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(54) **METHOD AND DEVICE FOR CONTROL OF MITE IN BEDS**

VERFAHREN UND VORRICHTUNG ZUR BEKÄMPFUNG VON MILBEN IN BETTEN

PROCEDE ET DISPOSITIF POUR LUTTER CONTRE LES ACARIENS DANS LES LITS

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- **PATENT ABSTRACTS OF JAPAN, Vol. 14, No. 412, C-755; & JP,A,02 156 984 (DAIKIN IND LTD), 15 June 1990.**

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Description

[0001] The present invention relates to a method of controlling house dust mites in beds in accordance with the preamble of the independent method Claim, and bed mite controlling apparatus according to the preamble of the independent apparatus Claim.

[0002] JP-A-62097597 reveals an air distributor by which hot air is blown toward the surface of a bed mattress, for example, on which the distributor has been laid, so as to kill ticks.

[0003] GB-A-2 283 174 reveals enclosing a bed in a cover and heating and blowing the air within the cover, so that mites in the bed will be killed by the heat.

[0004] House dust mites thrive in the dwellings of warm-blooded animals. The mites live on epithelium, from human beings, among others. The mites therefore thrive and propagate best in bedding and in mattresses.

[0005] The excretion from house dust mites is highly allergenic. This allergen is one of the most common of the allergens, parallel with pollen and animal epithelium , to which human beings are subjected. The allergy frequency is directly associated with the amount of mites in the environment. Recent reports have shown that the occurrence of mites in dwellings in Sweden is increasing.

[0006] It is estimated that in Sweden alone, there are about 100,000 people suffering from mite allergy and that about two million people in Sweden live in an environment in which mite allergy is likely to develop.

[0007] The only commercially available agents against mite allergy are semi-permeable protective covers for mattresses blankets, pillows bedspreads etc which encapsulate the mite allergen in the bed of the person concerned. These protective covers, however, are expensive (from about SEK 1,500.00 and higher for each standard bed) and have the drawback of rustling. In order to achieve the best effect, it is recommended that the bed is left unmade in the morning, that mattress and bedding are aired in the open during the day, that sheets are preferably washed each week, and that blankets are washed each month. Although these protective measures afford a certain through-passage of air, they do not prevent mites and their excretion from passing through the guard. Thus, mites remain living in mattresses, pillows and blankets, etc and are able to propagate freely. The known protective measures do therefore not remove the antigenic substances.

[0008] Accordingly, the object of the invention is to provide a method and an apparatus for controlling bed mites and therewith the production of allergenic substances.

[0009] This object is achieved by the inventive method defined in the independent method Claim. The object is also achieved by the inventive apparatus defined in the independent apparatus Claim.

[0010] Further embodiments of the invention are defined in the accompanying dependent Claims.

[0011] The invention is based on the realization that the growth of mites can be effectively prevented at humidities beneath about 7 g water per kilo air, which corresponds approximately to a 50% relative humidity at +21°C.

[0012] The increasing occurrence of mites in Swedish dwellings finds its explanation in the fact that humidity in Swedish buildings/dwellings has increased as a result of less effective ventilation, among other things.

[0013] Astigmata mites (house dust mites, storeroom mites, itch-mites) have no lungs and breathe through their skin. The mites are unable to drink and therefore obtain liquid through their skin and also through solid food. The mites therefore depend on a high humidity. Mites, which are microscopic arachnids , have a life span of about twenty-one days. Mites thrive best in temperatures in the range of +25°C to +30°C, and at a relative humidity of 65-80%. However, the growth of mites is inhibited effectively at humidities beneath 7 g per kilo (50% relative humidity at +21°C). A lowly active person (at sleep or at rest) discharges about 40 g water per hour, this water discharge constituting an important bed moisture source. According to the invention, it is important, above all else, to remove bed moisture deriving from the moisture discharged by said person, for instance, during the time in which the bed is not used.

[0014] The occurrence of mites in beds/bedding is reduced or eliminated by removing the primary survival conditions for mites, i.e. the moisture. This is achieved in accordance with the invention by passing through the lying surface of the bed/the mattress an air flow that has a moisture content of less than 7 g/kg, so as to take up moisture therefrom. The injection of air through the bed/mattress can be terminated when the humidity of the exhaust air from said bed/mattress is beneath 7 g/kg air. Naturally, the moisture content of the lying surface can be measured directly with known methods, so as to obtain an indication that the air blown through the bed/mattress has removed the mite life supporting conditions. The air is conveniently blown in a direction normal to the lying surface of the mattress or pillow, for instance from without and inwards or from within and outwards. According to the invention, the bed, or bedstead, may be fitted with an individual air blower for blowing air through the lying surface of the bed. This blower may conveniently be provided with an air filter. The blower may also serve several beds.

[0015] The moisture content of the air will be lowered before the air is blown through the mattress or pillows. This reduction in moisture content can be achieved in a conventional manner, by demoisturizing the supply air.

[0016] It will, however, be obvious that a bed need not necessarily be provided with its own fan, since air can be caused to pass through the lying surface of the mattress/bed by connecting the mattress or pillows to a source of subpressure (a central vacuum cleaner), or to a compressed air outlet (often provided in hospital wards).

[0017] According to one embodiment of the invention at present preferred, blowing of air through the lying surface is controlled by a timer, so that the air will be blown through the lying surface during those times at which the bed is not used for sleeping purposes. This ensures that the person using the bed will not be disturbed by draughts, fan noise, etc., associated with mite control.

[0018] This control of the air blown through said lying surface may also include a sensor which detects bed moisture content and activates the blower solely when the need arises. Alternatively, there may be provided sensor means that detect the moisture level of the exhaust air and which cuts-off the air supply when the moisture content of the exhaust air falls beneath a predetermined value.

[0019] The bed/mattress are permeable to air over the whole of their effective lying surface, and for this reason the outer bed covering comprises a generally air-permeable material so as to allow air to pass therethrough. In this regard, the mattress may include an air distributing system, for instance an air distributing chamber or a distributing chamber system, so as to provide uniform distribution of through-passing air across the lying surface. In the case of interior sprung mattresses, the spring accommodating space can be used as an air distributing chamber.

[0020] In the case of plastic foam mattresses or foamed rubber mattresses, the uppermost layer of the mattress may be formed from foam that has open air-permeable cells, wherein an air distributing system, for instance a perforated hose, may be laid in a loop between the uppermost mattress layer and the mattress layer immediately therebeneath.

[0021] It is known to pump air through spring mattresses and plastic foam mattresses, and also through an armchair with the intention of improving lying comfort/sitting comfort as a result of air blown through the user-contacting surface over substantially the whole of this surface. It is also known in this regard to heat or cool the air to further enhance the comfort of the user. See for instance DE-B-1,654,400, US-A-4,825,488, US-A-3,266,064, DE-A-1,654,384 and DE-A-1,778,130. However, none of these patent documents disclose that mites can be controlled by demoisturized air injection or that mites can be controlled by blowing demoisturized air through bedding surfaces that have come into contact with a person, such as to dry these surfaces to a moisture content at which mites are no longer able to survive. Furthermore, the known technique requires air to be blown through the mattress while the bed is occupied.

[0022] The invention will now be described in more detail with reference to an exemplifying embodiment thereof and also with reference to the accompanying drawing.

[0023] Fig. 1 illustrates inventive apparatus comprising a blower device and a mattress served thereby schematically and from above.

[0024] Fig. 2 is a schematic section view taken on the line II-II in Fig. 1.

[0025] Fig. 3 is a schematic view corresponding to Fig. 2 and illustrating an alternative embodiment of the invention.

[0026] Fig. 1 shows from above a mattress 6 which has beneath its outer layer an air distribution conduit 7 having perforations 8 and being positioned to provide a generally uniform flow of air upwardly through the lying surface of the mattress.

[0027] Air is supplied to the conduit 7 by means of an electric air pump 3. The supply air is first fed through an air filter 5 upstream of the pump 3. A sensor G2 is provided for sensing the humidity of the air leaving the air pump 3. G2 activates an air heater 4. The air entering the conduit 7 has a humidity of less than 7 g/kg air. The air passing through the outer layer 62 of the mattress 6 (for instance, a foamed plastic layer) is capable of drying the lying surface of said outer layer 62 to an extent at which mite survival conditions no longer exist. A moisture sensor G1 may be arranged to sense the humidity in the outer layer 62. The sensor G1 may be adapted to stop the air pump 3 and its associated devices (e.g. the heater 4) when the lying surface or outer surface of the mattress or bedding is sufficiently dry for the intended purpose. A timer 2 may be connected in the current supply circuit to the pump 3 and the heater 4, such as to activate the pump and heater during those times when the mattress 6 is not used as a bed, for instance during the day when the owner of the bed is at work.

[0028] It will be understood that the invention does not necessarily require a specially constructed mattress/bed. For instance, it is fully conceivable to use an air distribution device that comprises two textile sheets 71, 72 for instance, having a size corresponding to the size of the bed sheets for instance, these textile sheets 71, 72 being joined mutually around a region that corresponds to the lying surface of the mattress/bed 6 so as to establish between the sheets 71, 72 an air distribution chamber 73 which is connected to an air supply conduit corresponding to the conduit 7 in Fig. 1. The desired air distribution and drying of said surfaces can be achieved by suitable selection of the air-permeability of the sheets 71, 72.

[0029] An air distribution device may also be provided in a pillow, this device comprising, for instance, perforated conduits that are connected to an air pump (suction or pressure) similar to the embodiment shown in Figs. 1 and 2.

[0030] Bed moisture is concentrated generally on the pillow and mattress, which thus need to be dried by blowing demoisturized air through those surfaces thereof that come into contact with the person lying in the bed. The bed clothes, such as duvet, blankets and the like may, of course, be dried in a corresponding manner, although when the demoisturized air flow is directed vertically upwards, the exhaust flow from the mattress will also act on the undersurfaces of the bed clothes and

therewith dry the bed clothes to a suitable extent.

Claims

1. A method of controlling bed mites, **characterized by** passing through a lying surface on the bed mattress a flow of air whose humidity is lowered by demoisturizing to a level below 7 grams per kilo air, until the moisture content of the lying surface of said mattress which corresponds to the exhaust air leaving said lying surface has a moisture content of at most 7 grams per kilo air.

2. A method according to Claim 1, **characterized by** sensing the humidity of the supply air that shall be passed through the lying surface and, when necessary, lowering the humidity of the supply air to a level beneath 7 grams per kilo air prior to passing said air through the lying surface.

3. A method according to Claim 2, **characterized by** heating the supply air.

4. A method according to any one of Claims 1-3, **characterized by** passing the airflow through the mattress lying surfaces while the bed is not used as a bed.

5. A method according to any one of Claims 1-4, **characterized by** sensing the moisture content of the mattress lying surface or the humidity of the exhaust air leaving the mattress lying surface and stopping the injection of air through said lying surface when the sensed humidity has a value corresponding to at most 7 grams of water per kilo of air in the exhaust air.

6. A method according to any one of Claims 1-5, **characterized by** filtering the supply air prior to passing the air through the mattress.

7. Apparatus for controlling bed mites, **characterized in that** the bed/mattress lying surface is air-permeable (8, 62; 71, 72); and **in that** means (1-5, 7) are provided being adapted for passing a demoisturized air flow having a humidity below 7 grams per kilo air through the lying surface.

8. Apparatus according to Claim 7, **characterized in that** the apparatus includes a moisture sensor (G1) which is adapted to stop the injection of air through the lying surface when the moisture content of the lying surface no longer provides mite survival conditions, wherein the exhaust air from the lying surface has a moisture content of at most 7 grams per kilo air.

9. Apparatus according to Claim 7 or 8, **characterized in that** the air injection means are guided by a timer which allows the air injection means to operate when the bed is not used as a bed.

10. Apparatus according to any one of Claims 7-9, **characterized in that** the apparatus includes sensor means (G2) for sensing the humidity of the supply air, wherein the sensor means is adapted to activate means for lowering the humidity of the supply air prior to passing the supply air into the bed/mattress, so that the air delivered to the bed lying surface will have a humidity below 7 grams per kilo air.

Patentansprüche

1. Verfahren zur Bekämpfung von Bettmilben, **dadurch gekennzeichnet, dass** durch eine Liegeoberfläche auf der Bettenmatratze ein Fluss von Luft durchgeleitet wird, dessen Feuchtigkeit durch Entfeuchten auf ein Niveau von unter 7 g/kg Luft verringert wird, bis dass der Feuchtigkeitsgehalt der Liegeoberfläche der Matratze, welcher mit der die Liegeoberfläche verlassenden Abluft korrespondiert, einen Feuchtigkeitsgehalt von weniger als 7 g/kg Luft aufweist.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** der Feuchtigkeitsgehalt der Zufuhrluft, die durch die Liegeoberfläche durchtreten soll, erfasst wird und, wenn notwendig, der Feuchtigkeitsgehalt der Zufuhrluft auf ein Niveau unterhalb 7 g/kg Luft vor dem Durchleiten der Luft durch die Liegeoberfläche verringert wird.

3. Verfahren nach Anspruch 2, **dadurch gekennzeichnet, dass** die Zufuhrluft erwärmt wird.

4. Verfahren nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** der Luftstrom durch die Liegeoberflächen der Matratze geleitet wird, während das Bett nicht als Bett benutzt wird.

5. Verfahren nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** der Feuchtigkeitsgehalt der Liegeoberfläche der Matratze oder die Feuchtigkeit der die Liegeoberfläche der Matratze verlassenden Abluft sensorisch erfasst. wird und das Einblasen von Luft durch die Liegeoberfläche gestoppt wird, wenn die erfasste Feuchtigkeit einen Wert korrespondierend mit höchstens 7 g Wasser je Kilo Luft in der Abluft aufweist.

6. Verfahren nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** die Zufuhrluft vor der Durchleitung der Luft durch die Matratze gefiltert wird.

7. Vorrichtung zur Bekämpfung von Bettmilben, dadurch h **gekennzeichnet, dass** die Liegeoberfläche des Bettes/der Matratze luftdurchlässig (8, 62; 71, 72) ist und dass Mittel (1-5, 7) bereitgestellt sind, die dazu angepasst sind, einen entfeuchteten Luftstrom mit einer Feuchtigkeit unterhalb von 7 g/kg Luft durch die Liegeoberfläche durchzuleiten.

8. Vorrichtung nach Anspruch 7, **dadurch gekennzeichnet, dass** die Vorrichtung einen Feuchtigkeitssensor (G1) aufweist, welcher angepasst ist, das Einblasen von Luft durch die Liegeoberfläche zu stoppen, wenn der Feuchtigkeitsgehalt der Liegeoberfläche nicht länger Überlebensbedingungen von Milben bereitstellt, wobei die Abluft aus der Liegeoberfläche einen Feuchtigkeitsgehalt von höchstens 7 g/kg Luft aufweist.

9. Vorrichtung nach Anspruch 7 oder 8, **dadurch gekennzeichnet, dass** die Lufteinblasmittel durch einen Zeitgeber geführt sind, welcher den Lufteinblasmitteln gestattet, zu arbeiten, wenn das Bett nicht als Bett benutzt wird.

10. Vorrichtung nach einem der Ansprüche 7 bis 9, **dadurch gekennzeichnet, dass** die Vorrichtung einen Sensor (G2) zur sensorischen Ermittlung der Feuchtigkeit der Zufuhrluft aufweist, wobei der Sensor dazu angepasst ist, Mittel zur Verringerung der Feuchtigkeit der Zufuhrluft vor der Durchleitung der Zufuhrluft in das Bett/die Matratze zu aktivieren, so dass die zu der Liegeoberfläche des Bettes gelieferte Luft eine Feuchtigkeit unterhalb 7 g/kg Luft haben wird.

Revendications

1. Un procédé de lutte contre les acariens de lit **caractérisé par** la traversée d'une surface de couchage sur un matelas de lit par un écoulement de l'air dont l'humidité est rabaissée par assèchement jusqu'à un niveau inférieur à 7 g par kilo d'air, jusqu'à ce que la quantité d'humidité de la surface de couchage du matelas qui correspond à l'air d'échappement quittant ladite surface de couchage présente une quantité d'humidité au maximum de 7 g par kilo d'air.

2. Un procédé selon la revendication 1, **caractérisé par** la mesure de l'humidité de l'air d'alimentation qui doit traverser la surface de couchage, et, lorsque nécessaire, l'abaissement de l'humidité de l'air d'alimentation jusqu'à un niveau inférieur à 7 g par kilo d'air avant de faire traverser la surface de couchage par ledit air.

3. Un procédé selon la revendication 2, **caractérisé par** le chauffage de l'air d'alimentation.

4. Un procédé selon l'une quelconque des revendications 1 à 3, **caractérisé par** la traversée de l'écoulement d'air à travers la surface de couchage du matelas lorsque le lit n'est pas utilisé en tant que lit.

5. Un procédé selon l'une quelconque des revendications 1 à 4, **caractérisé par** la mesure de la quantité d'humidité de la surface de couchage du matelas ou de l'humidité de l'air d'échappement quittant la surface de couchage du matelas et l'interruption de l'injection d'air à travers la surface de couchage lorsque l'humidité mesurée présente une valeur correspondant au maximum à 7 g d'eau par kilo d'air dans l'air d'échappement.

6. Un procédé selon l'une quelconque des revendications 1 à 5, **caractérisé par** le filtrage de l'air d'alimentation avant de lui faire traverser le matelas.

7. Dispositif pour lutter contre les acariens de lit, **caractérisé en ce que** la surface de couchage du lit/matelas est perméable à l'air (8, 62 ; 71, 72), et **en ce que** des moyens (1 à 5, 7) sont utilisés, en étant adaptés pour faire passer un flux d'air asséché présentant une humidité inférieure à 7 g par kilo d'air à travers la surface de couchage.

8. Dispositif selon la revendication 7, **caractérisé en ce que** le dispositif inclut un capteur d'humidité (G1) qui est adapté à stopper l'injection d'air à travers la surface de couchage lorsque la quantité d'humidité de la surface de couchage ne présente plus de conditions permettant la survie d'acariens, dans lequel l'échappement d'air de la surface de couchage présente une quantité d'humidité au maximum de 7 g par kilo d'air.

9. Dispositif selon la revendication 7 ou 8, **caractérisé en ce que** les moyens d'injection d'air sont commandés par un minuteur qui permet aux moyens d'injection d'air de fonctionner lorsque le lit n'est pas utilisé en tant que lit.

10. Dispositif selon l'une quelconque des revendications 7 à 9, **caractérisé en ce que** le dispositif inclut des moyens de captage (G2) pour capter l'humidité de l'air d'alimentation, dans lequel les moyens de captage sont adaptés pour faire fonctionner les moyens pour abaisser l'humidité de l'air d'alimentation avant de faire passer l'air d'alimentation dans le lit/matelas, de sorte que l'air amené à la surface de couchage du lit présentera une humidité inférieure à 7 g par kilo d'air.

Fig.1

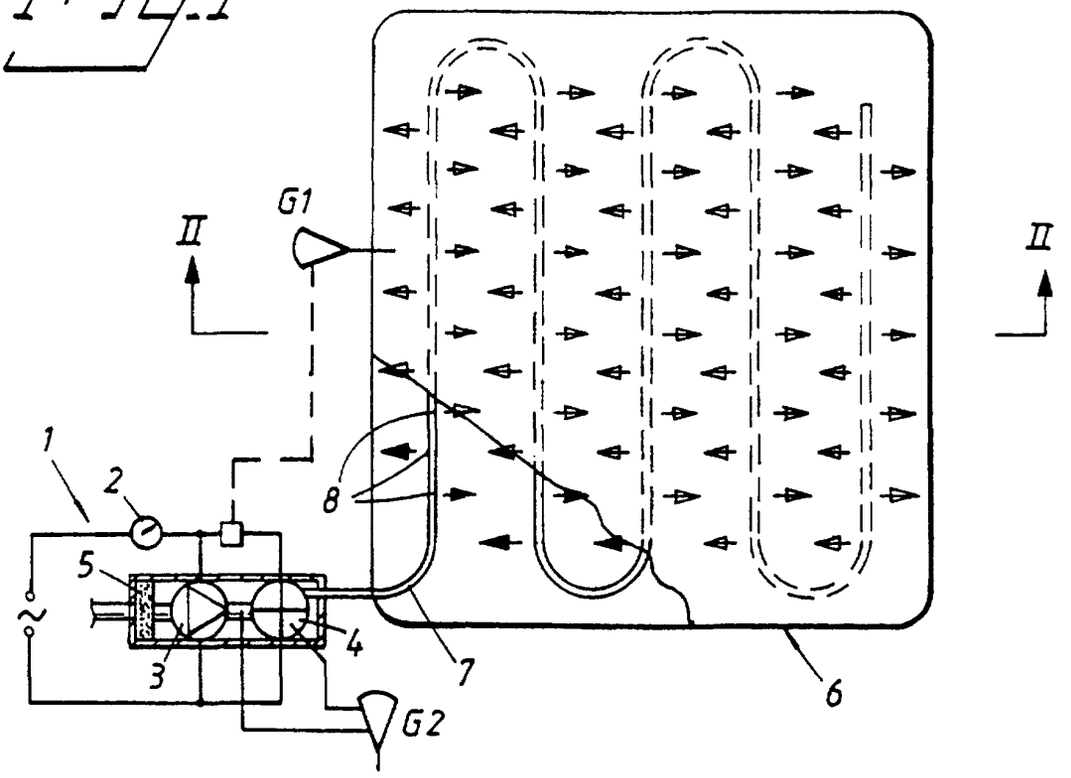

Fig.2

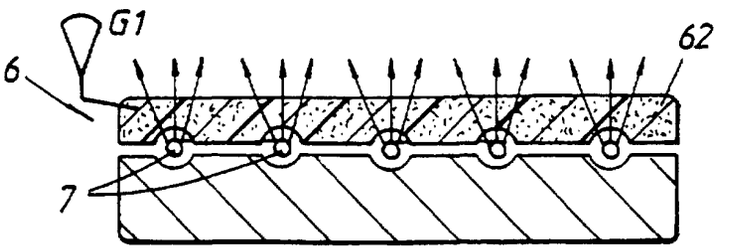

Fig.3