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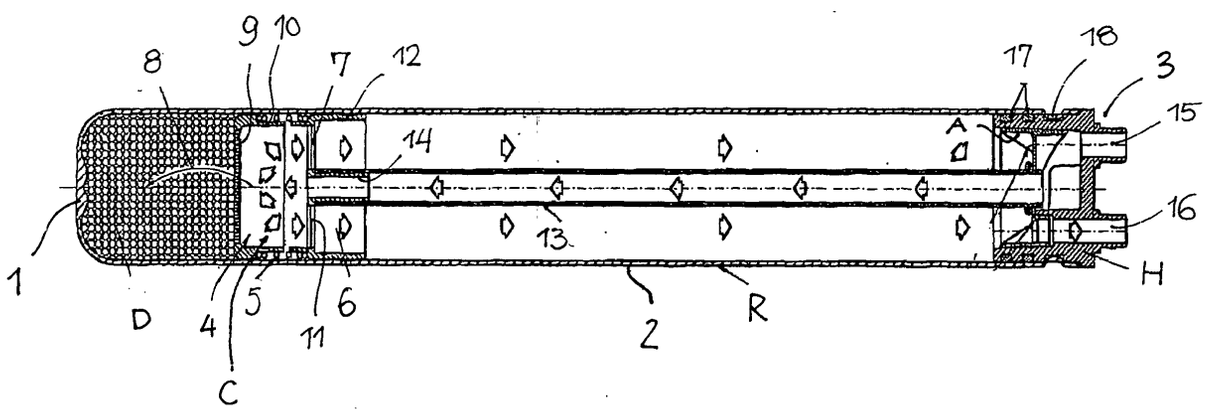
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(54) Receiver drier

(57) In a receiver drier R for an automotive air-conditioning system charge D of desiccant material is placed in the receiver drier casing 2 adjacent to a port-free end part 1 outside of the direct refrigerant flow path. The charge D is secured in place by a first strainer 4 constituting a separation between the charge D and a refrigerant flow deflection chamber C inside the casing 2.

FIG 1



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Description

[0001] The invention relates to a receiver drier for an automotive air-conditioning system according to the preamble part of claim 1.

[0002] The receiver drier of an automotive air-conditioning system (or generally in a refrigerating system) has the task to extract any water contained in the refrigerant, to store a predetermined amount of the refrigerant during operation of the system, and to filter out impurities from the refrigerant circulating through the receiver drier. The water is extracted by at least one charge of a desiccant material placed inside the casing. Impurities are caught by a filter structure.

[0003] In the receiver drier of DE 36 06 029 A desiccant material is placed directly in the refrigerant flow path inside the casing and between two spaced apart strainer walls each fixed to the inner casing wall. All of the refrigerant entering the receiver drier has to pass through the charge.

[0004] In the receiver drier of DE 39 710 638 U the desiccant material is contained in a permeable bag placed on top of a bell-shaped strainer fixed to a free end of a central refrigerant tube. The filter structure is placed in the strainer. All of the refrigerant entering the receiver drier has to pass through the desiccant material.

[0005] It is a drawback of conventional receiver driers that the entire refrigerant flow has to pass through the desiccant material which in time constitutes a flow obstacle of considerable flow resistance generating an undesirably large pressure drop. In operation the diameter of the drier receiver tends to decrease and the interspaces between the pearls of the desiccant material become clogged gradually. The density of the charge increases resulting in increasing flow resistance as well as in an increasing pressure drop which finally may jeopardise the operation of the entire refrigeration system. Moreover, the charge occupies a significant volume in the drier receiver wherein a large useful free volume would be very desirable. Placing the charge in the drier receiver is labour intensive and costly, because several installation steps and additional structural measures are needed.

[0006] It is a task of the invention to provide a receiver drier of the kind as disclosed which can be manufactured for fair costs, allows to comfortably place the charge of desiccant during assembly, and which contributes to increase the operational safety of the system by a reduced pressure drop in the refrigerant flow through the receiver drier.

[0007] This task is solved by the features of claim 1.

[0008] The charge of desiccant material is placed outside of the direct refrigerant flow path and occupies only a small part of the volume of the casing. The charge fulfils its function, so to speak, at a static level, and does not influence the pressure drop for the refrigerant flow negatively. The only pressure drop which is to be overcome by the refrigerant flow is caused by the cross-sections of the flow facilities and the filter structure. Preferably, the charge is directly received in the casing end closed by a port-free end part. No bag is necessary to confine the charge, however, if desired a permeable bag may be used. In the simplest way the desiccant material can be filled in directly into the casing, before the strainer is inserted and confines the charge, preferably under light compression, in a well defined manner outside of the direct refrigerant flow path. No further labour intensive installation steps are necessary. The accommodation of the desiccant charge assures that only a part of the refrigerant contained in the receiver drier will enter the charge in a static manner, even if the direct refrigerant flow is lively and strong. The arrangement of the charge outside of the direct flow path reflects the recognition that the desiccant material by nature generates a very strong attraction for any water contained in the refrigerant and reliably extracts water out of the refrigerant even if the refrigerant contacts the desiccant material in a static manner only.

[0009] Expediently, the charge is confined in an end part of the casing remote from the inlet/outlet ports. This occupies only a small part of the volume of the receiver drier. The remaining volume may desirably be used to enhance the sub-cooling effect of the receiver drier.

[0010] Of advantage is to define a refrigerant flow deflection chamber between the filter structure and the strainer. In the chamber a desirable turbulent flow dynamic condition occurs when the refrigerant seeks its way to the outlet port and such that any water reliably is extracted by the charge.

[0011] Expediently, the inlet/outlet ports are commonly provided in one end part of the casing, while the deflection chamber is located with axial distance from the port-equipped end part. A substantially central refrigerant tube extends from one port of the port-equipped end part into the deflection chamber. The filter structure is placed at or adjacent to the free end of the refrigerant tube. The only significant flow obstacle is created by the filter structure, while the charge of desiccant material fulfils its task in a static manner.

[0012] The filter structure needs some support, because it is arranged separately. Expediently, the filter structure is secured to a positioning holder which may be mounted to the free end of the refrigerant tube and/or may be supported by the inner casing wall.

[0013] For physical and thermal reasons the charge of desiccant material changes its volume during operation of the system. For this reason it is expedient to hold the charge under light compression and such that it may expand or contract. Expediently, the strainer is placed with a slide-fit contact at the casing inner wall such that it is able to move with the charge when the charge expands or contracts. A compression spring loads the strainer and compresses the charge via the strainer. Advantageously, the compression spring is seated on the positioning holder.

[0014] To facilitate the assembly of the receiver drier the refrigerant tube is stabilised by an adapter part of the port-equipped end part of the receiver drier. Via the adapter part the reaction force from the positioning holder and/or the strainer is backed up by the end part of the casing.

[0015] A pot-shaped strainer is easy to insert into the casing and is well guided by its contact to the inner wall of the receiver drier.

[0016] As an additional or alternative structure a layer of a gap recovering material may be placed between the strainer and the charge and/or between the port-free end part and the charge. The layer has to be permeable when positioned at the strainer. At the port-free end part the layer only needs to be resilient. Volume changes of the charge are taken up or compensated for by the layer. The charge remains under a relatively constant compression and, as a consequence, occupies only the minimum volume in the receiver drier.

[0017] Expediently, the refrigerant pipe, the positioning holder and the strainer coupled to the positioning holder by the compression spring may form one prefabricated unit which can be inserted comfortably into the casing. The structural unit even may be completed by the charge and/or the adapter part.

[0018] Embodiments of the invention will be explained with the help of the drawing. In the drawing is:

Fig. 1 a longitudinal sectional view of a receiver drier,

Fig. 2 a longitudinal sectional view of a welded embodiment of a receiver drier,

Fig. 3 a longitudinal sectional view of another embodiment of a receiver drier integrated into a condenser, and

Fig. 4 a schematic illustration of a condenser casing combined with a receiver drier, e.g. the receiver drier shown in Fig. 3.

[0019] The receiver drier R in Fig. 1 has a substantially cylindrical, relatively slim casing 2 of aluminium or steel material. The casing 2 is closed at the left end by an integrated end part 1, and is closed at the opposite, open end by an inserted and rigidly coupled end part 3. End part 3 is a so-called connector head H which serves to establish fluid-tight connections with a not shown connecting structure to which the receiver drier is to be mounted. The receiver drier R e.g. will operate in a position with the connector head H oriented downwardly.

[0020] The left end of casing 2 contains a charge D of a desiccant material. The material may be filled into the casing directly from the open casing end. The charge D is held in place and in contact with the casing inner wall and the end part 1 by a strainer 4. The strainer 4 has the shape of a pot with a perforated pot bottom wall 9 and a circumferentially continuous guiding wall 10. Guiding wall 10 may engage the inner casing wall with a slide-fit. Distant from strainer 4 a positioning holder 7 is installed in contact with the inner wall. The holder 7 has the shape of a pot with a perforated or partly open pot bottom wall carrying a net filter structure 11 and a circumferential guiding wall 12 which may contact the casing inner wall. The drier receiver R is equipped with a central longitudinally extending refrigerant tube 13 inserted by an adapter port A into port-equipped end part 3, and extending to the holder 7. The holder 7 may have a central tubular projection 14 which is inserted into the free end of the refrigerant tube 13. The holder 7 defines flow paths 6 for a refrigerant circulating through the receiver drier R.

[0021] The refrigerant enters the receiver drier R through an inlet port 15 in end part 4, the adapter part A and further through the refrigerant tube 13 from which it reaches a flow deflection chamber C commonly defined by strainer 4 and holder 7. A part of the refrigerant in chamber C also enters the charge D. The charge D extracts any water contained in the refrigerant. From chamber C the refrigerant passes through net filter structure 11 and then into the remaining part of the casing 2 until it leaves the receiver drier R through an outlet port 16. The chamber C and the remaining free space in the casing 2 provides a relatively big volume desirable for an effective sub-cooling effect of the receiver drier.

[0022] The connector head H as the port-equipped end part 3 is inserted into the free end of casing 2 and is rigidly coupled to casing 2 by a radial inward deformation 18, e.g. a circular crimping, of the casing wall. The connection region between the connector head H and the casing 2 additionally is sealed by O-rings 17. Other suitable connecting principles may be used instead.

[0023] A compression spring 5 is inserted between the strainer 4 and the holder 7 such that the strainer 4 is slightly pressed against the charge D. The part of the refrigerant entering the charge D is indicated by an arrow 8. The compression spring 5 allows the strainer 4 to move axially in case that the volume of the charge D should decrease due to a certain setting effect, or should increase for other reasons. In all operating conditions, however, the charge D may remain under a slight axial pre-load by the first strainer 4 and the compression spring 5.

[0024] The refrigerant tube 13, the holder 7, and strainer 4 coupled to the holder 7 by compression spring 5 may be prefabricated as a structural unit which can be inserted into the casing 2 comfortably after the charge D has been filled in. The structural unit even can be premounted to the connector head H such that it can be placed by one installation step when inserting the connector head H.

[0025] The structure as described above allows to reduce the costs to manufacture and assemble the receiver drier in comparison with conventional ones and considerably improves the system operational functionality

by reducing the pressure drop for the refrigerant flow. The charge D, e.g. constituting a molecular sieve, is applied at a static level close to the upper bottom of the casing, e.g. in case of an upright operating position of the drier receiver in the system. In operation and in time the diameter of the receiver drier tends to decrease. Then the pressure difference of the refrigerant flow between the inlet port and the outlet port increases considerably such that the performance of the receiver drier and of the entire system may be jeopardised. After some hours of operation of the receiver drier in the air-conditioning system, the risk of a flow obstruction increases proportionally to the diameter decrease, because also the cross-sectional area for the filtering action is decreasing. With the arrangement as disclosed above, the filter structure is separated from the charge absorbing the water. This is not only useful for receiver driers which will be installed in a stand alone location in the system, but also for receiver driers which are integrated to or into the condenser of the system. The integration into the condenser does not cause problems because the charge of desiccant material resists temperatures of up to 750°C and more when soldering the condenser and the receiver drier at the same time. The quality, pearl size, volume, and the like of the charge D easily can be adapted to the demand of the customer using the receiver drier. The same is true for the filter structure. The port-equipped end part 3 can be secured in place also by welding or the like.

[0026] The receiver drier of Fig. 2 is designed similar to the receiver drier of Fig. 1. The charge D of the desiccant material is received in the closed end of the casing 2 in direct contact with integrated end part 1. Between strainer 4 which is guided at the inner casing wall, and the charge D a layer 19 of a gap recovering material is provided which is permeable for the refrigerant but not for the desiccant material and which compensates for any volume variations of the charge D. The central refrigerant tube 13 is secured to end part 3 (connector head H) via adapter part A and abuts against the, in this case, bell-shaped positioning holder 7 resting on a projecting boss of strainer 4. The open end of holder 7 is equipped with the net filter structure 11. The chamber C is defined in part inside holder 7. In this case refrigerant tube 13 may be connected to outlet port 16. The connector head H is welded to the casing 2 via adapter part A.

[0027] The receiver drier R of Fig. 3 is intended to be integrated with a condenser casing 20 (Fig. 4) of the system. The tube-like, cylindrical casing 2 is closed at both ends by plug-shaped fixed end parts 1, 3. The charge D of the desiccant material is received directly in the end of the casing 2 closed by end part 1. At both ends of charge D layers 19 of a gap recovering material are provided. Strainer 4 with its perforated bottom wall 9 is installed with a press-fit contact with the casing inner wall. The positioning holder 7 is placed with axial distance from strainer 4 and carries the net filter structure 11. The refrigerant flow deflection chamber C is defined between the strainer 4 and the holder 7. In the region of chamber C inlet port 15 is formed in the casing wall 2, while the outlet port 16 is formed in the casing wall 2 about midway between the holder 7 and the other end part 3. The operating position of the receiver drier R may be selected such that the charge D will be at the top.

[0028] In Fig. 4 the receiver drier of Fig. 3 is mounted to the side of the condenser casing 20 such that the receiver drier R is supported by the casing 20 and such that the inlet and outlet ports 15, 16 establish the necessary flow connections with the interior of the casing 20.

Claims

1. Receiver drier (R) for an automotive air-conditioning system, comprising a casing (2) of substantially cylindrical shape with end parts (1, 3) closing both casing ends, inlet/outlet ports (15, 16), a charge (D) of a desiccant material fixed in place inside the casing (2), and a filter structure (11) provided within a direct flow path extending inside the casing (2) from the inlet port (15) to the outlet port (16), **characterised in that** the charge (D) of the desiccant material is placed outside the direct refrigerant flow path in a part of the casing (2) which is separated from the direct flow path by a permeable strainer (4) which secures the charge (D) in its place, and that the filter structure (11) is separated from the charge (D).

2. Receiver drier as in claim 1, **characterised in that** the charge (D) is placed in an end part of the casing (2) remote from the inlet/outlet ports (15, 16).

3. Receiver drier as in claim 1 **characterised in that** the filter structure (11) and the strainer (4) commonly define a refrigerant flow deflection chamber (C) which communicates directly with the inlet port (15) and which communicates indirectly via the filter structure (11) with the outlet port (16) and which communicates via the strainer (4) with the casing part containing the charge (D), respectively

4. Receiver drier as in claim 1, **characterised in that** the inlet/outlet ports (15, 16) are provided in one end part (3) of the casing (2), that the flow deflection chamber (C) is located with axial distance from the port-equipped end part (3), that a substantially central refrigerant tube (13) extends from one port (15, 16) of the port-equipped part (3) into the chamber (C), and that the filter structure (11) is placed at or adjacent to the free end of the refrigerant tube (13).

5. Receiver drier as in at least one of the preceding claims, **characterised in that** the filter structure (11) is secured to a positioning holder (7) which ei-

ther is supported by the inner casing wall and/or is mounted to the free end of the refrigerant tube (13).

6. Receiver drier as in claim 1, **characterised in that** the strainer (4) is placed with a slide-fit contact at the inner casing wall, and that a compression spring (5) is inserted between the positioning holder (7) mounted to the free end of the refrigerant tube (13) and the strainer (4) to yieldably compress the charge (D) via the strainer (4).

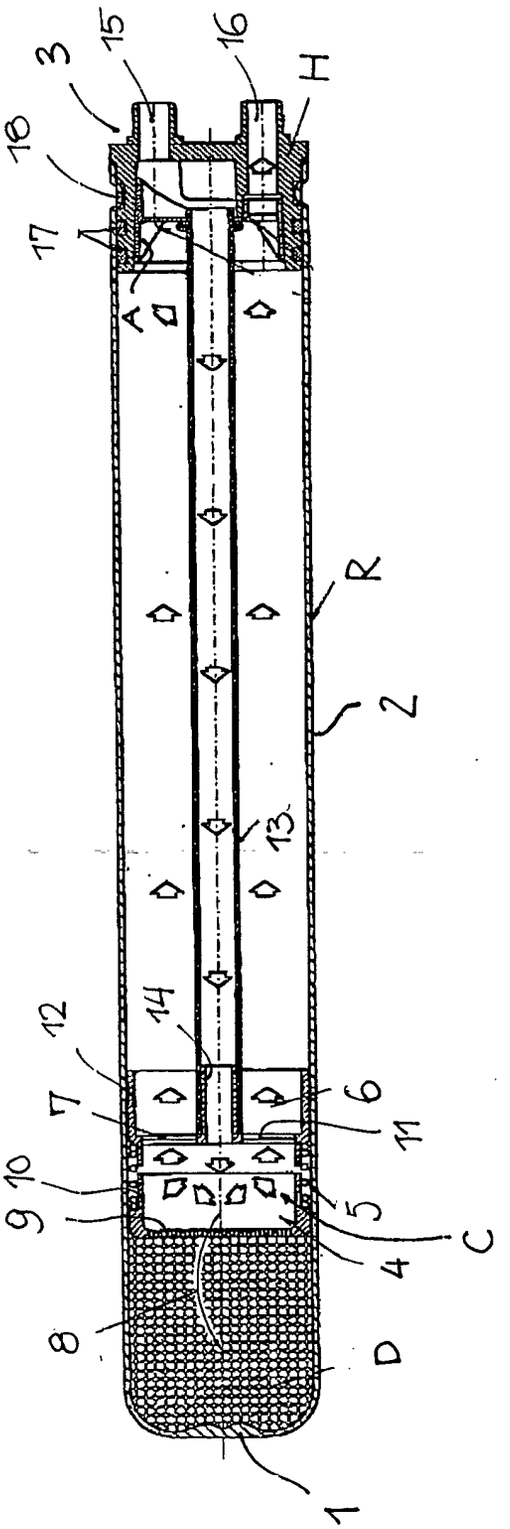
7. Receiver drier as in claim 4, **characterised in that** the refrigerant tube (13) is stabilised by an adapter part (A) of the port-equipped end part (3).

8. Receiver drier as in at least one of the preceding claims, **characterised in that** the strainer (4) is pot-shaped and has a perforated pot bottom wall (9) and a peripheral guiding wall (10).

9. Receiver drier as in at least one of the preceding claims, **characterised in that** a layer (19) of a liquid permeable gap recovering material is placed between the strainer (4) and the charge (D) and/or between the port-free end part (1) and the charge (D).

10. Receiver drier as in at least one of the preceding claims, **characterised in that** the refrigerant tube (13), the strainer (4) and the positioning holder (7) and the compression spring (5) define a prefabricated structural unit.

FIG 1



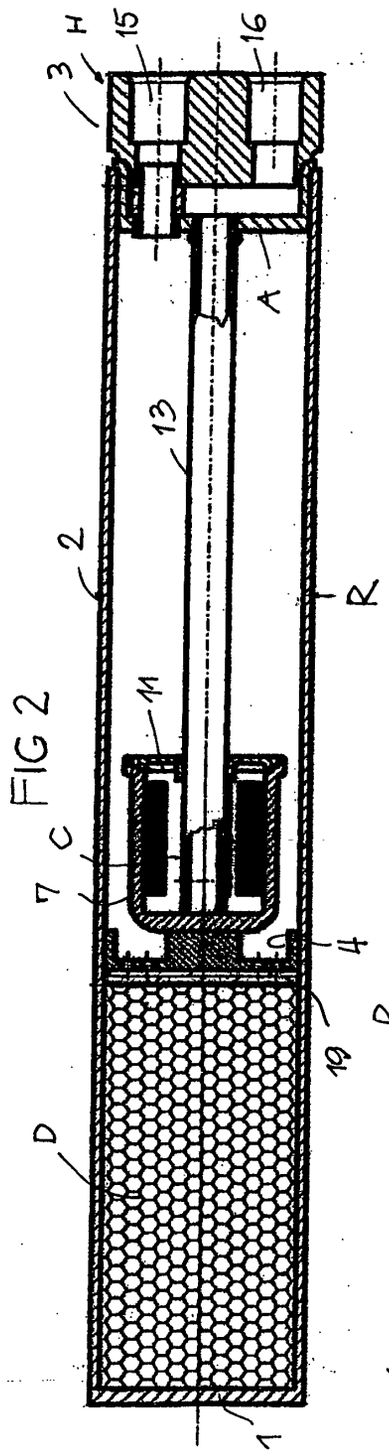


FIG 2

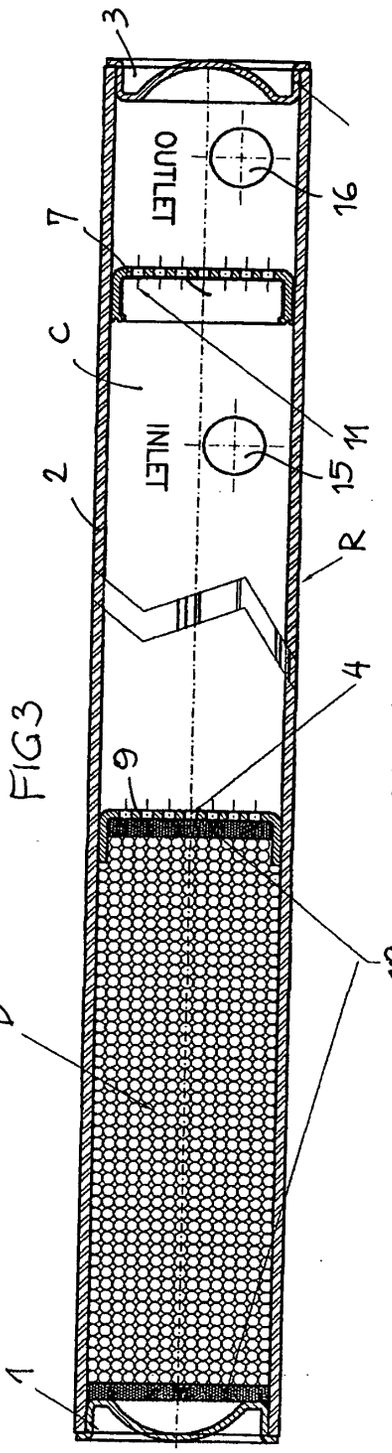


FIG3

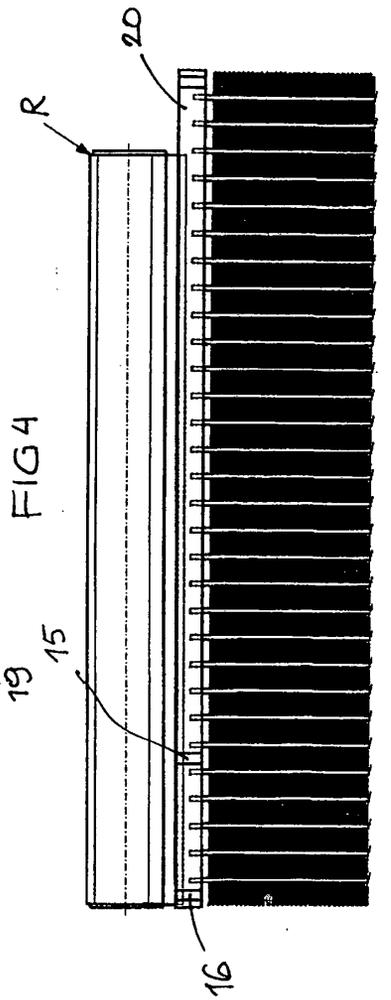


FIG4

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EUROPEAN SEARCH REPORT

Application Number
EP 02 01 0459

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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
MUNICH	31 October 2002	Ritter, C

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