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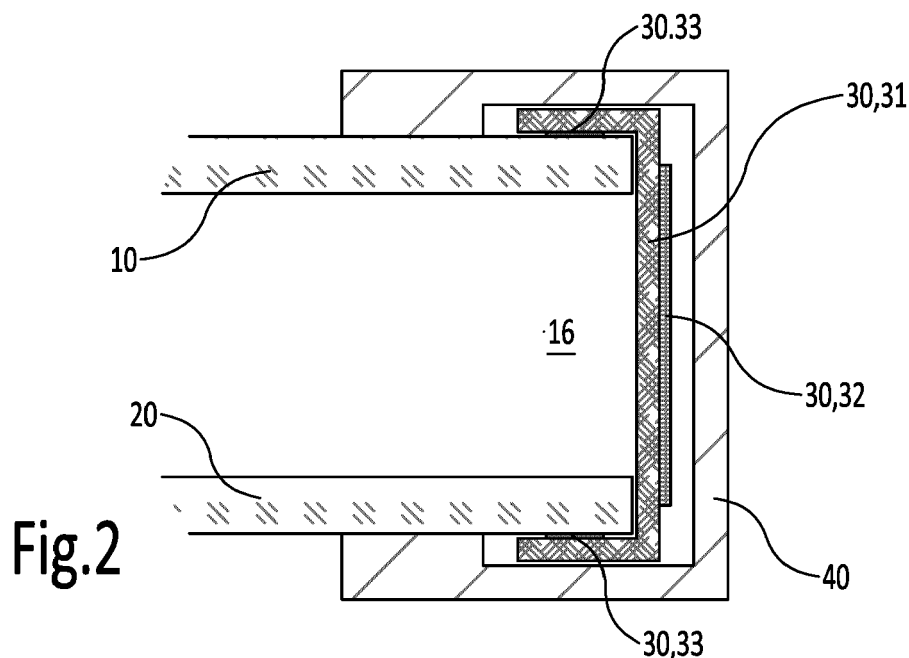
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(54) MULTI-WALLED PLATE MATERIAL AND SEALING TAPE THEREFOR

(57) A multi-walled plate material comprises a first plate body (10) and a second plate body (20) which are separated from each other by an intermediate cavity (15). The cavity is sealed at an outer end with a breathing sealing tape (30) which is at least substantially dust-tight but water vapour-permeable. The sealing tape comprises a micro-porous carrier (31) which is dust-tight for par-

ticles from a first size and is covered with a filter layer (32). The filter layer (32) comprises a breathing membrane wall which is at least water vapour-permeable but dust-tight for particles from a second size, which second size is smaller than the first size. The filter layer extends at least over the cavity opening (16).

**Fig. 2****EP 2 927 386 A1**

Description

[0001] The present invention relates to a multi-walled plate material comprising a first plate body and a second plate body which are separated from each other by at least one intermediate cavity, which cavity opens with a cavity opening on at least one outer end, wherein the cavity is sealed at the outer end with a breathing sealing tape which is at least substantially dust-tight but water vapour-permeable.

[0002] Such plate material is applied particularly in an outdoor environment as usually transparent or translucent roof covering in light corridors, roof coverings and other situations in which entry of daylight is desired under a watertight canopy. The plate material lies horizontally here or at a certain incline for an adequate drainage. In addition, such plate material is also increasingly being applied in the interior of offices, dwellings and other buildings as transparent or partially transparent partition wall, wherein the plate material is applied substantially vertically.

[0003] A critical factor here is the internal moisture management in the cavity or cavities which are present in the plate material and which enhance thermal insulation of the material. A certain cold and heat exchange unavoidably takes place between the cavity and the surrounding area, whereby condensation can occur in the cavity. In order to avoid this resulting in an ideal breeding ground for fungi, bacteria and other (micro-)organisms, the cavity has to be sealed as dust-tightly as possible in order to prevent penetration thereof while a water vapour exchange and drainage to the surrounding area nevertheless remains possible.

[0004] In order to provide for this the European patent application EP 376386 of applicant specifies a sealing tape which can be applied to the end surface of a multi-walled plate material and which, while being permeable to water vapour and water, is also dust-tight. The tape comprises a carrier here in the form of an aluminium tape in which macroscopic openings are provided which are in register with the cavity outer ends. Arranged at least over the openings on a side facing toward the cavity is a filter tape in the form of a non-woven textile of polyester or other fibres with a more or less random pore structure which provides for the desired dust-tightness for particles from a size of roughly 45 micron, while the structure is nevertheless sufficiently open to allow vapour and moisture transport therethrough.

[0005] Although this tape has proved in practice to be more than adequate as dust-tight and moisture-permeable seal of translucent or transparent multi-walled plate material for light corridors, roof coverings and the like, there is nevertheless a demand for such plate material to have a greater degree of dust-tightness without detracting too much from the capacity to be able to drain moisture accumulating inside the cavity and to exchange water vapour with the surrounding area. The present invention has for its object, among others, to provide a

multi-walled plate material and a sealing tape which meets this requirement.

[0006] In order to achieve the stated object a plate material of the type described in the preamble and a sealing tape have the feature according to the present invention that the sealing tape comprises a micro-porous carrier with at least a breathing zone which is permeable to water and water vapour but is dust-tight for particles from a first size, that at least the zone of the carrier is covered with a filter layer which comprises at least one breathing membrane wall which is at least water vapour-permeable but dust-tight for particles from a second size, which second size is smaller than the first size, and that the tape is folded with at least the carrier round the outer end of both plate bodies and is received with opposite longitudinal sides above respective edge parts of the first plate body and the second plate body, wherein the filter layer extends at least over the cavity opening.

[0007] The pores of the carrier are thus sealed at least at the position of the zone by the at least one membrane wall of the filter layer in a manner such that at least water vapour-exchanging communication with the surrounding area is maintained. The carrier functions as buffer and support for the filter layer and also as pre-filter which blocks particles from the first size, while the actual filter layer will also exclude smaller particles of a dimension between the first and second sizes. The carrier is permeable here to both moisture and water vapour, while the filter layer is at least vapour-permeable. The cavity of the plate material is therefore also hermetically sealed to these small particles while an adequate moisture management nevertheless remains available inside the cavity.

[0008] The filter layer can be embodied per se in various ways with a breathing membrane. A first preferred embodiment of the sealing tape and plate material has in this respect the feature that the filter layer comprises a film forming the membrane, and a more particular embodiment that the film comprises a porous polytetrafluoroethylene film. Such a membrane film is commercially available under various brand names, among others the brand name Gore-Tex®, and has the characteristic feature that it is to a certain extent permeable to water vapour while the material is substantially watertight up to a certain hydrostatic pressure. The present invention couples an additional feature hereto, namely that particles from the second size will also be blocked thereby. The membrane is preferably embodied here such that said hydrostatic pressure is minimal, for instance in the order of only several pascal, so as to form a minimal barrier to condensation, also in the liquid phase. This is particularly advantageous when the plate material is applied at an incline, for instance as roof or covering.

[0009] A second preferred embodiment of the sealing tape and plate material has in this respect the feature that the filter layer comprises a foam with cells which are separated from each other by a wall forming the membrane, and in a more particular embodiment the foam

comprises a hydrophilic foam, more particularly a hydrophilic polyurethane foam. Foamed plastics in particular are suitable in this respect for application within the scope of the invention because of their durability. Ultrathin cell walls are formed during foaming which are found to be to great extent dust-tight but sufficiently thin and 'open' to nevertheless breathe and allow passage of water vapour. This process can be precisely controlled and managed using so-called foaming agents, whereby the wall thickness of the cell walls and other properties of the foam can be influenced.

[0010] Successful results have already been achieved in this context with hydrophilic polyurethane foam. The hydrophilic foam layer functions here as it were as moisture buffer which absorbs and slowly but surely relinquishes condensation from the cavity in both vapour form and liquid form which is then evacuated. The filter layer thus contributes in significant measure toward a reduction in visible condensation and staining caused thereby in the cavity.

[0011] A further preferred embodiment of the plate material and the sealing tape is characterized according to the invention in that the carrier comprises a porous hydrophilic material. The hydrophilic carrier thus enhances moisture transport from or to the filter layer. Exceptionally good results have been achieved in this respect with a particular embodiment of the sealing tape and plate material according to the invention which is characterized in that the carrier comprises a non-woven tape of hydrophilic synthetic fibres, in particular hydrophilic (coated) polyester fibres.

[0012] A particularly practical embodiment of the plate material and sealing tape according to the invention has the feature that the carrier comprises adhesive strips which adhere to the longitudinal sides and with which the tape is fixed, and that the filter layer is optionally arranged on the same main surface between the adhesive strips on the carrier. The sealing tape can be arranged here by being glued simultaneously, or be provided beforehand at the position of the adhesive strips with a (self-)adhesive layer which is covered until the moment of adhesion with a protective film, for instance of silicone paper. In order to enhance an effective transport of moisture from the carrier to the outside via the filter layer a particular embodiment of the sealing tape and the plate material has the feature here according to the invention that the carrier comprises the filter layer on a side remote from the adhesive strips. Evacuation of moisture thus remains possible in accordance with the above described mechanism even if the filter layer breathes and is vapour-permeable but to a certain extent leakproof.

[0013] A further particular embodiment of the plate material and sealing tape is characterized according to the invention in that the carrier is provided on a side remote from the adhesive strips with a hydrophobic masking layer in a pattern completely sealing the carrier locally but leaving it clear elsewhere. The hydrophobic masking layer functions here as a barrier to moisture which could

otherwise penetrate from outside through the sealing tape into the cavity. Sufficient surface area of the carrier can nevertheless remain free thereof so that the overall breathing and (water) vapour-permeable capacity of the sealing tape is not thereby compromised.

[0014] In a typical specific embodiment the plate material and the sealing tape are characterized according to the invention in that the first size lies in a range of about 1 to 20 micron and the second size in a range of about 25 to 50 micron.

[0015] The invention also relates to a sealing tape of the type as applied in the above described multi-walled plate material according to invention, and will be further elucidated hereinbelow on the basis of a number of exemplary embodiments and an associated drawing. In the drawing:

- figure 1 shows a cross-section of an exemplary embodiment of a multi-walled plate material according to the invention;
- figure 2 shows a longitudinal section of an end surface of the plate material of figure 1 sealed with a sealing tape according to the invention;
- figure 3 shows a first exemplary embodiment of a sealing tape according to the invention for application with a multi-walled plate material;
- figure 4 shows a second exemplary embodiment of a sealing tape according to the invention for application with a multi-walled plate material;
- figure 5 shows a third exemplary embodiment of a sealing tape according to the invention for application with a multi-walled plate material; and
- figure 6 shows a fourth exemplary embodiment of a sealing tape according to the invention for application with a multi-walled plate material.

[0016] The figures are schematic and not always drawn to the same scale. Some dimensions in particular may be exaggerated to greater or lesser extent for the sake of clarity.

[0017] Corresponding parts are generally designated with the same reference numerals.

[0018] Figure 1 shows a double-walled plate material constructed from a first plate body 10 and a second plate body 20 which are separated from each other and held at a distance from each other by a number of parallel ribs 25. In this example use is made for these parts of a wholly transparent plastic such as polymethyl methacrylate (PMMA) or polycarbonate, and the parts are glued together. Thus situated between the two plate bodies are a number of mutually parallel cavity channels 15 which are separated from each other by intermediate walls 25 and which impart thermally excellent insulating properties to the plate material. The cavity channels finally debouch at an opposite end surface of the plate material, one of which is shown in figure 2.

[0019] Cavity channels 15 open with a cavity opening

16 on the end surfaces. In order to prevent dust particles and micro-organisms penetrating into cavity channels 15 the cavity openings of the successive cavity channels 15 are sealed with a sealing tape 30 according to the invention. This sealing tape 30 is dust-tight but breathing and thereby allows more or less free passage of water vapour. Sealing tape 30 extends over a whole end surface and is in turn covered with a closing profile 40 of aluminium or a suitable plastic. This closing profile maintains internally a distance from the breathing surface of sealing tape 30 which hereby retains the breathing and optionally a drainage capacity.

[0020] The sealing tape of figure 2 is shown in more detail in figure 3. It comprises a breathing carrier 31 in the form of a non-woven textile of hydrophilic synthetic fibres, in this example of polyester fibres which have been provided with a hydrophilic coating. The carrier has a thickness in the order of 200 to 900 micron and, because of its hydrophilic properties, is highly capable of transporting condensation moisture possibly occurring in cavity channels 16. Carrier 31 comprises on opposite longitudinal sides adhesive strips at the position of which an adhesive layer 33 is arranged for the purpose of being folded round the outer end of the plate material and being adhered to the surface of the first and second plate bodies 10,20. This adhesion is further supported by closing profile 40 which is pushed tightly over the sealing tape and will exert a certain clamping force on adhesive strips 33.

[0021] Carrier 31 with its more or less random non-woven structure is able to filter dust particles and micro-organisms from a first size in the order of 25 to 50 micron, but will allow passage of smaller particles and micro-organisms. In this example carrier 31 has a micro-fine pore structure with an average pore size in the order of 30 micron. In combination with the hydrophilic properties of the carrier material, carrier 31 is permeable to both water and water vapour and is in addition able to absorb and thus buffer a relatively large amount of water.

[0022] In order to also be able to exclude smaller particles from cavity channels 16 the carrier 31 is provided in a central zone with a filter layer 32 which is able to effectively block particles from a second size in the order of 10 to 20 micron. Filter layer 32 comprises for this purpose a breathing microporous membrane film with micropores of the stated fine dimensions, in this example a stretched polytetrafluoroethylene film, which is freely available commercially under for instance the brand name Gore-Tex®, or similar film. Film 32 is glued to carrier 31 along opposite longitudinal edges thereof and retains its breathing and filtering properties therebetween. In the embodiment of figure 3 the filter layer 32 is provided solely in the central zone of carrier 31, although the filter layer can instead also be arranged over the whole surface area. What is important here is that the cavity openings 16 will always be fully covered as shown in figure 2.

[0023] Figure 4 shows a second exemplary embodiment of a sealing tape according to the invention which can be applied as alternative. This embodiment is largely

similar to that of figure 3, although in this example a microporous foam layer 32 is arranged as filter layer on the carrier instead of a microporous membrane film. Use is made here of hydrophilic polyurethane foam, although other foamed plastics can also be applied instead. The cells of the foam formed herefrom are separated from each other by extremely thin cell walls, wherein because of their small thickness the cell walls retain a breathing and moisture-permeable capacity while being to large extent dust-tight for particles from a second size of only several micron or even less than one micron. The foam of this example is dust-tight for particles from in the order of about 5 micron.

[0024] The foam layer is advantageously foamed directly onto the carrier, thereby ensuring an adequate mutual adhesion. This process can be controlled in great measure using so-called foaming agents, whereby a cell wall thickness, a cell size and hydrophilic properties are adjustable. In addition to being substantially dust-tight for even very small particles in the order of only several micron or even smaller because of the microporosity of the walls and the cell structure constructed therefrom, such a foam has a high swelling capacity upon contact with water. It is hereby able to take up and absorb more than its own original volume of moisture and then gradually allow passage thereof. Such a foam is therefore highly suitable for the application described here.

[0025] A third exemplary embodiment of a sealing tape according to the invention is shown in figure 5. In this example filter layer 32 is not arranged on a side of the carrier remote from adhesive strips 33 but on the same side. Filter layer 32 is preferably also water-permeable in such a case in order to also allow draining of condensation in the liquid phase.

[0026] In order to prevent moisture transport from outside to inside the cavity via the sealing tape, a hydrophobic masking layer 35 can be provided on the tape which fully seals the tape at the position of a pattern arranged therein but leaves the pattern clear in between, as shown by way of illustration in the exemplary embodiment of figure 6. Masking layer 35 comprises for instance a watertight hydrophobic ink or glue arranged by means of screenprinting or printing on carrier 31. The hydrophobic properties hereof impart a great water-repellent character to the tape despite the hydrophilic properties of the carrier located thereunder. A lesser or greater water repellence of the sealing tape can be adjusted by selecting a finer or coarser pattern of the carrier.

[0027] Although the invention has been further elucidated above solely on the basis of a single exemplary embodiment, it will be apparent that the invention is by no means limited thereto. On the contrary, many variations and embodiments are still possible within the scope of the invention for a person with ordinary skill in the art.

[0028] Although the invention has been further elucidated on the basis of double-walled plate material, the invention can likewise be applied in multi-walled plate material assembled from more than two plate bodies with

cavity channels between them in each case. The materials and dimensions which have been given, although being particularly practical in use, are exchangeable for other materials and dimensions, particularly when a specific application requires this.

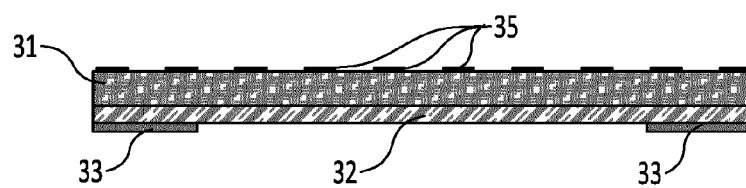
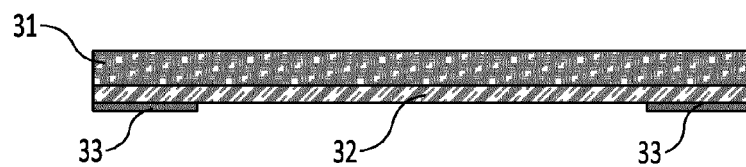
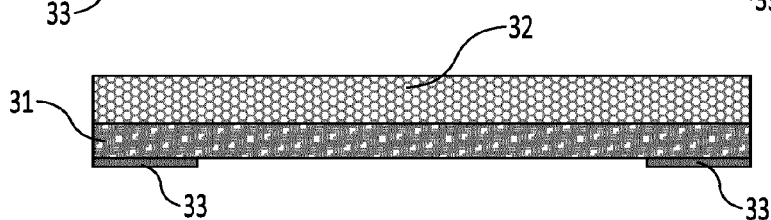
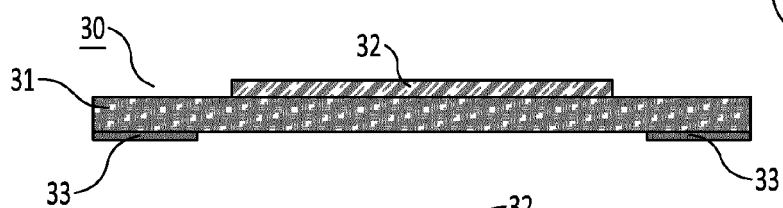
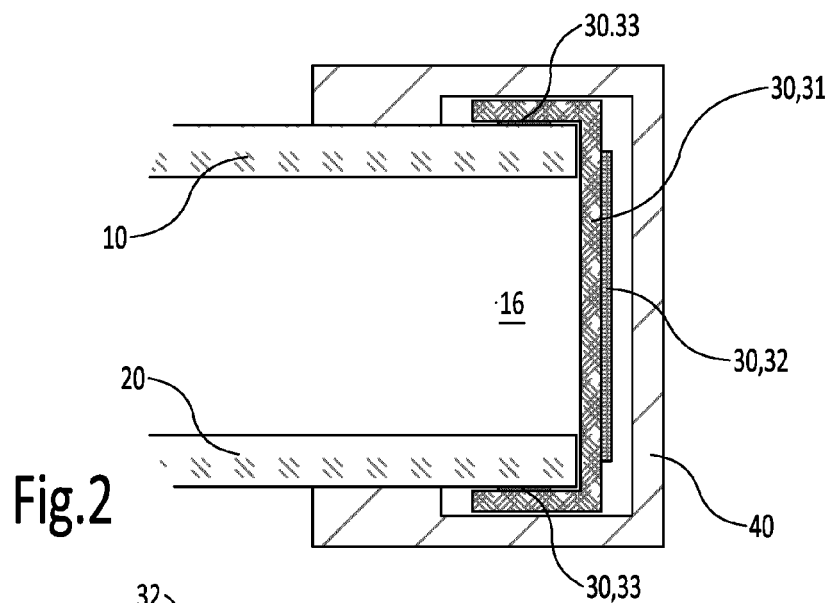
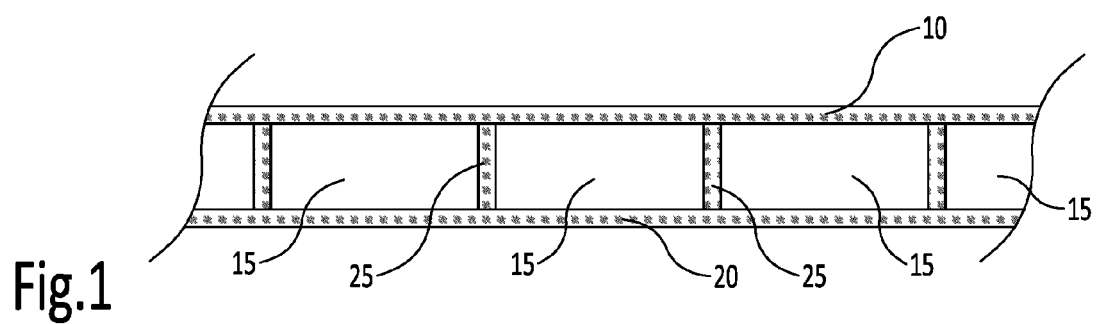
[0029] The plate material can be applied horizontally, optionally at an incline, and vertically, for instance as partition wall. In this latter case in particular an upper outer end of the plate material will be sealed with a sealing tape according to the invention in order to enhance natural ventilation of the cavity, although the same manner of sealing can also be applied at a lower outer end.

[0030] Both the given embodiments of the filter layer can be arranged internally as well as externally of the carrier and here be provided full-face, i.e. over the whole surface, or only in one or more zones of the carrier. In this latter case the zones will in any case lie over a full cross-sectional area of the cavity opening(s).

Claims

1. Multi-walled plate material comprising a first plate body and a second plate body which are separated from each other by at least one intermediate cavity, which cavity opens with a cavity opening on at least one outer end, wherein the cavity is sealed at the outer end with a breathing sealing tape which is at least substantially dust-tight but water vapour-permeable, **characterized in that** the sealing tape comprises a micro-porous carrier with at least a breathing zone which is permeable to water and water vapour but is dust-tight for particles from a first size, that at least the zone of the carrier is covered with a filter layer which comprises at least one breathing membrane wall which is at least water vapour-permeable but dust-tight for particles from a second size, which second size is smaller than the first size, and that the tape is folded with at least the carrier round the outer end of both plate bodies and is received with opposite longitudinal sides above respective edge parts of the first plate body and the second plate body, wherein the filter layer extends at least over the cavity opening.
2. Multi-walled plate material as claimed in claim 1, **characterized in that** the filter layer comprises a film forming the membrane.
3. Multi-walled plate material as claimed in claim 2, **characterized in that** the film comprises a porous polytetrafluoroethylene film.
4. Multi-walled plate material as claimed in claim 1, **characterized in that** the filter layer comprises a foam with cells which are separated from each other by a wall forming the membrane.

5. Multi-walled plate material as claimed in claim 4, **characterized in that** the foam comprises a hydrophilic foam.
6. Multi-walled plate material as claimed in claim 4 or 5, **characterized in that** the foam comprises a polyurethane foam.
7. Multi-walled plate material as claimed in one or more of the foregoing claims, **characterized in that** the carrier comprises a porous hydrophilic material.
8. Multi-walled plate material as claimed in claim 6, **characterized in that** the carrier comprises a non-woven tape of hydrophilic synthetic fibres, in particular polyester fibres.
9. Multi-walled plate material as claimed in one or more of the foregoing claims, **characterized in that** the carrier comprises adhesive strips which adhere to the longitudinal sides and with which the tape is fixed, and that the filter layer is optionally arranged on the same main surface between the adhesive strips on the carrier.
10. Multi-walled plate material as claimed in claim 9, **characterized in that** the carrier comprises the filter layer on a side remote from the adhesive strips.
11. Multi-walled plate material as claimed in one or more of the foregoing claims, **characterized in that** the carrier is provided on a side remote from the filter layer with a hydrophobic masking layer in a pattern completely sealing the carrier locally but leaving it clear elsewhere.
12. Multi-walled plate material as claimed in one or more of the foregoing claims, **characterized in that** the first size lies in a range of about 1 to 20 micron and the second size in a range of about 25 to 50 micron.
13. Sealing tape of the type as applied in the multi-walled plate material as claimed in one or more of the foregoing claims.





EUROPEAN SEARCH REPORT

Application Number
EP 15 16 1515

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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