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(54) **Portable microwave drying apparatus**

Tragbares Gerät zur Trocknung mittels Mikrowellen
Dispositif portable de séchage utilisant des micro-ondes

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Description

[0001] The present invention relates to a portable drying apparatus for drying structures by means of microwaves, said apparatus comprising a housing divided by a partition into two compartments, the first compartment thereof housing a magnetron and the second compartment constituting an application chamber for radiation, which is confined by said partition and metal side walls on five flanks, the sixth flank being permeable to radiation for the transmission of radiated power from the application chamber to a structure to be dried. This type of drying apparatus is disclosed in the Applicant's patent publication

EP 555,257.

[0002] An object of the invention is to provide a cost-efficient drying apparatus, wherein the matching of power transmission and uniformity of field are improved while avoiding the reflection of energy back to the magnetron.

[0003] This object is achieved on the basis of the characterizing features set forth in the appended claim 1. The dependent claims disclose preferred embodiments of the invention for optimizing the fulfilment of the above objective.

[0004] One exemplary embodiment of the invention will now be described in more detail with reference made to the accompanying drawing, which shows a drying apparatus of the invention in a lateral view and partially cut away as far as an application chamber 2 is concerned.

[0005] A substantially cubic-shaped housing 1 is made of metal sheets and the housing dimensions can be e.g. 40 cm x 40 cm x 40 cm. The housing is divided by a partition 13 into two compartments, the first housing a magnetron 4 functioning as a radiation-generating power source and the second compartment constituting an application chamber 2, functioning as a radiation transmission antenna and confined by the partition 13 and metal side walls 3 on five flanks. The application chamber 2 has a sixth flank which is permeable to radiation for the transmission of radiated power from the chamber 2 to a structure to be dried.

[0006] As its power source, the apparatus employs a conventional technical unit of a home microwave oven, comprising the magnetron 4 provided with a drive circuit, an operating switch 5, and a wave tube 7. The housing element of a home microwave oven or at least part of its housing element is removed in order to fit the unit as a power source in the housing 1. The magnetron-fitted power source 4 is positioned in such a way that a transmission aperture 8 of the wave tube 7 coincides with an aperture present in the partition 13.

[0007] The application chamber 2 is provided with a metal reflector cone, supported by a dielectric plate 10 and having its apex pointing towards the transmission aperture 8 of the wave tube 7. A plane wave propagating directly down from the aperture 8 reflects from the surface of a cone 9 by way of the walls of the application chamber 2 downwards in a more uniformly distributed fashion. The dielectric plate 10, placed at a proper height and having a proper thickness, contributes to a uniform distribution of the field and at the same time constitutes a support for the cone 9. Preferably, the plate 10 is distanced from a plane defined by the edges of the open flank of the chamber 2 by a spacing S which is within the range of 60 -100 mm. The plate 10 has a thickness which is e.g. about 1/4 of the length of an applied wave as the wave propagates in a dielectric material constituting the plate 10. The plate thickness is e.g. about 20 mm, if the microwave has a frequency of 2,4 GHz. The reflector cone 9 has a base diameter of e.g. 100 mm and a height of about 100 mm, as well. The cone 9 can be adapted to be vertically movable, if it is desirable to further enhance the uniformity of field.

[0008] The described arrangement is also effective in eliminating the hazardous situation, wherein the power is not able to get out of the chamber 2 e.g. to a dry wall structure but, instead, endeavours to work its way back to the magnetron by way of the wave tube 7. Such a path for back reflection does not exist and, hence, a possible back reflection remains highly insignificant.

[0009] The wall of the wave tube 7 opposite to a radiation source 6 of the magnetron is set an angle of either 90° or 45° relative to the partition 13. Tests have indicated that good results are obtained with both wall directions. Furthermore, in view of diminishing back reflection and providing a more uniform field, it is beneficial that between the radiation source 6 and the application chamber 2 be fitted a wall of the wave tube 7 for blocking the transmission of radiated power from the radiation source 6 directly into the application chamber 2 and vice versa.

[0010] The application chamber 2 has the edges of its open flank fitted with microswitches 11, which operate as limit switches and which both must be pressed in before the magnetron 4 starts up. This makes sure that radiation cannot be accidentally directed out of the apparatus until the apparatus is set against a surface to be dried, which is capable of absorbing radiation energy.

[0011] The housing 1 has two opposite walls 3 thereof provided with sliding wall sections 12 which, in an extended condition, constitute triangular extensions for the stationary box walls 3. When the walls 12 are in an extended condition, the application chamber 2 can be fitted tightly against a corner defined by walls or by a wall and a floor.

[0012] The housing 1 is further provided with a handle 14 for carrying the apparatus along.

[0013] An apparatus of the invention can be used for drying, directly from the surface of a structure without damaging

the structures, e.g. external and partition walls of buildings, pillars, balconies, sub-floors, underground passages, floors, basement structures, and roofs in new construction as well as at renovation sites. For example, wet and damaged bathroom wall and floor coverings are removed. Wet floats and cements are dressed and milled down to the neat concrete or brick surface, followed by drying the wall and floor structures by means of an apparatus of the invention. This speeds up renovation work.

Claims

1. A portable drying apparatus for drying structures by means of microwaves, said apparatus comprising a housing (1) divided by a partition (13) into compartments, the first compartment thereof housing a magnetron (4) coupled to a wave tube (7) for guiding the microwaves and the second compartment constituting an application chamber (2) for radiation, which is confined by said partition (13) and metal side walls (3) on five flanks, the sixth flank being permeable to radiation for the transmission of radiated power from the application chamber (2) to a structure to be dried, **characterized in that** the wave tube (7) has a transmission aperture (8) positioned so as to coincide with an aperture present in the partition (13), and that the application chamber (2) houses a metal reflector cone (9), supported by a dielectric plate (10) and having its apex pointing towards the transmission aperture (8) of the wave tube (7).
2. An apparatus as set forth in claim 1, **characterized in that** the dielectric plate (10) is distanced by a spacing (S) of 60-100 mm from a plane defined by edges (11) of the open flank of the application chamber (2).
3. An apparatus as set forth in claim 1 or 2, **characterized in that** the housing (1) has dimensions which in centimeters are about 40x40x40, and that the partition (13) divides the housing into substantially equal compartments.
4. An apparatus as set forth in any of claims 1-3, **characterized in that** the dielectric plate (10) has a thickness which is about 1/4 of the length of an applied wave as the wave propagates in a dielectric material constituting said plate.
5. An apparatus as set forth in any of claims 1-4, **characterized in that** the wall of the wave tube (7) located opposite to a radiation source (6) of the magnetron (4) is positioned at an angle of either 90° or 45° relative to the partition (13).
6. An apparatus as set forth in any of claims 1-5, **characterized in that** between the radiation source (6) and the application chamber (2) is a wall of the wave tube (7) for blocking the transmission of radiated power from the radiation source (6) directly into the application chamber (2).
7. An apparatus as set forth in any of claims 1-6, **characterized in that** the housing (1) has two opposite walls (3) thereof provided with sliding wall sections (12) which, in an extended condition, constitute triangular extensions for the stationary box walls (3) for fitting the application chamber (2) tightly against a corner defined by structures to be dried, such as walls or a wall and a floor.

Patentansprüche

1. Eine tragbare Trockenvorrichtung zum Trocknen von Strukturen mit Hilfe von Mikrowellen, wobei die Vorrichtung ein Gehäuse (1) aufweist, das durch eine Partition (13) in zwei Fächer unterteilt ist, wobei das erste Fach desselben ein Magnetron (4) häust, das mit einer Wellenröhre (7) zum Leiten der Mikrowellen gekoppelt ist, und das zweite Fach eine Zuführkammer (2) für Strahlung bildet, das durch die Partition (13) und die Metallseitenwände (3) an fünf Flanken begrenzt ist, wobei die sechste Flanke durchlässig für Strahlung für die Übertragung von abgestrahlter Leistung von der Zuführkammer (2) zu einer Struktur ist, die getrocknet werden soll, **dadurch gekennzeichnet, dass** die Wellenröhre (7) eine Übertragungsapertur (8) aufweist, die positioniert ist, um mit einer Apertur zusammenzufallen, die in der Partition (13) vorhanden ist, und dass die Zuführkammer (2) einen Metallreflektorkegel (9) häust, der durch eine dielektrische Platte (10) getragen wird und seine Spitze derart aufweist, dass sie hin zu der Übertragungsöffnung (8) der Wellenröhre (7) zeigt.
2. Eine Vorrichtung gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die dielektrische Platte (10) um eine Beabstandung (S) von 60-100 mm von einer Ebene distanziert ist, die durch Ränder (11) der offenen Flanke der Zuführkammer (2) definiert ist.
3. Eine Vorrichtung gemäß Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** das Gehäuse (1) Dimensionen auf-

weist, die in Zentimetern ungefähr 40 x 40 x 40 sind, und dass die Partition (13) das Gehäuse im Wesentlichen in gleiche Fächer unterteilt.

4. Eine Vorrichtung gemäß einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** die dielektrische Platte (10) eine Dicke aufweist, die ungefähr 1/4 der Länge einer zugeführten Welle ist, wenn sich die Welle in einem dielektrischen Material ausbreitet, das die Platte bildet.
5. Eine Vorrichtung gemäß einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** die Wand der Wellenröhre (7), die gegenüber einer Strahlungsquelle (6) des Magnetrons angeordnet ist, in einem Winkel von entweder 90° oder 45° relativ zu der Partition (13) positioniert ist.
6. Eine Vorrichtung gemäß einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** zwischen der Strahlungsquelle (6) und der Zuführkammer (2) eine Wand der Wellenröhre (7) zum Blockieren der Übertragung von abgestrahlter Leistung von der Strahlungsquelle (6) direkt in die Zuführkammer (2) vorliegt.
7. Eine Vorrichtung gemäß einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** das Gehäuse (1) zwei gegenüberliegende Wände (3) desselben aufweist, die mit Schiebewandabschnitten (12) versehen sind, die in einem ausgefahrenen Zustand dreieckige Erweiterungen für die stationären Kastenwände (3) bilden, zum engen Einpassen der Zuführkammer (2) gegen eine Ecke, die durch Strukturen definiert ist, die getrocknet werden sollen, wie z.B. Wände oder eine Wand und einen Boden.

Revendications

1. Appareil de séchage portable pour sécher des structures au moyen de micro-ondes, ledit appareil comprenant un boîtier (1) séparé par une cloison (13) en deux compartiments, le premier compartiment du boîtier abritant un magnétron (4) couplé à un tube à ondes (7) pour guider les micro-ondes et le second compartiment constituant une chambre d'application (2) pour les rayonnements, qui est confinée par ladite cloison (13) et des parois latérales en métal (3) sur cinq flancs, le sixième flanc étant perméable aux rayonnements pour transmettre la puissance irradiée depuis la chambre d'application (2) vers une structure à sécher, **caractérisé en ce que** le tube à ondes (7) comporte une ouverture de transmission (8) située de façon à coïncider avec une ouverture présente dans la cloison (13), et que la chambre d'application (2) abrite un cône réflecteur métallique (9), soutenu par une plaque diélectrique (10) et dont l'extrémité pointe en direction de l'ouverture de transmission (8) du tube à ondes (7).
2. Appareil selon la revendication 1, **caractérisé en ce que** la plaque diélectrique (10) est située à une distance (D) comprise entre 60 et 100 mm par rapport à un plan défini par les bords (11) du flanc ouvert de la chambre d'application (2).
3. Appareil selon la revendication 1 ou 2, **caractérisé en ce que** le boîtier (1) a des dimensions qui, en centimètres, avoisinent 40 x 40 x 40, et **en ce que** la cloison (13) sépare le boîtier en des compartiments sensiblement égaux.
4. Appareil selon l'une quelconque des revendications 1 à 3, **caractérisé en ce que** l'épaisseur de la plaque diélectrique (10) avoisine 1/4 de la longueur d'une onde appliquée au fur et à mesure de sa propagation dans un matériau diélectrique constituant ladite plaque.
5. Appareil selon l'une quelconque des revendications 1 à 4, **caractérisé en ce que** la paroi du tube à ondes (7) située à l'opposé d'une source de rayonnement (6) du magnétron (4) est placée à un angle de 90 ou de 45 par rapport à la cloison (13).
6. Appareil selon l'une quelconque des revendications 1 à 5, **caractérisé en ce qu'il** existe entre la source de rayonnement (6) et la chambre d'application (2) une paroi du tube à ondes (7) pour bloquer la transmission de la puissance irradiée depuis la source de rayonnement (6) directement dans la chambre d'application (2).
7. Appareil selon l'une quelconque des revendications 1 à 6, **caractérisé en ce que** le boîtier (1) comporte deux cloisons opposées (3) pourvues de sections de parois coulissantes (12) qui, en condition étirée, constituent des extensions triangulaires pour les parois de boîte fixes (3) destinées à ajuster la chambre d'application (2) de façon étanche par rapport à un angle défini par les structures à sécher, telles que les parois ou une paroi et un plancher.

