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(54) **CASTING FEEDER**

(57) It is provided a sleeve for sprue (1) comprising: retaining walls (2), an internal volume (3) defined by the retaining walls (2), the retaining walls (2) defining a connection portion (20) with a main mould (100) and a main portion (21), the main portion (21) defining a portion of internal volume (3) having a substantially tubular shape defining a central axis (21a), the retaining walls (2) in the main portion (21): define an outer wall (22) defining a first mean diameter d, comprise protuberances (23) protruding from said outer wall (22) towards the interior of the internal volume (3), the protuberances (2b) protrude by a value between 0.1 d and 0.5 d and extend predominantly in the axial direction (21a).

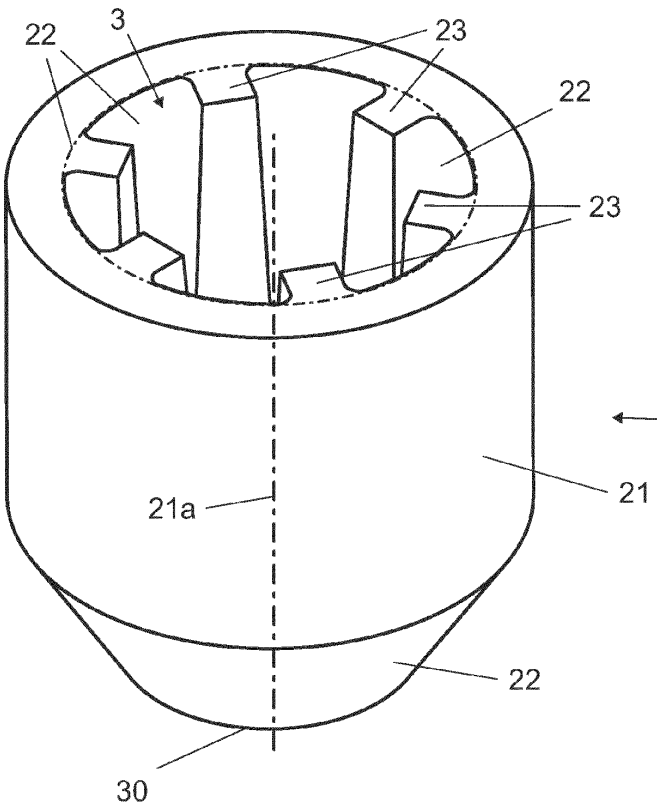


*Fig. 1*

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## Description

**[0001]** The present invention relates to a sleeve for sprue, in particular for foundry use of the type specified in the preamble to the first claim.

**[0002]** The sprues used, in particular, in metal foundry processes and, more particularly, in ferrous material foundry processes, are currently known.

**[0003]** As is well known, liquid metal has a larger volume than solid metal, as do the vast majority of materials.

**[0004]** As a consequence, when metal solidifies from a liquid state, it includes shrinkage volumes or cavities that do not allow the metal to maintain the same shape as it had when it was in a liquid state. The latter coincided, of course, with the shape of the container in which the liquid metal was placed.

**[0005]** Consequently, in order to allow the solid metal to be shaped exactly like a cavity of the desired form, and thus to make metal parts by casting, the moulds include a sacrificial portion within which the metal forms the said shrinkage cavities.

**[0006]** This sacrificial portion, present in the moulds, is called a sprue and is surrounded by mould walls called sleeve for sprue.

**[0007]** The sprue must therefore comprise the portion of liquid metal that solidifies last. It generally has a cylindrical shape with an inlet, to the non-sacrificial portion of the mould, of a truncated cone shape.

**[0008]** Following solidification of the metal, the sprue portion is separated from the non-sacrificial portion. Typically, this separation is achieved through an initial brittle fracture and subsequent machining.

**[0009]** The known technique described includes some major drawbacks.

**[0010]** In particular, the molten metal contained in the sprue has been melted, expending thermal energy at high temperatures, and will then be discarded.

**[0011]** This melting is therefore a waste of energy that one would like to avoid in any way. However, the sprue must have minimum dimensions that allow the shrinkage cavity not to enter the non-sacrificial portion of the mould, and also considering a safety margin for uncontrollable process variables.

**[0012]** In this situation, the technical task underlying the present invention is to devise a sleeve for sprue capable of substantially obviating at least part of the aforementioned drawbacks.

**[0013]** Within the scope of said technical task, it is an important scope of the invention to obtain a sleeve for sprue having a smaller volume than commonly used volumes.

**[0014]** It is also an important scope of the invention to achieve a sleeve for sprue which allows the entire shrinkage cavity to be contained within the non-sacrificial portion of the mould.

**[0015]** The specified technical task and purposes are achieved by a sleeve for sprue as claimed in the appended claim 1.

**[0016]** Preferred technical solutions are highlighted in the dependent claims.

**[0017]** The features and advantages of the invention are hereinafter clarified by the detailed description of preferred embodiments of the invention, with reference to the appended drawings, in which:

**Fig. 1** shows an axonometric view of a sleeve for sprue according to the invention;

**Fig. 2** shows a side view of the mould walls of a sleeve for sprue according to the invention and a portion of the mould immediately below;

**Fig. 3** shows a preferred scaled example of the sectional view III-III, shown in Fig. 2, of the die walls of the sleeve for sprue according to the invention; and

**Fig. 4** shows a preferred scaled example of the sectional view IV-IV, indicated in Fig. 2, of the die walls of the sprue according to the invention.

**[0018]** Herein, measurements, values, shapes and geometrical references (such as perpendicularity and parallelism), when associated with words such as "approximately" or other similar terms such as "nearly" or "substantially", are to be understood as unless there are measurement errors or inaccuracies due to production and/or manufacturing errors and, more importantly, unless there is a slight deviation from the value, measurement, shape or geometrical reference with which it is associated. For example, such terms, when associated with a value, preferably indicate a deviation of no more than 10% of the value.

**[0019]** Furthermore, when used, terms such as "first", "second", "top", "bottom", "principal" and "secondary" do not necessarily identify an order, priority of relationship or relative position, but may simply be used to more clearly distinguish between different components.

**[0020]** Unless otherwise specified, as reflected in the following discussions, terms such as "processing", "computing", "determination", "calculation", or the like, are considered to refer to the action and/or processes of a computer or similar electronic computing device that manipulates and/or transforms data represented as physical quantities, such as electronic quantities of registers of a computer system and/or memories in, other data similarly represented as physical quantities within computer systems, registers or other information storage, transmission or display devices.

**[0021]** Measurements and data reported herein shall, unless otherwise indicated, be considered to have been made in ICAO International Standard Atmosphere (ISO 2533:1975).

**[0022]** With reference to the Figures, the sleeve for sprue according to the invention is globally referred to as number **1.**

**[0023]** The sleeve for sprue 1 is subservient to a main mould **100,** of a non-sacrificial type, defining an operating

volume **100a** having the shape of the part to be made. The main mould 100 and the sleeve for sprue 1 together form a complete mould **101.**

**[0024]** The complete mould 101 is preferably for foundry use, more particularly for ferrous metal materials, such as steel and cast iron.

**[0025]** It is accordingly preferably made of compacted powders in insulating, isothermal or other materials known to them.

**[0026]** Said compacted powders preferably have the following preferred compositions. In a first example, they are exothermic powders and preferably comprise the following materials: Al2O3: 45%-50%; Al met: 23%-28%; SiO2: 15%-20%; Fe2O3: 3%-5%; Other < 5%.

**[0027]** In a second example, they are insulating powders and preferably consist of the following materials: Al2O3: 60%-65%; SiO2: 30%-35%; Fe2O3: 1%-3%; CaO <3%.

**[0028]** The sleeve for sprue 1 is configured to hold a sprue 1a, i.e. a metal sacrificial element.

**[0029]** The sleeve for sprue 1 comprising retaining walls **2,** preferably made of said refractory material and preferably integral with the walls of the main mould 100, and an inner volume 3 defined by the retaining walls 2.

**[0030]** The internal volume **3** is in fluid passage communication with the operating volume 100a.

**[0031]** The retaining walls 2 define a connection portion **20** with a main mould 100 and a main portion **21** of the mould, preferably constituting the majority of the internal volume 3.

**[0032]** The retaining walls 2 are preferably exclusively side walls and lack an upper wall.

**[0033]** The sprue is therefore preferably a so-called open-air sprue.

**[0034]** The connection portion **20** is preferably of a per se known type. It defines a boundary surface **30** that virtually divides the internal volume 3 from the operational volume 100a. It is, moreover, preferably truncated cone-shaped with a minor base formed by said boundary surface **20a,** it could also be cylindrical, cylindrical with oval cross-section or other.

**[0035]** The main portion 21, in turn, borders the connection portion 20 on one side, defining an internal surface **31,** and the external environment on the other side, defining an external surface **32.**

**[0036]** The inner volume 3, at the main portion **21** preferably defines a substantially tubular shape defining a central axis **21a,** and with the inner surface 31 and the outer surface 32 preferably crooked and more preferably perpendicular to the central axis 21a.

**[0037]** Further preferably, the retaining walls 2 in the main portion 21 define an outer wall 22 and comprise protuberances **23** protruding from the outer wall 22 towards the interior of the inner volume 3.

**[0038]** The outer wall 22 preferably defines a first mean diameter d. The virtual extension of the outer wall 22, which in reality is interrupted by the protuberances 23, preferably defines a circular surface, more preferably a cylindrical surface, possibly with a diameter varying from the inner surface 31 to the outer surface 32, but preferably being constant.

**[0039]** The outer wall 22 also defines a surface s, virtual, which would coincide with the real surface if the protuberances 23 were not present.

**[0040]** Preferably, the protuberances 23 extend predominantly in the axial direction 21a and, more preferably, are parallel to said axial direction 21a.

**[0041]** Furthermore, the protuberances 23, preferably, extend along most of the outer wall 22, and more preferably along the entire length of said outer wall 22.

**[0042]** Furthermore, preferably, wherein said protuberances 2b have a section, in the plane perpendicular to the central axis 21a of rectangular shape, more preferably substantially square. Said section obviously has connections with the outer wall 22. The protuberances also define inner sides **23a** whose ideal extension would make, in the section perpendicular to the central axis 21a a polygon, preferably regular, preferably with a number of sides between 4 and 16 depending on the size of the sprue, more preferably between 4 and 8.

**[0043]** Furthermore, preferably, the protuberances 23 decrease in circumferential thickness by moving away from said connection portion 20, as illustrated in the sections of Figs. 3 and 4. Preferably, this reduction is of linear dimensions of between 10% and 20% and provides for substantially unchanged proportions.

**[0044]** Dimensionally, preferably, the protuberances 23 protrude by an average value of between 0.1 d and 0.5 d, with d comprising the diameter of the outer wall 22 as cited. More preferably this value is between 0.1 d and 0.4 d, more preferably still between 0.2 d and 0.4 d, more preferably still between 0.25 and 0.35.

**[0045]** Further, the protuberances 23 occupy a surface area of the outer wall 22 between 0.3 s and 0.7 s, with s comprising the value of the ideal surface area of the outer wall 22 as cited. More preferably, this value is between 0.4 s and 0.6 s.

**[0046]** The operation of the sleeve for sprue 1, described above in structural terms, does not vary from the operation of known sprue types.

**[0047]** The sleeve for sprue 1 is in fact placed on the main mould 100 at the area that solidifies last.

**[0048]** When the liquid metal is inserted into the operating volume 100a of the main mould 100, the entire inner volume 3 of the sleeve for sprue 1 is also filled.

**[0049]** The liquid metal solidifies inside the main mould 100, forming the desired shaped part and remains liquid in the sleeve for sprue 1.

**[0050]** Thereafter, the liquid metal solidifies everywhere, including in the sleeve for sprue 1 inside which it forms a shrinkage cavity.

**[0051]** The part, including the sprue counter-mould, is extracted from the operating volume 100a. The sprue counter-mould is then removed, first roughly, for example by impact causing a brittle fracture at the boundary surface 30, and then by tooling.

**[0052]** The sleeve for sprue 1 according to the invention achieves important advantages.

**[0053]** In fact, tests of the applicant, have surprisingly shown that the volume of liquid metal inside the sleeve for sprue 1 remains liquid, and thus at temperature, for longer than the period of time during which the same volume of metal placed in a conventional, cylindrical, smooth-walled sprue would remain liquid.

**[0054]** This advantage is also contrary to the expectations of the skilled person in the trade, who usually believes that in order to keep the metal liquid for longer, it is necessary to maximise the surface/volume ratio.

**[0055]** The invention is susceptible to variations within the inventive concept as defined by the claims.

## Claims

**1.** Sleeve for sprue (1) comprising

- retaining walls (2)
- an internal volume (3) defined by said retaining walls (2),
- said retaining walls (2) defining a connection portion (20) with a main mould (100) and a main portion (21),
- said main portion (21) defining a portion of internal volume (3) having a substantially tubular shape defining a central axis (21a),
- and **characterised by** said retaining walls (2) in said main portion (21):

  - define an outer wall (22) defining a first mean diameter d,
  - comprise protuberances (23) protruding from said outer wall (22) towards the interior of said internal volume (3),
  - said protuberances (2b) protrude by a value between 0.1 d and 0.5 d and extend predominantly in the axial direction (21a).

**2.** Sleeve for sprue (1) according to claim 1, wherein said outer wall (22) is cylindrical.

**3.** Sleeve for sprue (1) according to any one of the preceding claims, wherein said protuberances (23) protrude by a value of between 0.2 d and 0.4 d.

**4.** Sleeve for sprue (1) according to any one of the preceding claims, wherein said outer wall (22) defines an area s and said protuberances (23) occupy an area of said outer wall (22) between 0.3 s and 0.7 s.

**5.** Sleeve for sprue (1) according to any one of the preceding claims, wherein said protuberances (23) extend along the entire length of said outer wall (22).

**6.** Sleeve for sprue (1) according to any one of the preceding claims, wherein said protuberances (23) decrease in circumferential thickness as they recede from said connection portion (20).

**7.** Sleeve for sprue (1) according to any one of the preceding claims, wherein said protuberances (23) have a section, in the plane perpendicular to the central axis (21a) of rectangular shape.

**8.** Sleeve for sprue (1) according to any one of the preceding claims, wherein said protuberances (23) have a section, in the plane perpendicular to the central axis (21a), of rectangular shape.

**9.** Sleeve for sprue (1) according to any one of the preceding claims, wherein said connection portion (20) is truncated cone-shaped and narrows away from said main portion (21).

**10.** Sleeve for sprue (1) according to any one of the preceding claims, configured for metal foundry.

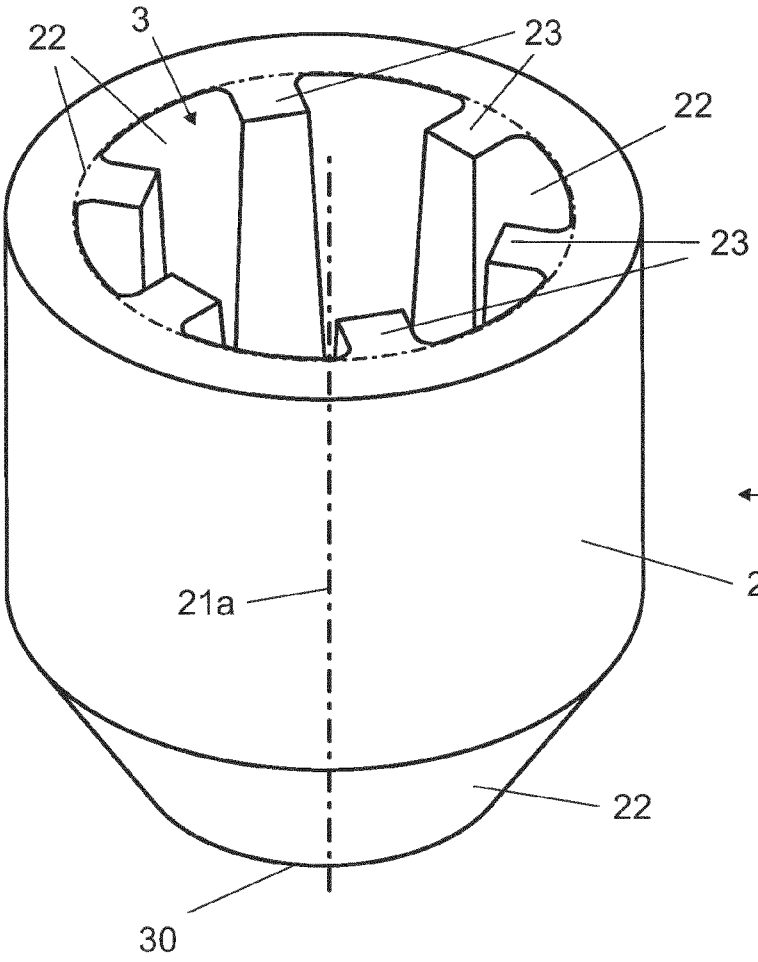
22
3
23
22
23
1
21
21a
22
30

*Fig. 1*

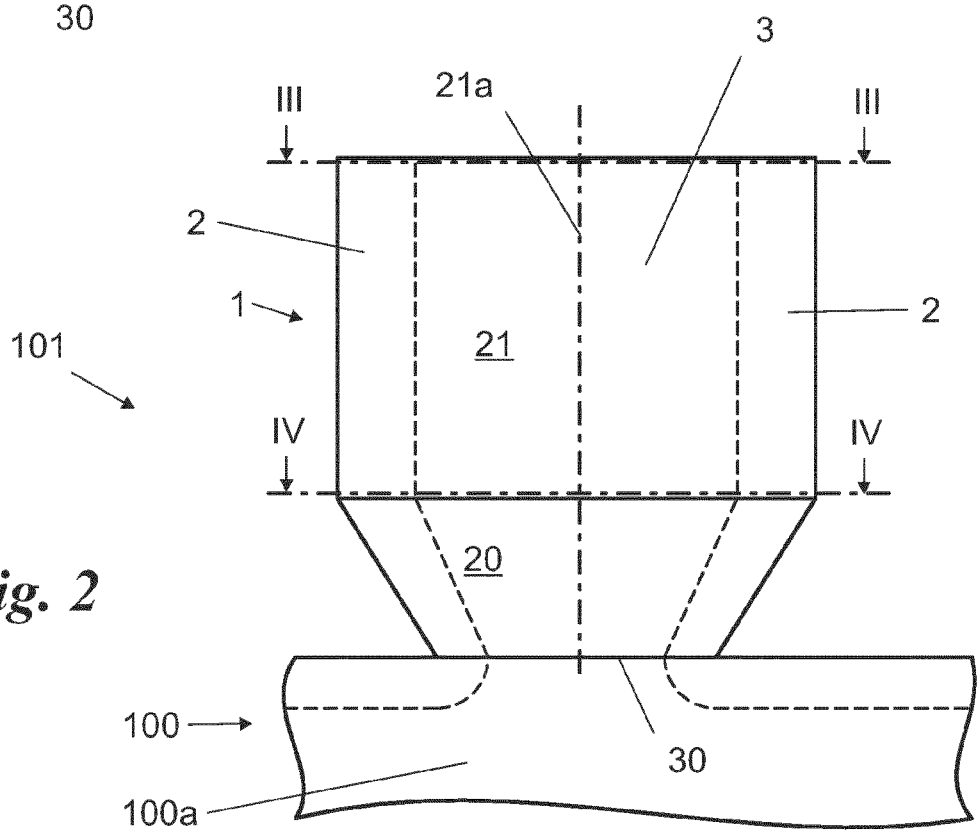
3
III
21a
III
2
1
2
101
21
IV
IV
20
100
30
100a

*Fig. 2*

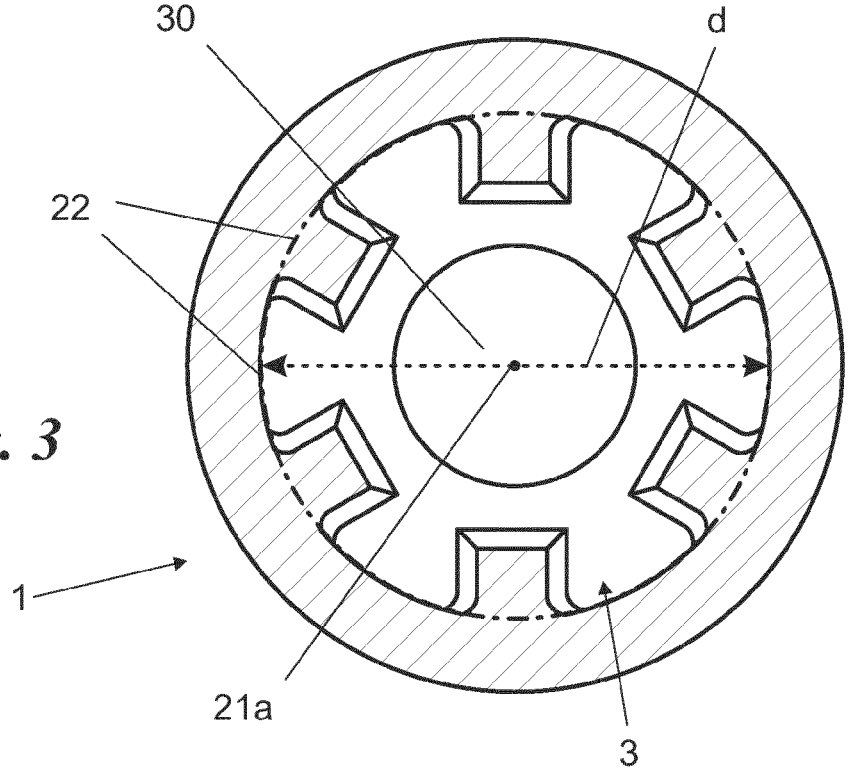


*Fig. 3*

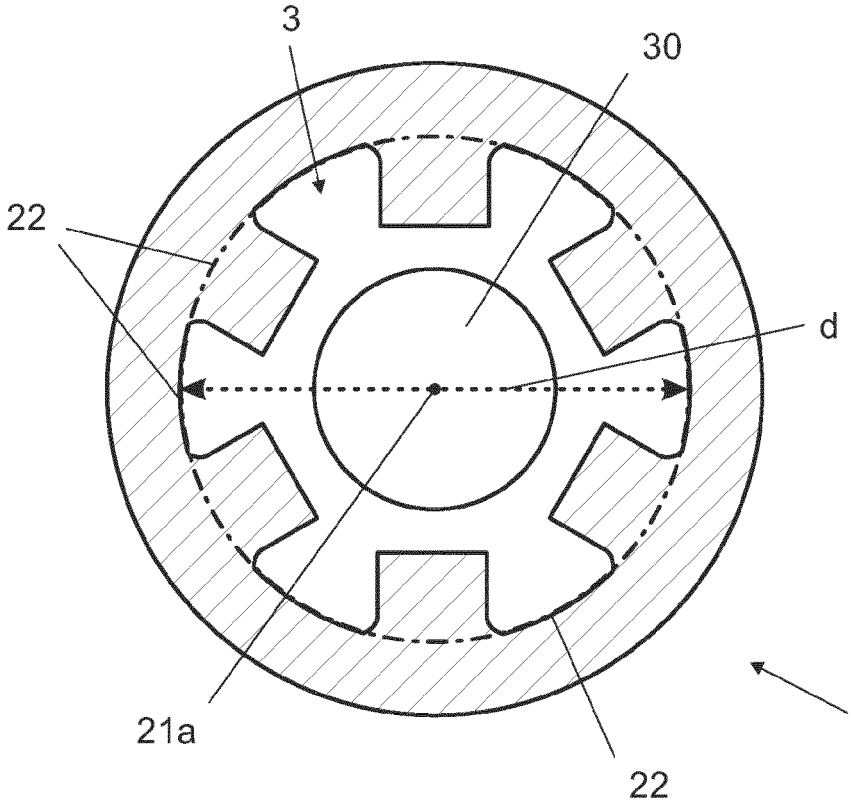


*Fig. 4*

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# EUROPEAN SEARCH REPORT

Application Number
EP 23 18 9085

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| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| X | WO 2017/064592 A1 (FAPROSID S R L [IT])<br>20 April 2017 (2017-04-20)<br>* figures 23-33 * | 1-10 | INV.<br>B22C9/08 |
| X | CN 208 131 922 U (FOSECO INT)<br>23 November 2018 (2018-11-23)<br>* figures 1-8 * | 1-10 | |
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The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| The Hague | 14 December 2023 | Desvignes, Rémi |

CATEGORY OF CITED DOCUMENTS

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# ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 18 9085

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