).

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(54) Title: INVERSION CASTING DEVICE WITH CRYSTALLIZER

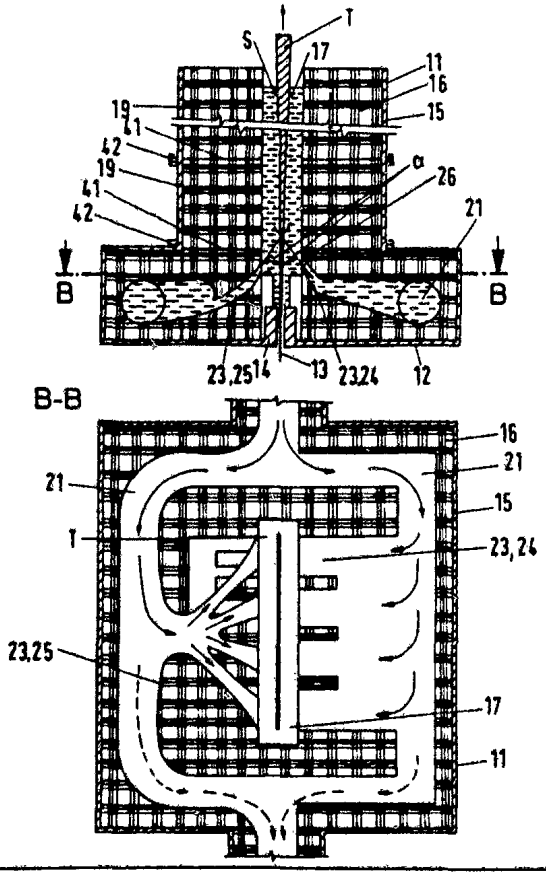
(54) Bezeichnung: INVERSIONSGIESSEINRICHTUNG MIT KRISTALLISATOR

(57) Abstract

The invention concerns an inversion casting device with crystallizer which at its base has a slit-shaped aperture with seal through which a carrier belt passes; the casting device communicates with a melt delivery unit. The invention is characterized by the fact that a cross unit (21) encloses the crystallizer vessel (11) horizontally, the cross unit (21) is connected to nozzles (23) in the vicinity of the aperture (13), and the nozzle openings (26) are configured in such a way that the outflowing melt (5) falls onto the carrier belt (T) at a shallow angle α in the direction of movement of the belt.

(57) Zusammenfassung

Die Erfindung betrifft eine Inversionsgießeinrichtung mit Kristallisator, der einen im Boden angeordneten und mit einer Abdichtung versehenen schlitzförmigen Durchtritt zur Durchleitung eines Trägerbandes aufweist und der mit einer Schmelzenzuführung in Verbindung steht. Die Erfindung ist dadurch gekennzeichnet, daß eine das Kristallisatorgefäß (11) horizontal umgreifende Vorlage (21) vorgesehen ist, daß die Vorlage (21) mit im Bereich des Durchtritts (13) angeordneten Düsen (23) in Verbindung steht und daß die Düsenmündungen (26) in der Weise angeordnet sind, daß die ausströmende Schmelze (5) in einem flachen Neigungswinkel α in Bandabzugsrichtung auf das Trägerband (T) auftritt.



INVERSION CASTING DEVICE WITH CRYSTALLIZER

BACKGROUND OF THE INVENTION

The invention is directed to an inversion casting device with a crystallizer which has a slit-shaped passage for guiding a substrate strip, this passage being arranged in the base and provided with a seal, and which communicates with a melt feed.

DISCUSSION OF THE PRIOR ART

In inversion casting, a purified metal profile, not cooled, with a low heat content is guided through molten metal in a melt vessel. Upon contact with the metal wire or metal strand, the molten metal crystallizes on the relatively cool metal profile. The crystallization thickness depends on the duration of contact and on the temperatures of the metal profile and metal melt.

In an inversion casting device known from US Patent No. 3466186, a wire is drawn through a vessel filled with molten metal. The vessel has a sealable passage in the bottom region. The melt is fed to the vessel in the vicinity of the surface of the bath. In a special embodiment the wire provided for crystallization is enclosed by a sleeve having passages in the base region of the melt vessel, through which liquid metal is supplied to the wire. Further, a process for producing thin metal strands is known from European reference EP 0 311 602 B1 in which the substrate strip is likewise drawn upward through the bottom of a melt vessel in the vertical direction through the liquid melt. In both of these references, the wire or strip is guided through the immobile bath of molten metal. Contact between the substrate element and the melt results in an irregular flow profile not subject to outside influence. Depending on this unfavourable flow profile, an

irregular temperature distribution can come about, particularly as regards inversion casting of strips.

SUMMARY OF THE INVENTION

According to a broad aspect of the present invention there is provided an inversion casting device, including:

a crystallizer vessel having a base in which a slit-shaped passage is provided through which a substrate strip is guidable;

a collecting tank arranged to pass horizontally about the crystallizer vessel; and

nozzles arranged in a region of the passage and being in fluid communication with the collecting tank, the nozzles having orifices arranged so that melt flowing out of the orifices from the collecting tank strikes the substrate strip at a flat angle of inclination in a strip take-off direction.

Preferably the nozzles are arranged so that the angle of inclination from the substrate strip is < 30°.

Preferably the nozzles are slit-shaped and have a thickness that is less than 1/3 of an exit thickness of the substrate strip, and a thickness/length ratio of 1/10 to 1/30.

Preferably a plurality of slit-shaped nozzles are arranged along a breadth of the strip, and the device further includes supporting walls arranged to separate the nozzles.

Preferably the nozzles are tubular and have a diameter of 20 to 40mm.

Preferably the collecting tank has a filler neck, the nozzles being in direct fluid communication with the

collecting tank.

Preferably the collecting tank if configured as a sleeve, and further including a shield arranged in the vessel so as to separate the sleeve from an interior of the vessel, the nozzles being provided in the shield.

Preferably the vessel has outer walls, and further comprising electric coils provided in the outer walls of the vessel so as to increase a flow velocity of the melt.

Preferably the crystallizer vessel has at least one horizontal separating cut above the collecting tank.

Preferably the device further includes detachable clamping means at an external side of the vessel for liquid-tight closure of the separating cut.

Preferably the horizontal separating cut separates the vessel into vessel parts, each of the vessel parts being a prefabricated casing portion provided with a refractory material.

Preferably the distance of the shield from the substrate strip is between 20 and 80mm.

Preferably the collecting tank has an outlet, and further includes emergency stopper means for bringing the collecting tank in fluid communication with an exit ladle.

In order that the invention may be more clearly ascertained, preferred embodiments will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 shows a schematic view of an inversion casting device pursuant to the present invention;

Figure 2 shows a longitudinal section through a crystallizer;

Figure 2B is a cross-section along line B-B in Figure 2; and

Figure 3 shows a longitudinal section through a crystallizer with shields.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 shows a vessel 11 through which is guided a substrate strip T entering at the bottom of the vessel. The substrate strip T is located on a strip roller 62 which is arranged below the vessel 11 and supported on a stand 61. The substrate strip T is transported by means of a take-off roller 63 provided above the vessel 11.

The bottom area of the vessel 11 is enclosed by a collecting tank 21 having a filler neck 27 on the melt supply side and an emergency stopper 54 on the melt discharge side. A supply ladle 51 can be positioned above the filler neck 27, the supply ladle 51 has an immersion pipe 52 which can dip into the opening of the filler neck 27. In the region of the vessel 11, the collecting tank 21 has slit-shaped nozzles 24 which are shown schematically in the drawing. The melt is designated by S. A discharge ladle 53 can be arranged beneath the melt discharge side of the tank 21.

Figure 2 shows a longitudinal section through the vessel 11 through which a substrate strip T is guided through the melt S. The vessel 11 has a casting 15 which is provided with a refractory lining 16. The vessel 11 has separating cuts 41. Clamping elements 42 which join the individual vessel parts 19 are provided at the outside of the vessel in the region of the separating cuts 41.

A passage 13 with seal 14 such as an electromagnetic brake is provided in the vessel bottom 12.

The lower part of the vessel 11 is constructed as a collecting tank 21 which has nozzles 23 whose orifice 26 communicates with the vessel interior 17. The nozzles 23 are constructed as slit-shaped nozzles 24 on the right-hand side of the longitudinal section and as tubular nozzles 25 on the left-hand side. The angle of inclination of the nozzles 23 is less than 30°.

Section BB is taken through the collecting tank 21 and is shown as a top view in Figure 2B. The melt flows from filler necks, not shown in more detail, into the

annular collecting tank 21 by means of which the molten metal can reach the substrate strip T located at the center of the vessel 11. In emergencies, the melt located in the vessel and in the filler neck can be discharged via an outlet which is only suggested in the drawing.

The collecting tank 21 provided in the refractory lining 16 which is enclosed by a metallic casing 15 is circular. On the right-hand side of Figure 2, nozzle 23 is designed as a slit-shaped nozzle 24. For the sake of stability, the nozzle 24 can be interrupted by supporting walls 28. On the left-hand side of Figure 2, nozzle 23 is formed by tubular nozzles 25. In the upper part on the left-hand side, the individual tubular nozzles 25 are connected to a collecting tank running parallel to the vessel interior 17. A central collecting tank is provided in the lower region. The arrows shown in Figure 2B indicate the flow direction of the liquid metal. The arrows in dash-dot lines apply to the case in which an emergency ladle is connected and the crystallizer is to be emptied. The crystallizer can be filled with melt from one or two sides.

Figure 3 shows a vessel 11 with a refractory lining 16 which is enclosed by a casing 15. Shields 31 are provided in the vessel interior 17 and are so arranged that a sleeve-shaped collecting tank 22 results. The shields 31 are so dimensioned that when the vessel is filled with melt S, the latter can flow off via an overflow 32.

On the left-hand side of Figure 3, the shield 31 has a conically narrowing cross section so that the melt flowing with the substrate strip T is not obstructed.

Further, elements 33 for regulating temperature are provided in the shields 31, e.g., coiled arrangements of cooling tubes through which coolant or heating medium can be guided.

In Figure 3, coils 34 by means of which the flow of the melt S can be influenced are provided in the

refractory lining 16 parallel to the shields 31.

Further, Figure 3 shows the angle of inclination of the nozzles 23 which have a diameter D. The thickness of the substrate strip T is designated by d. The distance of the substrate strip from the individual shields 31 is designated by B. The passage 13 whose seal 14 prevents the melt S from running out of the vessel 11 is provided in the bottom 12 of the vessel.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. An inversion casting device, including:

a crystallizer vessel having a base in which a slit-shaped passage is provided through which a substrate strip is guidable;

a collecting tank arranged to pass horizontally about the crystallizer vessel; and

nozzles arranged in a region of the passage and being in fluid communication with the collecting tank, the nozzles having orifices arranged so that melt flowing out of the orifices from the collecting tank strikes the substrate strip at a flat angle of inclination in a strip take-off direction.

2. An inversion casting device as claimed in claim 1, wherein the nozzles are arranged so that the angle of inclination from the substrate strip is < 30°.

3. An inversion casting device as claimed in either claims 1 or 2, wherein the nozzles are slit-shaped and have a thickness that is less than 1/3 of an exit thickness of the substrate strip, and a thickness/length ratio of 1/10 to 1/30.

4. An inversion casting device as claimed in any one of the preceding claims, wherein a plurality of slit-shaped nozzles are arranged along a breadth of the strip, and further including supporting walls arranged to separate the nozzles.

5. An inversion casting device as claimed in claim 1, wherein the nozzles are tubular and have a diameter of 20 to 40mm.

6. An inversion casting device as claimed in any one of the preceding claims, wherein the collecting tank has a filler neck, the nozzles being in direct fluid communication with the collecting tank.

7. An inversion casting device as claimed in any one of the preceding claims, wherein the collecting tank is configured as a sleeve, and further including a shield

arranged in the vessel so as to separate the sleeve from an interior of the vessel, the nozzles being provided in the shield.

8. An inversion casting device as claimed in claim 7, wherein the shield has a head region provided with an overflow that communicates with the collecting tank.

9. An inversion casting device as claimed in either claims 7 to 8, wherein the shield includes means for adjusting temperature.

10. An inversion casting device as claimed in any one of the preceding claims, wherein the vessel has outer walls, and further comprising electric coils provided in the outer walls of the vessel so as to increase a flow velocity of the melt.

11. An inversion casting device as claimed in any one of claims 7 to 9, wherein the shield is configured to open with an inclination to the vessel interior in the take-off direction of the substrate strip.

12. An inversion casting device as claimed in any one of the preceding claims, wherein the crystallizer vessel has at least one horizontal separating cut above the collecting tank.

13. An inversion casting device as claimed in claim 12, and further including detachable clamping means at an external side of the vessel for liquid-tight closure of the separating cut.

14. An inversion casting device as claimed in either claims 12 or 13, wherein the horizontal separating cut separates the vessel into vessel parts, each of the vessel parts being a prefabricated casing portion provided with a refractory material.

15. An inversion casting device as claimed in any one of claims 7 to 9, wherein he shield is arranged in the vessel so as to be parallel to the substrate strip and at a distance from the substrate strip so that a flow of melt is not impeded.

16. An inversion casting device as claimed in claim 15, wherein the distance of the shield from the substrate strip is between 20 and 80mm.

17. An inversion casting device as claimed in claim 8, wherein the collecting tank has an outlet, and further including emergency stopper means for bringing the collecting tank in fluid communication with an exit ladle.

18. An inversion casting device as claimed in any one of the preceding claims, and further including sealing means for closing the passage in the base of the vessel.

19. An inversion casting device as claimed in claim 18, wherein the sealing means is an electromagnetic brake.

20. An inversion casting device substantially as hereinbefore described with reference to figures 1, 2 and 2B or to figure 3 of the accompanying drawings.

Dated this 12th day of December 1997

MANNESMANN AG

By their Patent Attorneys

GRIFFITH HACK

Fellows Institute of Patent

Attorneys of Australia

Abstract

An inversion casting device with a crystallizer which has a slit-shaped passage for guiding a substrate strip, this passage being arranged in the base and provided with a seal, and which communicates with a melt feed. A collecting tank is provided which passes horizontally about the crystallizer vessel so that the collecting tank communicates with nozzles (23) arranged in the region of the passage the nozzle orifices are so arranged that the melt flowing out strikes the substrate strip at a flat angle of inclination α in the strip take-off direction.

Fig.1

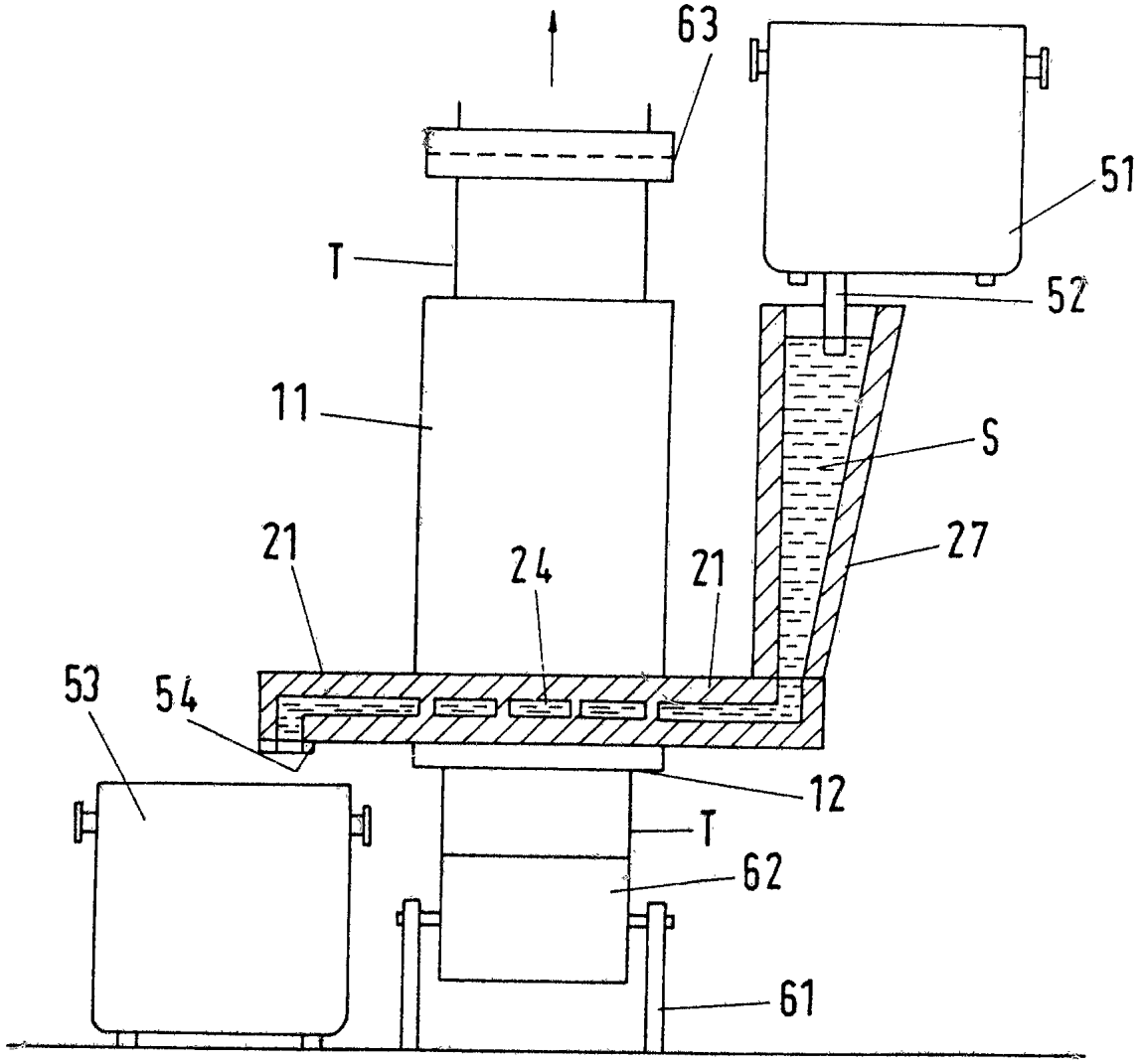


Fig.2

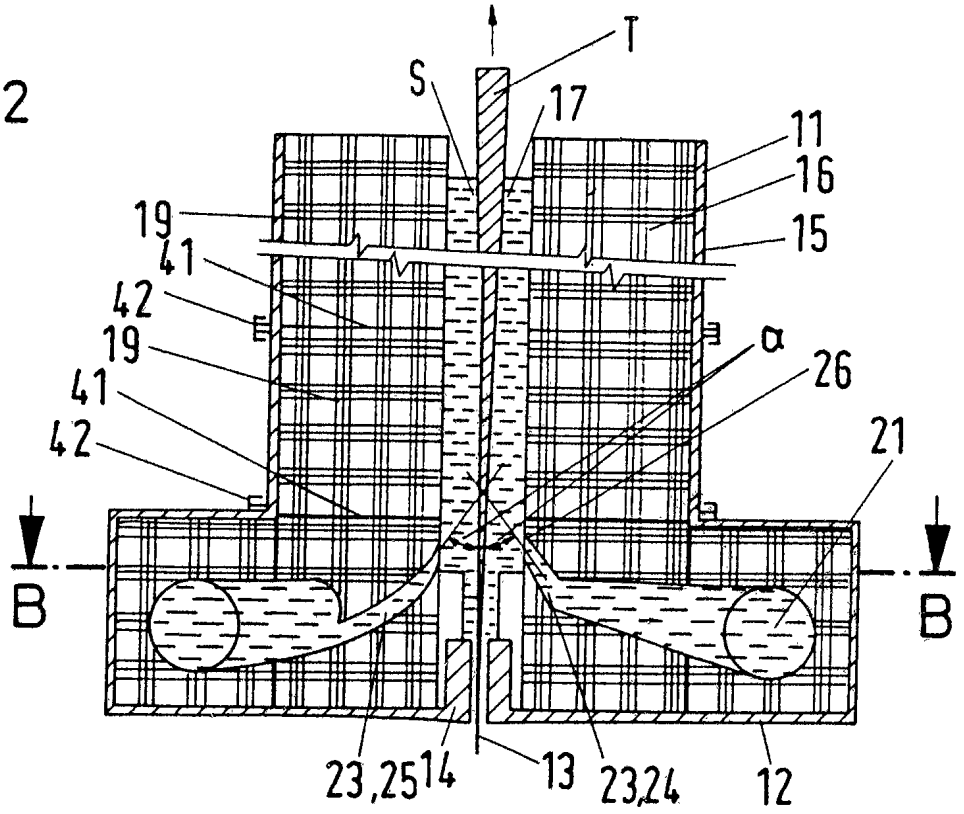

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Fig. 2 B

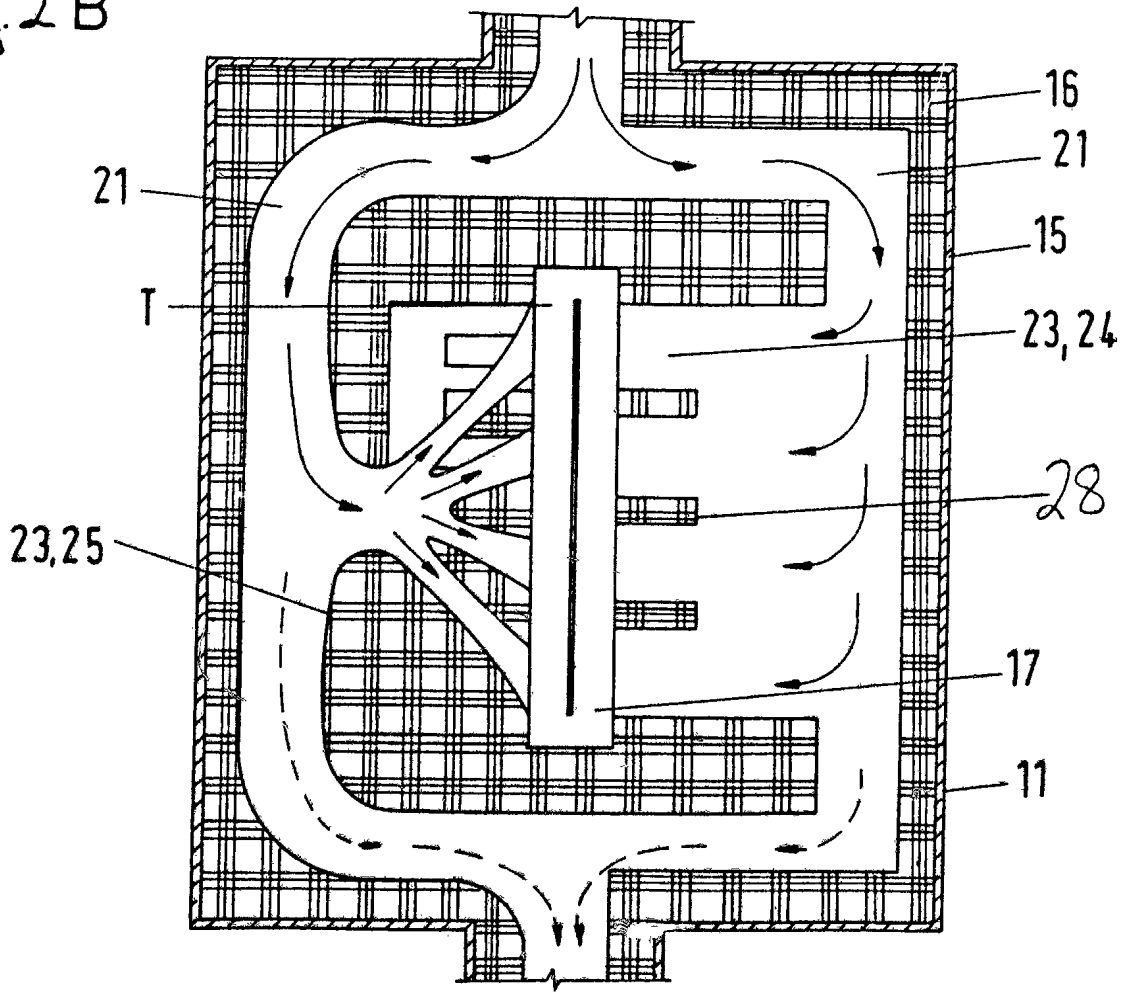
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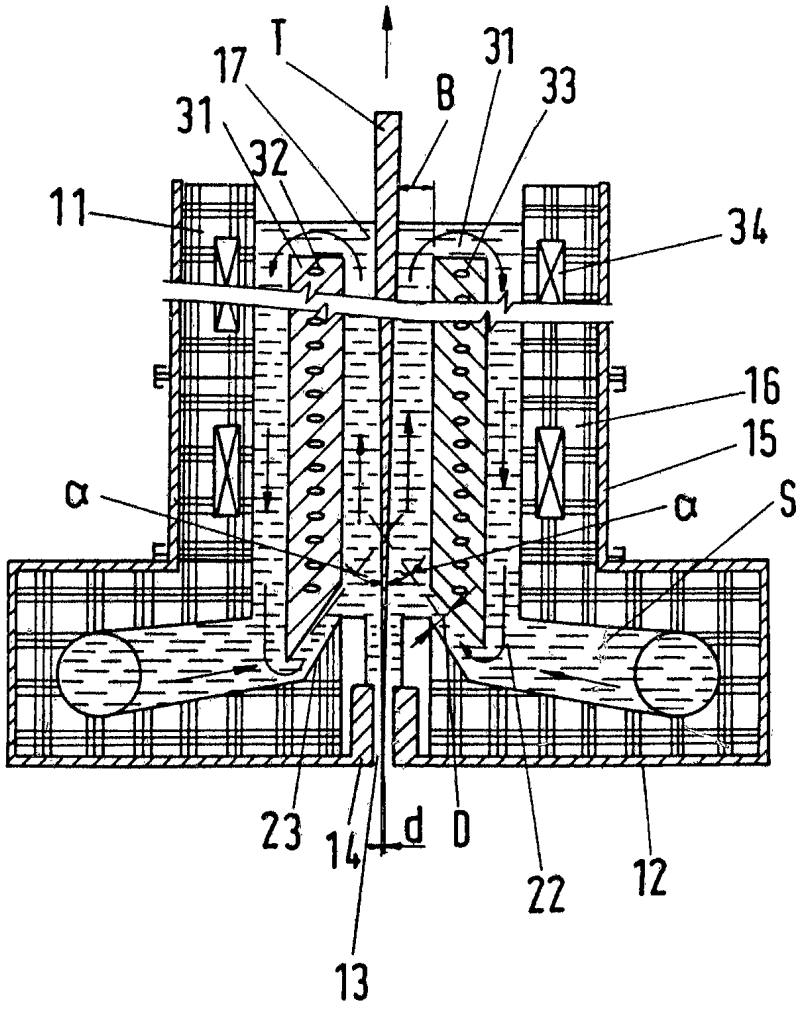
Fig.3



INTERNATIONAL SEARCH REPORT

Interna al Application No
PCT/DE 95/00786

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 C23C2/00 B22D11/00

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 C23C B22D

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO,A,93 18198 (MANNESMANN) 16 September 1993 see page 14, paragraph 3 - page 15; figure 4 see page 13, line 5 - line 6	1,18
A	US,A,2 702 525 (MARSHALL G. WHITFIELD) 22 February 1955 see column 1, line 79 - column 2, line 10; figure 1 see column 3, line 57 - line 82	1
A	FR,A,2 485 569 (NIPPON) 31 December 1981 see claims 1-9; figures 3,8,12,14	1,2

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
23 November 1995	07.12.1995

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+ 31-70) 340-3016	Elsen, D

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INTERNATIONAL SEARCH REPORT

Intern al Application No
PCT/DE 95/00786

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 3 no. 142 (C-065) ,24 November 1979 & JP,A,54 119342 (HITACHI CABLE) 17 September 1979, see abstract	
A	PATENT ABSTRACTS OF JAPAN vol. 11 no. 24 (C-399) ,23 January 1987 & JP,A,61 199064 (HITACHI CABLE) 3 September 1986, see abstract	

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

information on patent family members

Intern al Applicaton No
PCT/DE 95/00786

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WO-A-9318198	16-09-93	DE-A-	4208578	16-09-93
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		FI-A-	944194	12-09-94
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		US-A-	4757781	19-07-88

INTERNATIONALER RECHERCHENBERICHT

Interna ...les Aktenzeichen
PCT/DE 95/00786

A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
IPK 6 C23C2/00 B22D11/00

Nach der Internationalen Patentklassifikation (IPK) oder nach der nationalen Klassifikation und der IPK

B. RECHERCHIERTE GEBIETE

Recherchierter Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole)
IPK 6 C23C B22D

Recherchierte aber nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Gebiete fallen

Während der internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe)

C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
A	WO,A,93 18198 (MANNESMANN) 16.September 1993 siehe Seite 14, Absatz 3 - Seite 15; Abbildung 4 siehe Seite 13, Zeile 5 - Zeile 6	1,18
A	US,A,2 702 525 (MARSHALL G. WHITFIELD) 22.Februar 1955 siehe Spalte 1, Zeile 79 - Spalte 2, Zeile 10; Abbildung 1 siehe Spalte 3, Zeile 57 - Zeile 82	1
A	FR,A,2 485 569 (NIPPON) 31.Dezember 1981 siehe Ansprüche 1-9; Abbildungen 3,8,12,14	1,2

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[X] Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen

[X] Siehe Anhang Patentfamilie

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Name und Postanschrift der Internationale Recherchenbehörde	Bevollmächtigter Bediensteter
Europäisches Patentamt, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016	Elsen, D

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C.(Fortsetzung) ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
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