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(54) A gasket arrangement between two refractory sleeves on the spout of a metallurgical vessel

(57) The invention relates to a gasket arrangement (3) for a submerged nozzle (1) and a collector nozzle (2) sitting in the latter comprising a gasket element forming the sealing region in the form of a ridged gasket (4) made of compressible fibre material, the submerged nozzle being provided with means for conveying inert gas within an annular chamber (6) located in the sealing region for sealing with inert gas. In order to release the inert gas seal the submerged nozzle (1) has an annular groove (10) preferably disposed in front of the annular space and into which a sealing lip (9) of the ridged gasket (4) can be pushed, gas-tight, around the whole circumference.

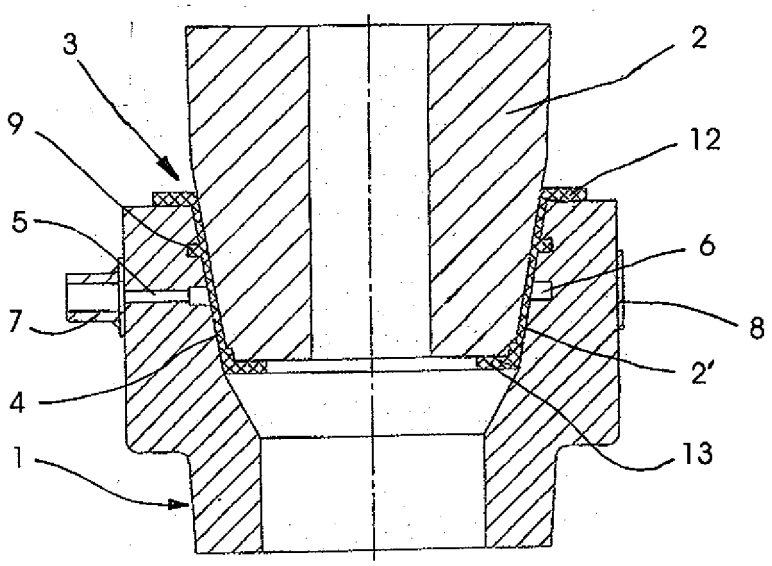

Fig. 1

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Description

[0001] The invention relates to a gasket arrangement between two refractory pouring elements on the spout of a metallurgical vessel, preferably between a collector nozzle and a submerged nozzle, comprising a gasket element made of compressible material.

[0002] These types of gasket arrangement are used in particular when casting steel using the continuous casting method. Here the collector nozzle forms the outlet of a slide closure or the like on a metallurgical vessel. The submerged nozzle connected to the said collector nozzle conveys the molten steel into a metallurgical vessel or mould suitable for this purpose.

[0003] This gasket arrangement formed between the submerged nozzle and the collector nozzle prevents ambient air from being sucked into the molten metal between the latter when casting. In order to guarantee the tightness of the seat, inert gas, the gas pressure of which counteracts the negative pressure produced here during casting, is delivered to the annular space located concentrically to said seat.

[0004] This type of gasket arrangement is disclosed in publication DE-A-40 24 520. Compressible sealing rings are arranged here above and below the annular space which, in co-operation with the gas pressure of the inert gas in the annular space, should prevent the outflowing molten steel from coming into contact with the ambient air when being cast and from oxidising as a result. This gasket arrangement is additionally equipped with a device intended to indicate whether the sealing rings have sprung a leak and so that there is a risk of ambient air being sucked into the casting channel. This type of display device requires a large amount of apparatus and can not independently re-establish the tightness of the system.

[0005] Additionally, the disadvantage of those sealing rings exists in the fact, that they are not sufficient fixed in the submerged nozzle. With the connection of the submerged nozzle onto the collector nozzle the sealing ring can move a little bit and in the consequence a correct sealing is possibly not anymore fulfilled.

[0006] The object underlying this invention is to avoid this disadvantage and to provide a gasket arrangement of the type specified at the start which, with simple means guarantees an improved sealing between the nozzles with the gasket element.

[0007] This object is achieved according to the invention in that holding means are assigned to the submerged nozzle or to the collector nozzle and to the gasket element by means of which the gasket element is positioned in the inlet opening of the submerged nozzle.

[0008] Very advantageously, at least one groove is assigned to the submerged nozzle in the sealing region and at least one outer lip, which can be pressed into this groove, is assigned to the gasket element as holding means.

[0009] According to the invention the groove provided as an annular groove for receiving the lip is preferably located centrally between the annular space which can be exposed to inert gas and the upstream face surface of the submerged nozzle.

[0010] Furthermore, the invention makes provision such that the annular space which can be exposed to inert gas is formed by an annular groove located in the submerged nozzle and which can be connected to an inert gas supply line via a gas channel of the submerged nozzle.

[0011] In addition, the invention makes provision such that the gasket element is formed by a ridged gasket comprising an upper and a lower sealing flange, the lip preferably being positioned centrally between the upper sealing flange and the annular space which can be exposed to inert gas. This type of configuration facilitates fitting and production of the gasket element as a one-part component.

[0012] In order to facilitate the fitting of the ridged gasket the invention makes provision such that the lip is elastic. It is also advantageous if it has a preferably rectangular cross-section adapted to the annular groove receiving it, as seen from the external dimensions.

[0013] In another version the invention also makes provision such that the ridged gasket has an annular groove with a recess arranged around the circumference and which can be exposed to inert gas in the region of the seat. Therefore, the corresponding annular groove in the submerged nozzle may be dispensable. In this version too the ridged gasket is made in one part.

[0014] In the following the invention is described in more detail by means of an exemplary embodiment with reference to the drawings. These are showed as follows:

Fig. 1 a first version of a gasket arrangement according to the invention shown in section,

Fig. 2 a longitudinal section through a submerged nozzle with the gasket arrangement according to Fig. 1,

Fig. 3 a second version of a gasket arrangement according to the invention, partially shown diagrammatically, and

Fig. 4 a third version of a gasket arrangement shown partially in a cross section.

[0015] A refractory submerged nozzle 1 as the one pouring element according to Fig. 1 and Fig. 2 serves as an immersion tube for a continuous casting plant with a means for regulating the flow, e.g. slide closure or stopper rod (not illustrated) the collector nozzle 2 of which can be connected as a second pouring element, gas-tight, to the submerged nozzle 1.

[0016] Needless to say this gasket arrangement can be used for various refractory sleeve connections, for example between a collector nozzle and a so-called shroud tube. Instead of a slide closure, a refractory metering nozzle or the like fitted to the spout of a tundish can also be provided.

[0017] In order to seal the connection a gasket arrangement 3 is provided with a ridged gasket 4. It forms the seat of the collector nozzle 2 in the submerged nozzle 1. In order to fulfil its sealing function, it is produced from compressible fibre material with refractory properties.

[0018] In the submerged nozzle 1 there is a gas channel 5 for conveying inert gas to an annular space 6 of the submerged nozzle located concentrically in the region of the seat. The gas channel 5 leads to a connecting piece 7 which can be connected to an inert gas supply line (not shown). The connecting piece 7 is clamped securely to the submerged nozzle 1 with a steel band 8. If the annular space 6 is exposed to inert gas, a sealing effect is then produced in the region of the seat by the gas pressure which is established and which counteracts the suction effect applied here when casting. This sealing effect supports the sealing effect of the ridged gasket 4 sealing the seat.

[0019] According to the invention the ridged gasket 4 has as holding means a lip 9 which can be pressed into an additional groove 10 of the submerged nozzle 1. This groove 10 in the form of an annular groove is located approximately centrally between the annular space 6 and the face surface 11 of the submerged nozzle. It is thus guaranteed that it does not cause any appreciable weakening of the submerged nozzle.

[0020] This groove 10 could also be formed by just part of the circumference of the inlet opening 1' of the submerged nozzle 1 and the lip 9 would then also accordingly not be provided round the whole circumference.

[0021] The submerged nozzle 1 at its inlet opening 1' and the collector nozzle 2 projecting into the latter on its outer surface 2' is formed such as to taper conically. The ridged gasket 4 located between the latter is also in the form of a truncated cone. The taper here is for example approximately 5° to 45°. This is associated with a further advantage within the framework of the invention in so far as this ridged gasket 4 can be placed manually, without any particular effort, into the inlet opening 1' of the submerged nozzle 1 and its lip 9 lying on the outside can be pressed into the groove 10.

[0022] Moreover, the ridged gasket 4 has an upper sealing flange 12 and a lower sealing flange 13 which co-operate with the upper face surface of the submerged nozzle 1 and with the lower collector nozzle 2 and strike against these face surfaces. For the purpose of comprehensive sealing the axial distance between the sealing flanges 12 and 13 is matched to the axial length of the seat. Therefore, the ridged gasket 4 can be fitted such that it is pressed, gas-tight, against the face surfaces of the submerged nozzle and the collector nozzle.

[0023] This ridged gasket 4 and with it the lip 9 are elastic and the latter preferably has a rectangular or similar cross-section that, with its outer dimensions, corresponds to the cross-section of the annular groove 10. However, depending for example on the intended sealing effect, the lip 9 and the annular groove 10 can also have a cross-sectional geometry different from a rectangle.

[0024] The lip 9 can increase the sealing effect of the ridged gasket 4 with simple means which are automatically effective after establishing the connection between the submerged nozzle and the collector nozzle.

[0025] In the described exemplary embodiment the lip 9 is disposed upstream of the inert gas seal in the direction of casting. However, the lip can in principle also be positioned downstream of the inert gas seal.

[0026] The gasket arrangement according to Fig. 3 only differs from the arrangement according to Fig. 1 and Fig. 2 in that in Fig. 3 the annular space which can be exposed to inert gas is formed by a corresponding annular groove 14 in the ridged gasket 4 which has a recess arranged around the circumference. The annular groove 14 is located within the ridged gasket 4 such that it is positioned relative to the submerged nozzle 1 at the same level as the annular groove 6 provided in the submerged nozzle according to Fig. 2.

[0027] This embodiment of the gasket is associated with the fact that the annular groove 6 in the submerged nozzle is then dispensable. This results in easier handling of the submerged nozzle. The ridged gasket 4 is also made in one part in this embodiment. This is advantageous for the production and fitting of the ridged gasket.

[0028] Fig. 4 shows a gasket arrangement with a refractory nozzle 22 and below a refractory nozzle 21 with a gasket element 23 there between. The nozzle 22 is provided with a surrounding shell 22' or the like, in which the nozzle 22 is mortared.

[0029] With this gasket arrangement the holding means are assigned to the upper nozzle 22 as lip 29 on the circumference of the shell 22' resp. to the compressible gasket element 23 as corresponding groove 30, thus instead to the joining nozzle 21.

[0030] Therewith, before the mounting of the lower onto the upper nozzle 21, 22 the gasket element 23 can be put over that tapered circumference of the nozzle 22 and it is then fixed suitable by these holding means. As a consequence it is again ensured, that the gasket element 23 is not being moved at the moment when the lower nozzle 21 is pressed to the upper.

[0031] The gasket arrangement according to the invention can also be used, as mentioned above, in other similarly co-operating refractory pouring elements of metallurgical devices, such as for example shroud pipes, immersion spouts and similar components.

[0032] The invention is sufficiently demonstrated by the exemplary embodiments described. It could however also be made in other versions. Thus, conversely, on the submerged nozzle a projecting lip to the inside and on the sealing element a corresponding groove could be provided as holding means. In addition, the gasket element could also be made without or with just one flange.

[0033] Theoretically, a groove could also be provided in the submerged nozzle in the sealing region before and/or after the annular space as seen in the direction of casting, into which a respective lip of the gasket element could be pressed. Just two grooves without this

annular space could also be provided.

[0034] Moreover there could be arranged as holding means vice versa a groove circumference the collector nozzle and a lip protrudes inside of the gasket element. This groove could be provided on the shell 22' or directly on the refractory nozzle, when at least no shell would extend to the sealing region.

Claims

1. Gasket arrangement between two refractory pouring elements on the spout of a metallurgical vessel, preferably between a collector nozzle (2) and a submerged nozzle (1), comprising a gasket element (4) in the inlet opening (1') of the submerged nozzle, **characterised in that** there are provided for the submerged nozzle (1) or for the collector nozzle and the gasket element (4) holding means by means of which the gasket element (4) is suitably positioned.

2. Gasket arrangement according to Claim 1, **characterised in that** at least one groove (10) is assigned to the submerged nozzle (1) in the sealing region and at least one lip (9), which can be pressed into this groove (10), is assigned to the gasket element (4) as holding means, by means of which the gasket element (4) is additionally positioned in the inlet opening (1') of the submerged nozzle (1).

3. Gasket arrangement according to Claim 2, **characterised in that** the groove (10) on the submerged nozzle (1) is in the form of an annular groove and the outer lip (9) on the gasket element (4) is in the form of a ring.

4. Gasket element according to Claim 3, **characterised in that** the lip (9) is elastic and has a preferably rectangular cross-section which is made in approximately the same form as this receiving groove (10).

5. Gasket arrangement according to any of the preceding Claims 1 to 4, **characterised in that** the submerged nozzle (1) at its inlet opening (1') and the collector nozzle (2) projecting into the latter taper conically on their outer surface (2') and the gasket element (4) located between the latter is also in the form of a truncated cone.

6. Gasket arrangement according to any of the preceding Claims 1 to 5, **characterised in that** the submerged nozzle (1) is provided with means for conveying inert gas into the sealing region and with a corresponding annular space (6 and 14), the groove (10) preferably being located centrally between the annular space (6 and 14) and the upper face surface (11) of the submerged nozzle.

7. Gasket element for a gasket arrangement according to Claim 6, **characterised in that** the gasket element (4) is formed by a ridged gasket, the annular lip (9) preferably being positioned above the annular space (6 and 14) which can be exposed to inert gas.

8. Gasket element according to Claim 7, **characterised in that** the ridged gasket is formed by a lower and an upper radially outwardly extending sealing flange (12, 13).

9. Gasket element according to Claim 8, **characterised in that** the two end side sealing flanges (12, 13) co-operate with the upper face surface of the submerged nozzle (1) and with the lower face surface of the collector nozzle (2).

10. Gasket element according to any of the preceding Claims 7 to 9, **characterised in that** the ridged gasket (4) in the region of the seat has an annular groove (14) which can be exposed to inert gas and with a recess arranged around the circumference.

11. Gasket element according to any of the preceding Claims 7 to 10, **characterised in that** the ridged gasket (4) is made of refractory compressible fibre material.

12. Submerged nozzle, with an inlet opening (1'), **characterised in that** at least one groove (10) is assigned to the inlet opening (1') in the sealing region.

13. Submerged nozzle according to Claim 12, **characterised in that** the groove (10) is in the form of an annular groove in the tapered inlet opening (1').

14. Refractory nozzle, in particular a collector nozzle, **characterised in that** holding means are assigned to the lower sealing region of the circumference.

15. Refractory nozzle, **characterised in that** as holding means one or more lips (29) are provided on the circumference of a shell (22') encasing the nozzle (22).

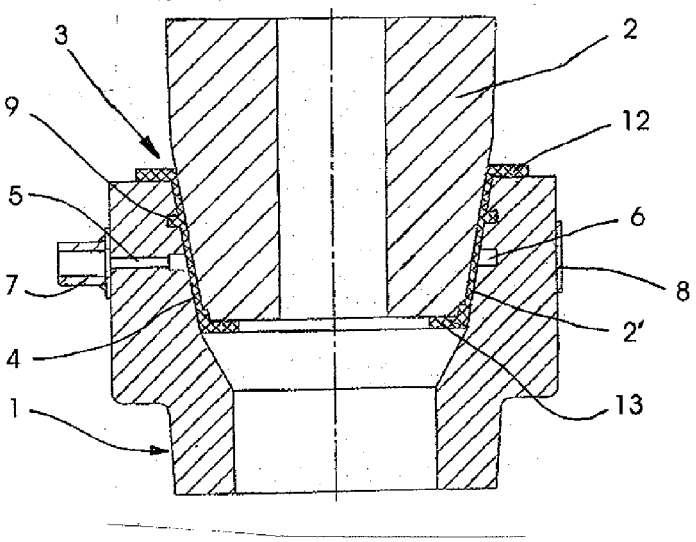

Fig. 1

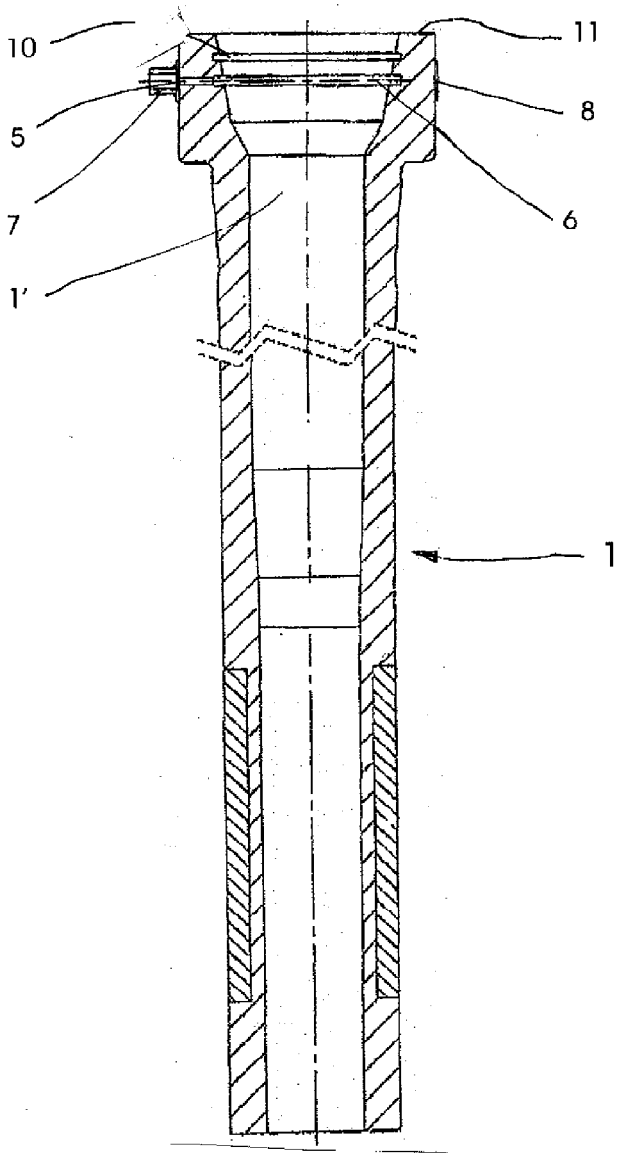

Fig. 2

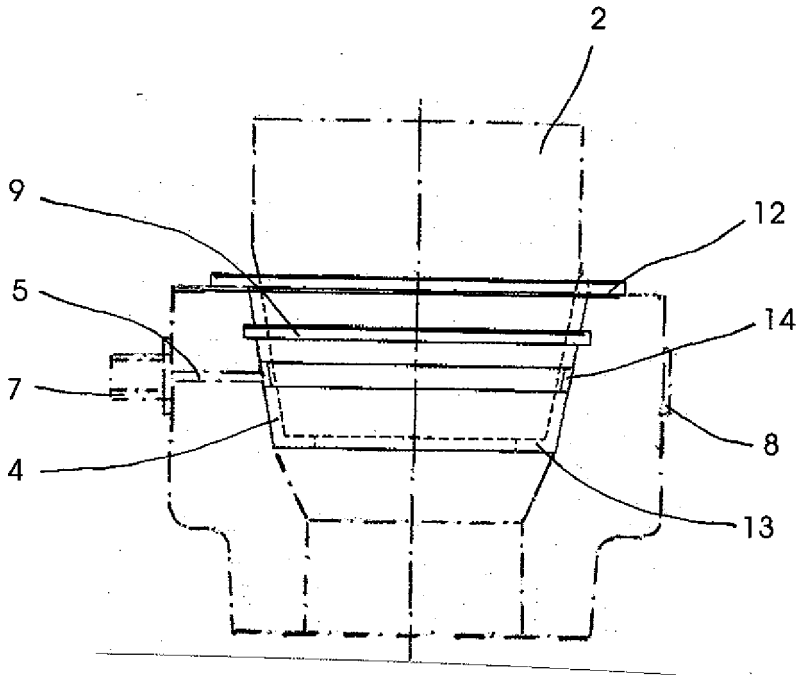

Fig. 3

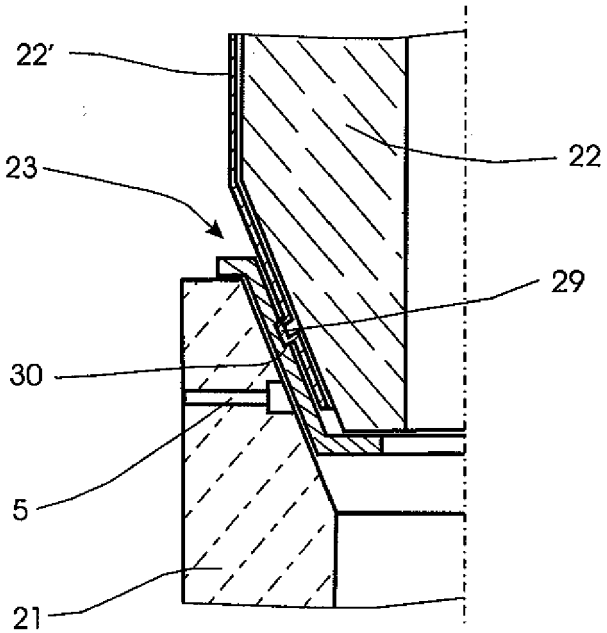

Fig. 4

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PARTIAL EUROPEAN SEARCH REPORT

under Rule 62a and/or 63 of the European Patent Convention. This report shall be considered, for the purposes of subsequent proceedings, as the European search report

Application Number
EP 13 19 4917

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	BE 1 008 567 A (CENTRE RECH METALLURGIQUE [BE]) 4 June 1996 (1996-06-04) * page 4, line 36 - page 5, line 33; figures 2,3 * -----	1-5,9,11 6-8,10	INV. F16J15/10 B22D41/50
Y,D	DE 40 24 520 A1 (DIDIER WERKE AG [DE]) 6 February 1992 (1992-02-06) * figure 1 * -----	6-8,10	

TECHNICAL FIELDS SEARCHED (IPC)

F16J
B22D

INCOMPLETE SEARCH

The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC so that only a partial search (R.62a, 63) has been carried out.

Claims searched completely :

Claims searched incompletely :

Claims not searched :

Reason for the limitation of the search:

see sheet C

Place of search	Date of completion of the search	Examiner
Munich	27 May 2014	Rischard, Marc

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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INCOMPLETE SEARCH
SHEET C

Application Number
EP 13 19 4917

Claim(s) completely searchable:
1-11

Claim(s) not searched:
12-15

Reason for the limitation of the search:

Claims 1,12,14,15 have been drafted as separate independent claims. Under Article 84 in combination with Rule 43(2) EPC, an application may contain more than one independent claim in a particular category only if the subject-matter claimed falls within one or more of the exceptional situations set out in paragraph (a), (b) or (c) of Rule 43(2) EPC. This is not the case in the present application, however, for the following reason:
The claims all relate to a gasket arrangement for a casting nozzle. The products can thus not be considered as being interrelated or proposing alternative solutions to a same problem.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 13 19 4917

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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27-05-2014

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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