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(54) Radiating element and relative radiator

(57) In a radiator (1) having a number of superimposed radiating elements (2) formed from respective flattened tubular members (10), each radiating element (2) has end portions (9) permanently deformed to define, at each end portion (9), two walls (11) which project with respect to an undeformed central portion (8), are provided with holes (14), and are soldered to respective walls (11) of adjacent radiating elements (2); an end (12) of each end portion (9) being closed by permanent deformation by compressing the end (12).

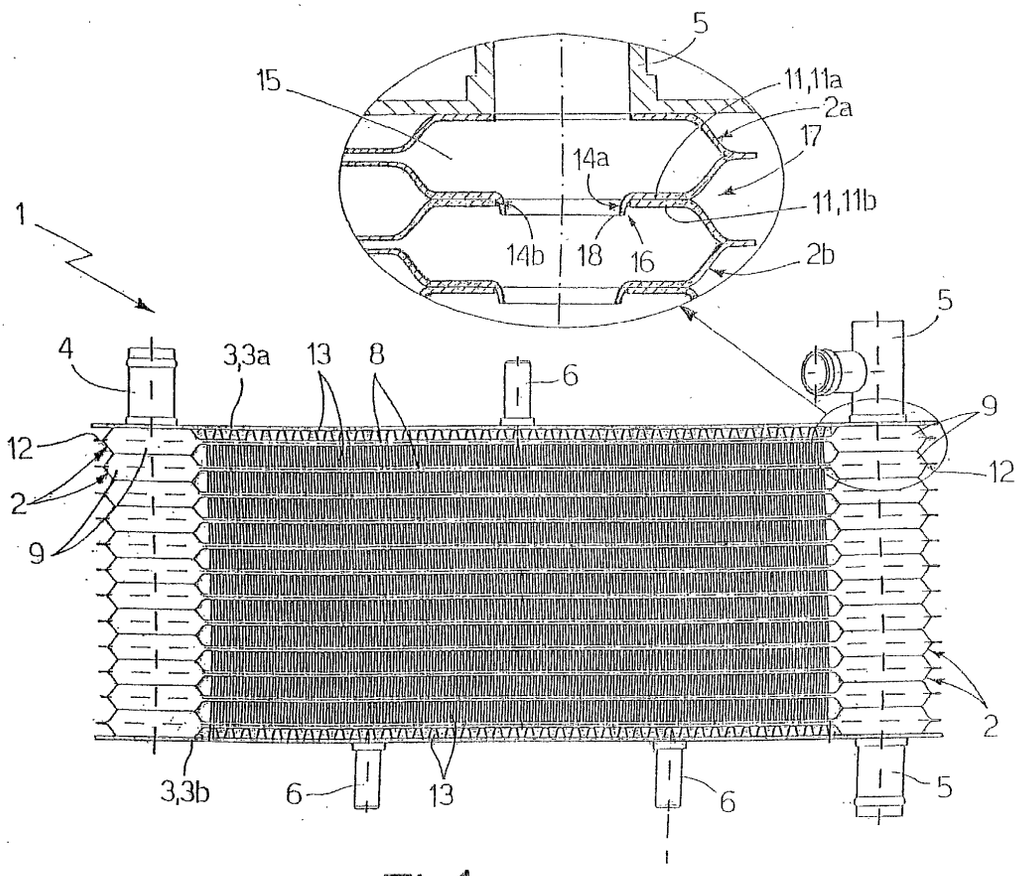

Fig.1

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Description

[0001] The present invention relates to a radiating element, to a radiator comprising at least one radiating element, and to a method of producing the radiating element.

[0002] The present invention may be used to advantage for cooling the cooling fluid of a vehicle, in particular a motor vehicle, engine, to which the following description refers purely by way of example.

[0003] A radiator is currently produced comprising a number of superimposed radiating elements, each of which is formed from a flattened tubular member and has permanently deformed end portions to define, at each end portion, two facing, substantially flat walls projecting with respect to an undeformed central portion of the radiating element; and each wall is placed in contact with, and normally soldered to, at least one wall of an adjacent radiating element.

[0004] Each wall has a hole to define, in the radiator, two end manifolds communicating with respective cooling fluid inlet and outlet fittings.

[0005] In one known method, the end portions are closed by plugging members force-fitted inside the respective open ends.

[0006] Such a solution is disadvantageous in terms of cost and storage by requiring additional manufacture of the plugging members - which must be sized according to the end cross sections of the radiating elements - and by requiring high-precision equipment for inserting the plugging members inside the respective ends.

[0007] It is an object of the present invention to provide a radiating element and relative radiator designed to eliminate the aforementioned drawbacks, and which are also cheap and easy to produce.

[0008] A first object of the present invention is to provide a radiating element for radiators as claimed in Claim 1.

[0009] A second object of the present invention is to provide a method of producing a radiating element for radiators as claimed in Claim 4.

[0010] A third object of the present invention is to provide a radiator as claimed in Claim 9.

[0011] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a front view and enlarged detail in section of a preferred embodiment of a radiator in accordance with the teachings of the present invention;

Figure 2 shows a side view of Figure 1;

Figures 3 to 7 show steps, with partly sectioned enlarged details, in a method of producing a radiating element and radiator in accordance with the present invention;

Figure 8 shows an alternative embodiment of the step in Figure 7;

Figure 9 is a plan view of Figure 7 or 8, and shows a preferred embodiment of a radiating element in accordance with the present invention.

[0012] Number 1 in Figure 1 indicates as a whole a radiator for cooling the cooling fluid of a vehicle, in particular a motor vehicle, engine.

[0013] Radiator 1 comprises a number of superimposed radiating elements 2; two parallel, facing guard plates 3 on opposite sides of radiating elements 2; a water inlet fitting 4 fitted to a top plate 3a; two water outlet fittings 5 at the opposite end to inlet fitting 4 and fitted to top plate 3a and a bottom plate 3b respectively; and anchoring pins 6 connected integrally to plates 3 for assembly to a supporting structure (not shown) .

[0014] Each radiating element 2 extends along a longitudinal axis 7, and comprises a central portion 8, and two end portions 9 at opposite ends of central portion 8. As explained in detail later on, each end portion 9 is formed by permanent deformation of a respective end portion of a flattened tubular member 10 (Figure 3), and comprises two parallel, facing, substantially flat walls 11, and a closed end 12. Each wall 11 is placed in contact with a respective wall 11 of an adjacent radiating element 2, or with a portion of a plate 3, and projects with respect to central portion 8; and, in the gaps between central portions 8 of adjacent radiating elements 2, or between central portions 8 and plates 3, undulated sheet metal strips 13 are inserted to improve heat exchange.

[0015] Each wall 11 is soldered or welded, and preferably though not necessarily projection welded, to the adjacent wall 11 or adjacent plate 3.

[0016] Walls 11 have respective through holes 14 which, when walls 11 are soldered to one another, define at end portions 9 respective end manifolds 15 (only one shown), a first of which has one end communicating with fitting 4 and one end closed by bottom plate 3b, and a second of which has two ends communicating with respective fittings 5.

[0017] Each pair of adjacent radiating elements 2 has an aligning and connecting device 16 for assembling radiating elements 2 one on top of the other in a given relative position, in particular with holes 14 substantially coaxial with each other.

[0018] With reference to a generic pair 17 of adjacent radiating elements 2 comprising a first radiating element 2a and a second radiating element 2b, aligning and connecting device 16 comprises two annular collars 18 (only one shown in Figure 1) located at respective end portions 9 of radiating element 2a, and each of which projects from a bottom wall 11a of a respective end portion 9 and extends along the edge of a hole 14a formed in bottom wall 11a; and two holes 14b, each of which is formed through a top wall 11b of a respective end portion 9 of radiating element 2b, and is of such a cross section as to house relative annular collar 18 with relatively little slack.

[0019] Radiating element 2 adjacent to bottom plate 3b preferably has no annular collars 18.

[0020] Figure 3 shows a first step in a method of producing radiating element 2 and radiator 1, and wherein a flattened tubular member 10 with open ends and of given length is prepared, and, as shown in Figure 4, is provided with end portions 9 by means of permanent deformation by two forming punches 19, while central portion 8 is left undeformed. Forming punches 19 move in opposite directions along a path coincident with longitudinal axis 7, and are inserted inside respective open ends of each tubular member 10, which is held in position by a known supporting device not shown.

[0021] In the next step shown in Figure 5, each tubular member 10 is provided, at each end portion 9 and in walls 11a and 11b, with respective holes 14a and 14b, which are coaxial along an axis 7a crosswise to longitudinal axis 7, have different cross sections, and are formed by a pair of cutting punches 20 also of different sizes and moving in opposite directions along a path crosswise to longitudinal axis 7. More specifically, hole 14a has a smaller cross section than hole 14b.

[0022] As shown in Figure 6, hole 14a is then widened and provided along the edge with annular collar 18 projecting from wall 11a. This is done by means of an edging punch 21, which is moved along a path crosswise to longitudinal axis 7, is inserted through hole 14b, and is fed forward so as to interfere with the edge of hole 14a and so widen hole 14a and simultaneously form, by permanent deformation of wall 11a, annular collar 18 projecting from wall 11a.

[0023] In the next step shown in Figure 7, ends 12 of end portions 9 are closed by permanent deformation, by compressing ends 12 between two pressure members 22 moving in opposite directions along a path crosswise to longitudinal axis 7. To prevent walls 11 from also being deformed during compression, each end portion 9 is inserted, at the closing step, in a die (not shown) from which end 12 projects.

[0024] Alternatively, as shown in Figure 8, the step of closing each end 12 by permanent deformation of end 12, is performed by two closing punches 23, which are located on opposite sides of longitudinal axis 7, move in the same direction parallel to longitudinal axis 7, and have respective contoured profiles to close relative end 12 gradually by compression.

[0025] In a further step not shown, each end 12 may then be folded onto itself or towards central portion 8. This has the twofold advantage, on the one hand, of reinforcing closure of end 12 and, on the other, of reducing the longitudinal dimension of radiating element 2.

[0026] The above operations result in the formation of a radiating element 2 as shown in Figure 9.

[0027] A number of radiating elements 2 are then placed one on top of the other by inserting annular collars 18 inside respective holes 14b to align and connect each radiating element 2 to the adjacent radiating element 2.

[0028] As stated, walls 11 of adjacent radiating elements 2 are joined by soldering or welding, and each end 12 is also preferably, though not necessarily, soldered or welded - in particular, projection welded.

[0029] Closing ends 12 of end portions 9 by permanent deformation is definitely advantageous by speeding up the production cycle and simplifying storage by eliminating the need for storing separate plugging members, thus reducing cost.

[0030] Clearly, the radiating element and radiator described and illustrated herein may be used for cooling various types of fluid, and changes may be made without, however, departing from the scope of the present invention.

Claims

1. A radiating element for radiators, said radiating element (2) being formed from a flattened tubular member (10) and comprising a central portion (8), and two end portions (9) at opposite ends of said central portion (8); each said end portion (9) comprising two facing, substantially flat walls (11) projecting with respect to said central portion (8) and having respective holes (14); and the radiating element (2) being **characterized in that** each said end portion (9) comprises an end (12) closed by permanent deformation by compressing said end (12).

2. A radiating element as claimed in Claim 1, **characterized in that** said end (12) is soldered or welded, in particular projection welded.

3. A radiating element as claimed in Claim 1 or 2, **characterized in that** said end (12) is folded onto itself.

4. A method of producing radiating elements (2) for radiators, comprising the steps of:

   - preparing at least one flattened tubular member (10) of given length, extending along a longitudinal axis (7) and having open ends;
   - permanently deforming the open end portions (9) of said tubular member (10) by means of forming punches (19) moving parallel to said longitudinal axis (7) to define, at each said end portion (9), two facing, substantially flat walls (11) projecting with respect to an undeformed central portion (8) of said tubular member (10); and
   - perforating said two walls (11) of each said end portion (9) by means of a pair of cutting punches (20) moving crosswise to said longitudinal axis (7);

   the method being **characterized by**:

- closing an end (12) of each said end portion (9) by permanent deformation by compressing said end (12).

5. A method as claimed in Claim 4, **characterized by** soldering or welding, in particular projection welding, said end (12).

6. A method as claimed in Claim 4 or 5, **characterized by** folding said end (12) onto itself.

7. A method as claimed in one of Claims 4 to 6, **characterized in that** said step of closing each said end (12) is performed by two pressure members (22) moving towards each other along a path crosswise to said longitudinal axis (7).

8. A method as claimed in one of Claims 4 to 6, **characterized in that** said step of closing each said end (12) is performed by two closing punches (23) which are located on opposite sides of said longitudinal axis (7), move parallel to said longitudinal axis (7), and have respective contoured profiles to close said end (12) gradually by compression.

9. A radiator comprising at least one radiating element (2) as claimed in one of Claims 1 to 3.

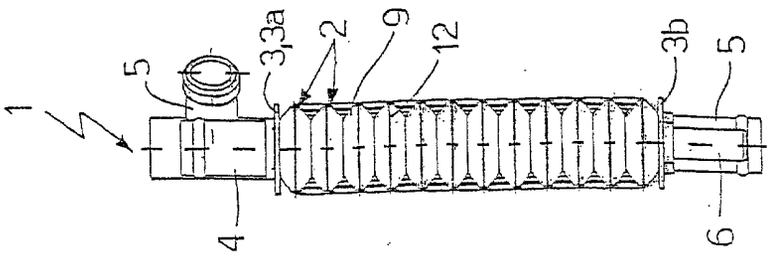
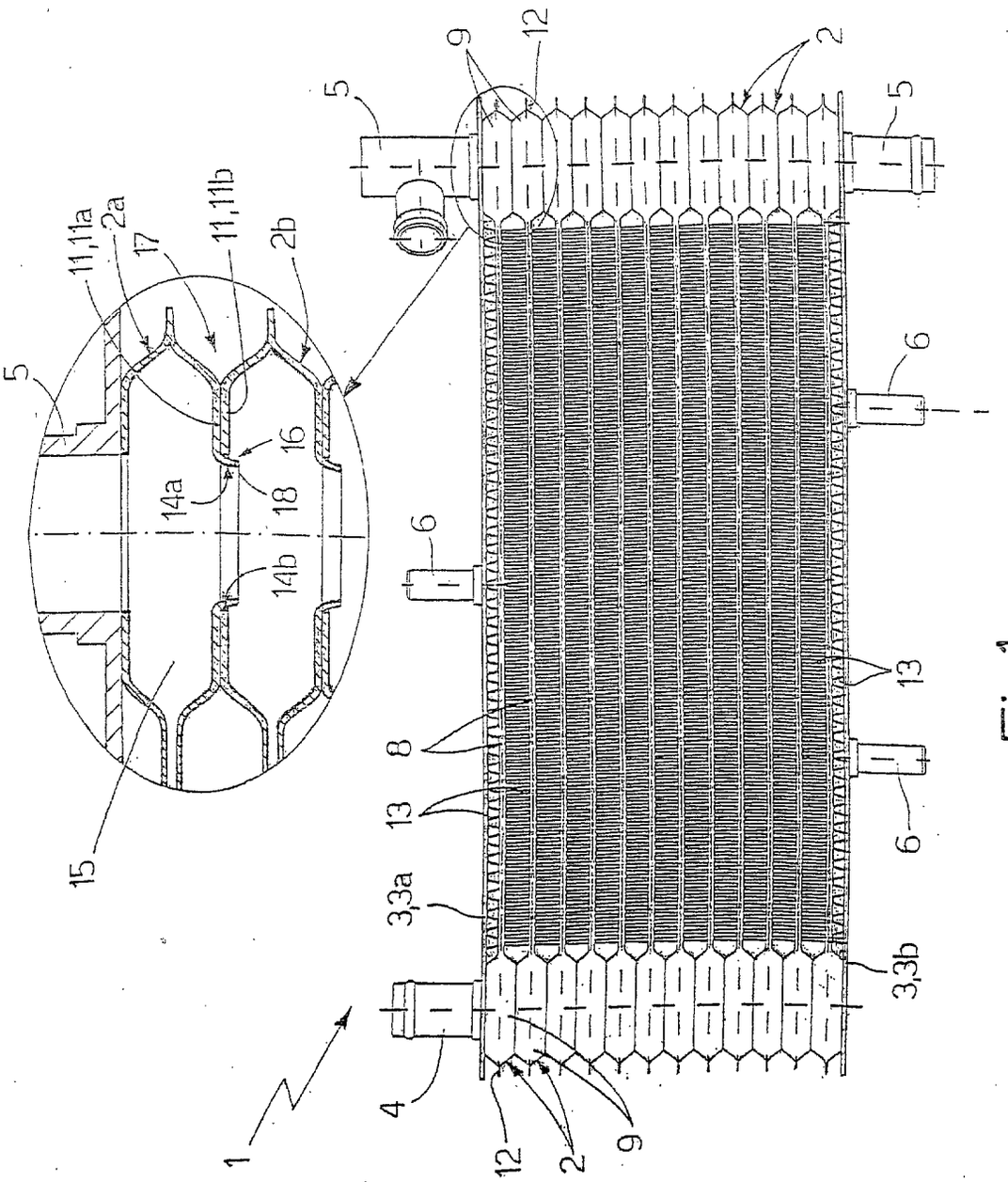

1
5
3,3a
2
9
12
3b
5
4
6

Fig.2


1
5
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2a
17
11,11b
2b
16
18
14a
14b
15
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13
8
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3,3a
3,3b
4
12
2
9

Fig.1

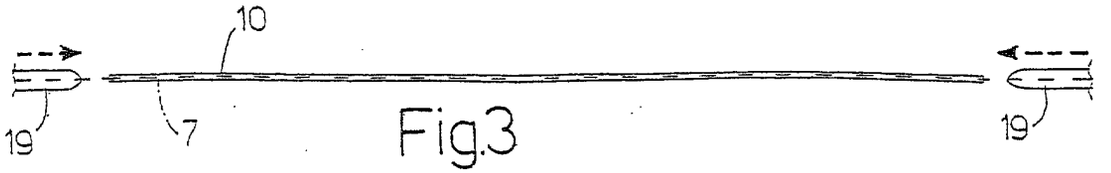

Fig.3

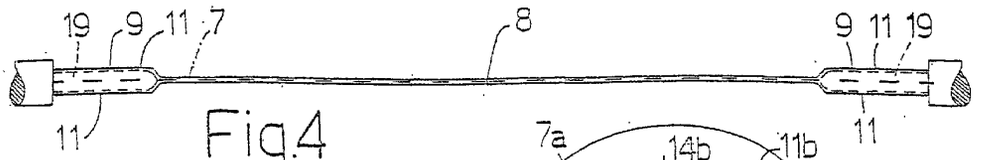

Fig.4

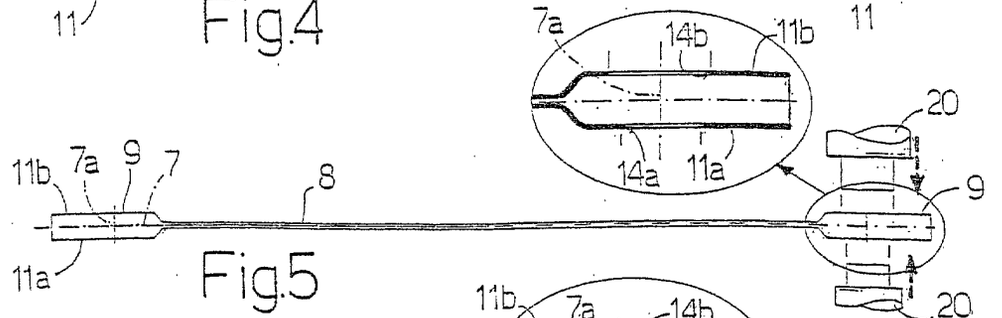

Fig.5

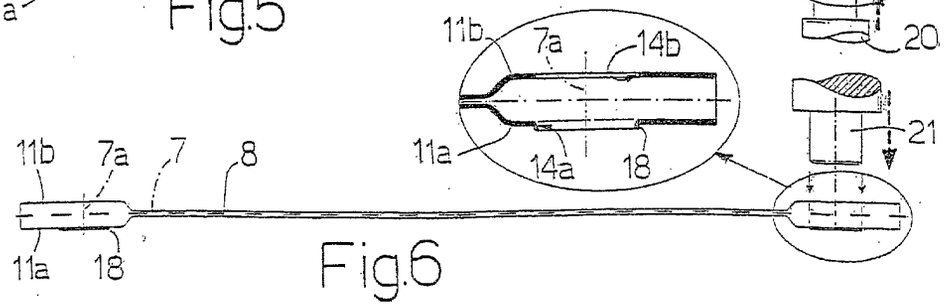

Fig.6

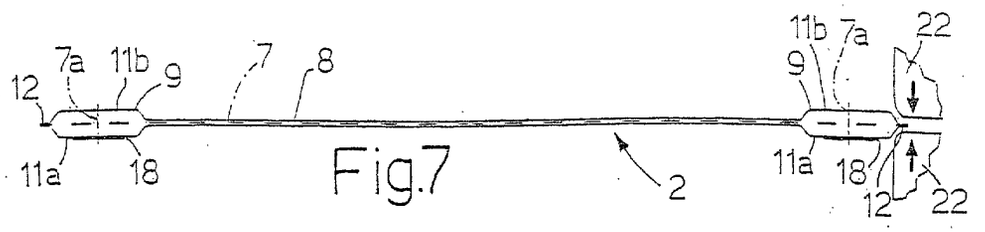

Fig.7

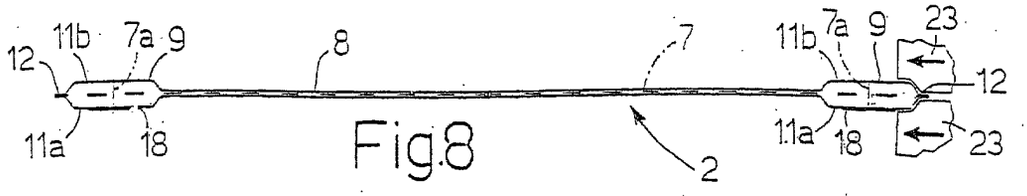

Fig.8

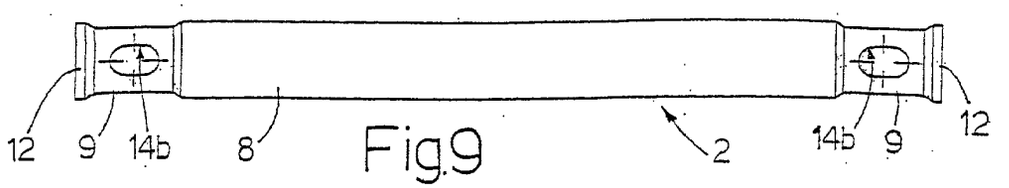

Fig.9

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 02 01 2204

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	EP 0 692 691 A (VALEO ENGINE COOLING AB) 17 January 1996 (1996-01-17) * abstract; figures 11B,13 * ---	1-9	F28D1/053
A	BE 653 079 A (SILVIO SALA, GIUSEPPE SALA) 31 December 1964 (1964-12-31) * figures 4-11 * -----	1-9	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

F28D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	15 October 2002	Bain, D

CATEGORY OF CITED DOCUMENTS

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15-10-2002

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