

DESCRIPTION

HEAT TRANSPIRATION METHOD, HEAT TRANSPIRATION
CONTAINER AND HEAT TRANSPIRATION APPARATUS USED IN
THE SAME

5

[TECHNICAL FIELD]

The present invention relates to a heat transpiration method
used for exterminating insects indoors, a heat transpiration
container used in the method, a heat transpiration apparatus for
10 transpiring a chemical used for killing or repelling insects, giving
out fragrant, deodorization or other purpose in a stable manner for
an extended period time, a heat transpiration container and a
method thereof preferably employed for the same, and a method of
controlling the heat transpiration temperature for transpiring an
15 insecticidal technical product indoors.

[BACKGROUND ART]

For heat transpiration of insecticidal chemicals, such
methods have been known as heating an transpiring liquid that
20 moves up in an absorbent wick so as to transpire the transpiring
liquid, and heating an insecticidal chemical adsorbed into a porous
base such as fibrous plate (solid mat) so as to transpire the
insecticide, among others.

In the case of the former method, since the insecticide is used
25 in the form of solution, preparation of the insecticide with water

added thereto leads to poor stability of transpiration which makes the method not suitable for evaporating the chemical over a long time.

Although the latter method using the mat does not employ a solvent, substantial part of the chemical remains without being transpired, and transpiration sustained over a long period of time cannot be expected.

Thus main object of the present invention is to provide a heat transpiration method capable of efficiently transpiring the chemical and a heat transpiration container used for the same.

Another object of the present invention is to provide a heat transpiration apparatus capable of transpiring the chemical stably over a long period of time, a heat transpiration container used for the same and a method thereof.

[DISCLOSURE OF THE INVENTION]

(I)

Through a research to solve the problems described above, the inventors of the present invention found a fact that transpiration of insecticidal chemical with much higher efficiency can be achieved by heating an insecticidal technical product than using an transpiring liquid to which water is added, making it possible to transpire the insecticidal chemical stably over a long period of time, thus completing the present invention. According to the present invention, since the insecticidal technical product is

transpired by heating, it becomes unnecessary to use a solvent for heat transpiration and accordingly to distinguish between water-soluble and oil-based properties as in the case of insecticidal chemical in liquid phase, enabling it to make the container and the
5 apparatus compact.

The heat transpiration method according to the present invention is a method for exterminating or repel vermin that is characterized in that the insecticidal technical product or a modified insecticidal technical product made by adding an additive
10 to the former is heated to transpire.

The insecticidal technical product according to the present invention refers to an insecticide component per se that does not include solvent, and may be a mixture of two or more insecticide components. Since the insecticidal technical product is the
15 insecticide component per se, an insecticidal mat of non-solvent type does not fall within the scope of the present invention. The insecticidal technical product used in the present invention refers to those prepared by adding effectiveness increasing agents, transpiration regulators, particle size regulators, stabilizers,
20 antioxidants, ultraviolet inhibitors and colorants to the insecticidal technical product.

According to the heat transpiration method of the present invention, it is preferable to put the insecticidal technical product or the modified insecticidal technical product in a container and
25 heat the container thereby to transpire the insecticidal technical

product or the modified insecticidal technical product.

The heat transpiration method of the present invention makes it possible to transpire the insecticidal technical product or the modified insecticidal technical product while a gas-permeable film is put into contact with the liquid surface of the insecticidal technical product or the modified insecticidal technical product. This increases the amount of an insecticidal component that is transpired.

The heat transpiration method of the present invention also makes it possible to transpire the insecticidal technical product or the modified insecticidal technical product while the liquid surface of the insecticidal technical product or the modified insecticidal technical product is open to the transpiration space. This increases the amount of the insecticidal component that is transpired. The transpiration space herein refers to a space filled with air from which vermin is to be got rid of by means of the heat transpiration method of the present invention, such as a living room or a kitchen of a residence, factory, aircraft, automobile, railroad car and ship.

For the heat transpiration container used in the heat transpiration method of the present invention as described above, such a container may be used that comprises a container body that houses an insecticidal technical product or a modified insecticidal technical product consisting of the insecticidal technical product and an additive, and a gas-permeable film that closes an transpiration aperture of the container body through which the

insecticidal chemical transpires. Alternatively, such a heat transpiration container may be used that comprises a container body that houses an insecticidal technical product or a modified insecticidal technical product consisting of the insecticidal technical product and an additive, and a gas-permeable film that touches the liquid surface of the insecticidal technical product or the modified insecticidal technical product at least when the insecticidal chemical is heated to transpire.

(II)

10 The heat transpiration apparatus of the present invention comprises a container body that contains a transpiring liquid, an inner film and an outer film that are put one on another and close an transpiration aperture of the container body, feeding means for supplying the transpiring liquid inbetween the inner film and the outer film and a heater that heats the container body, while at least 15 the outer film of the inner film and the outer film is a gas-permeable film.

With such a construction as the inner film and the outer film (gas-permeable films) are put one on another and the transpiring 20 liquid is supplied by the feeding means into the gap between the films, the transpiring liquid spreads by capillary effect between the inner and outer films and makes contact with the inner surface of the outer film over a large area. As a result, since the contact area of the transpiring liquid with the films does not decrease even when 25 the amount of the transpiring liquid contained in the container body

has decreased after use over a long time, stable transpiration is ensured over an extended period of time. To achieve this effect, the inner film and the outer film are put one on another in such a manner as capillary effect phenomenon occurs.

5 In the heat transpiration apparatus of the present invention, the feeding means is preferably a liquid introduction hole provided at a position where the inner film touches the transpiring liquid when the container body is held at such an angle as the transpiring liquid touches the inner film. This configuration makes it possible
10 to quickly supply the transpiring liquid inbetween the inner and outer films when the container body is tilted.

The heat transpiration container of the present invention suitable for use in the heat transpiration apparatus comprises the container body that contains the transpiring liquid and the inner
15 film and the outer film that are put one on another and close the transpiration aperture of the container, wherein at least the outer film among the inner film and the outer film is a gas-permeable film. The heat transpiration container of the present invention may be embossed to form a channel for supplying the transpiring liquid to
20 at least one of the inner film and the outer film.

The heat transpiration container of the present invention is produced by closing the transpiration aperture of the container body with the inner film, inserting a feeder nozzle, that is used for supplying the transpiring liquid through the inner film, into the
25 container body, supplying the transpiring liquid through the feeder

nozzle into the container body and placing the outer film onto the inner film for sealing. According to the method of the present invention, such troubles can be prevented from occurring as the transpiring liquid that has spilled out when filling the container
5 with the liquid wets the flange and causes unsatisfactory bonding.

Another heat transpiration apparatus of the present invention comprises the container body that contains the transpiring liquid, the inner film and the outer film that are put one on another and close the transpiration aperture of the container
10 body and a heater that heats the container body, wherein the inner film is a liquid absorbent film, the outer film is a gas-permeable film and a part of the inner film makes contact with the transpiring liquid. Since a part of the inner film that is a liquid absorbent film makes contact with the transpiring liquid, the transpiring liquid is
15 absorbed into the inner film through this portion by the capillary effect so as to infiltrate and diffuse over a large surface area on the inside of the inner film. As a result, the transpiring liquid can be brought into contact with the outer film that is put on the inner film over a large area of the inside of the outer film.

20 Another heat transpiration container of the present invention suitable for use in the heat transpiration apparatus described above comprises a container body that contains the transpiring liquid and an inner film and an outer film that are put one on another and close an transpiration aperture of the container body, wherein the
25 inner film is a liquid absorbent film and the outer film is a gas-

permeable film. The liquid absorbent film may be an unwoven fabric.

The transpiring liquid of the present invention may be, besides the insecticidal technical product described previously, such
5 a material as a vermin repellent, a disinfectant, a fragrant, a deodorant or an insecticide.

(III)

Since the insecticidal technical product is a insecticide component per se that does not include a solvent, only several
10 milliliters of the insecticidal technical product is used at the most even in an apparatus designed for long period of heat transpiration, such that 12 hours of transpiration per day is repeated for 30 to 60 days. Accordingly, the heat transpiration container is a small container comprising a sheet about 30 mm square with a recess
15 formed at the center thereof to a depth of about 1 to 2 mm. Such a small container requires fine adjustment of the temperature in order to regulate the amount of transpiration. However, it is difficult to precisely control the temperature of the heater that heats the container so as to keep the optimum temperature for
20 transpiration. It is also difficult to set the optimum temperature through fine adjustment of the heater for each setting when the heating temperature is changed to set the duration of transpiration for the insecticide component.

Therefore the inventors of the present invention investigated
25 on a method of controlling the heat transpiration temperature for

setting the amount of transpiring liquid such as insecticide component to be transpired, and reached a finding that surface temperature in the recess that contains the transpiring liquid can be controlled by changing the depth of the recess of the heat

5 transpiration container and/or the flange size, even when the heater temperature is kept constant, thus enabling it to adjust the amount of transpiring liquid to transpire.

The method of controlling the heat transpiration temperature according to the present invention has been completed on the basis
10 of the finding described above, and consists of the following methods.

(1) A method of controlling a heat transpiration temperature, which comprises controlling a surface temperature in a recess by means of the depth of the recess, in case that a container having the recess that contains a transpiring liquid is heated so as to transpire the
15 transpiring liquid.

(2) A method of controlling a heat transpiration temperature, which comprises controlling a surface temperature in a recess by means of the surface area of a flange, in case that a container having the flange provided on the periphery of the recess that contains a
20 transpiring liquid is heated so as to transpire the transpiring liquid.

(3) A method of controlling a heat transpiration temperature, which comprises controlling a surface temperature in a recess by means of the volume of a rib, in case that a container having the rib that protrudes from the bottom of the recess that contains a transpiring
25 liquid into the recess space is heated to transpire the transpiring

liquid.

(4) The method of controlling the heat transpiration temperature according to any one of (1) to (3), wherein the transpiring liquid is an insecticidal technical product.

5 In order to transpire the transpiring liquid by heating the container having the recess and the flange provided on the periphery of the recess, surface temperature in the recess may be controlled by means of either the depth of recess or the surface area of the flange.

10 In order to transpire the transpiring liquid by heating the container having the recess that contains the transpiring liquid, the flange provided on the periphery of the recess and the rib that protrudes from the bottom of the recess into the recess space, surface temperature in the recess may be controlled by means of at
15 least one selected from among the depth of the recess, the surface area of the flange and the volume of the rib.

(IV)

 As described previously, only a very small amount of the insecticidal technical product is used since the insecticidal technical
20 product is the insecticide component per se that does not include a solvent. Therefore, the heat transpiration container is also small and it has been very difficult to visually recognize the amount of remaining transpiring liquid such as insecticidal technical product when the container is simply placed on the heater surface. And it
25 is preferable that the amount of transpiration is stable when the

insecticidal technical product is transpired over an extended period of time.

Therefore the inventors made a research on the heat transpiration apparatus and heat transpiration method that allow it to easily check the amount of the transpiring liquid remaining in the heat transpiration container and are capable of maintaining stable transpiration over an extended period of time. And it was found that, when the heat transpiration container filled with the transpiring liquid is placed or held on the heater surface while being tilted for heat transpiration, since the transpiring liquid makes contact with the transparent or semi-transparent gas-permeable film that closes the transpiration aperture, the liquid surface in the container can be seen through the film and the amount of the transpiring liquid that remains after a period of transpiration can be easily checked. That is, according to the present invention, the heat transpiration container serves as an indicator of the remaining amount of the transpiring liquid as it is placed or held on the heater surface at such an angle as the transpiring liquid touches the gas-permeable film.

The inventors further found such a surprising fact that the amount of transpiration of the transpiring liquid contained in the container is stabilized over a long period of time from the early stage to the latter stage of transpiration when the heat transpiration container is placed or held on the heater surface while being tilted by such an angle as the transpiring liquid touches the

gas permeable film, and thereby completed the present invention.

As to the reason why the amount of transpiration of the transpiring liquid contained in the container is stabilized when the heat transpiration container is placed or held on the heater surface while
5 being tilted by such an angle as the transpiring liquid touches the gas permeable film, it is supposedly because the gas permeable film and the transpiring liquid are kept always in stable contact with each other.

Accordingly, the heat transpiration apparatus and the heat
10 transpiration method of the present invention have the constitution as described below.

(1) A heat transpiration apparatus comprising a heat transpiration container comprising a container body that contains a transpiring liquid and a transparent or semi-transparent gas-permeable film
15 that closes a transpiration aperture of the container body, which is placed or held on a heater surface at such an angle as the transpiring liquid touches the film.

(2) A heat transpiration apparatus comprising a heat transpiration container comprising a container body that contains a transpiring
20 liquid and a transparent or semi-transparent gas-permeable film that closes a transpiration aperture of the container body, which is placed or held on a heater surface that is disposed at such an angle as the transpiring liquid touches the film.

(3) The heat transpiration apparatus according to (2), wherein the
25 heat transpiration container is placed or held on the heater surface

that is disposed at such an angle from 10 to 90° from the horizontal plane.

(4) The heat transpiration apparatus according to any one of (1) to (3), wherein the transpiration aperture of the container body has
5 inclined lower end that becomes narrower toward the end.

(5) The heat transpiration apparatus according to any one of (1) to (4), wherein the transpiring liquid is an insecticidal technical product.

(6) The heat transpiration apparatus according to any one of (1) to
10 (5), wherein the transpiring liquid contains a colorant.

(7) A heat transpiration method, which comprises placing or holding a heat transpiration container comprising a container body that contains a transpiring liquid and a transparent or semi-transparent gas-permeable film that closes a transpiration aperture of the
15 container body on the heater surface at such an angle that the transpiring liquid touches the film, and heating the transpiring liquid so as to transpire.

In the heat transpiration apparatus according to (1), the transpiration aperture is preferably tilted by an angle from 10 to
20 90° from the horizontal plane, similarly to the case of (2). Also in the heat transpiration apparatus according to (1), the heater surface may be disposed substantially horizontal (specifically, for example, 0 to 10° from the horizontal surface) as long as the transpiring liquid touches the gas-permeable film. For the transpiring liquid,
25 besides the insecticidal technical product, such a material as a

vermin repellent, a fragrant, a deodorant or an insecticide may be used.

(V)

In the heat transpiration apparatus having the heat
5 transpiration container that comprises the transparent or semi-transparent gas-permeable film is disposed at a tilted position as described above, the liquid surface in the container can be seen through the film and the amount of the transpiring liquid that remains in the container can be easily checked. Moreover, since
10 the transpiring liquid is caused to touch the film by the tilted positioning, the amount of transpiration becomes stabilized over a long period of time from the early stage to the latter stage of transpiration.

In the heat transpiration apparatus described above, in case
15 the container is made in a very shallow construction and is substantially completely filled with the transpiring liquid, the film 135 sometimes touches the bottom 130a of the container body 130 near the center thereof as the transpiring liquid 133 decreases through transpiration, as shown in Fig. 53(a) to (c). That is, before
20 transpiration of the transpiring liquid 133 begins as shown in Fig. 53(a), the container body 130 of which aperture is closed by the gas-permeable film 135 is filled with the transpiring liquid 133. However, a negative pressure develops in the container as the transpiring liquid 133 transpires, and therefore the film 135
25 approaches the bottom 130a of the container 130 as shown in Fig.

53(b) and eventually touches the bottom 130a as shown in Fig. 53(c). When the film 135 touches the bottom surface 130a of the container body 130, the transpiring liquid 133 is forced toward the periphery of the container in an uneven distribution, thus making it difficult
5 to precisely know the amount of remaining transpiring liquid 133 since the transpiring liquid sometimes cannot flow down smoothly toward the lower end of the container body 130.

Therefore, the inventors made a research on the heat transpiration container that allows it to precisely know the amount
10 of the transpiring liquid remaining therein, and the heat transpiration apparatus and the heat transpiration method that employ the heat transpiration container. Through the research, it was found that, when the heat transpiration container is used in vertical or tilted posture so that the transpiring liquid touches the
15 film while an air reservoir is provided in the container body that is closed by the transparent or semi-transparent gas-permeable film so as to prevent the gas-permeable film from touching the bottom of the container body as the transpiring liquid transpires, entire transpiring liquid flows toward the bottom of the container body,
20 and therefore it is made possible to precisely know the amount of transpiring liquid that remains in the heat transpiration container. Upon this finding, the inventors completed the present invention.

Accordingly, the heat transpiration container of the present invention comprises the container body that opens at the top and
25 contains the transpiring liquid therein, and the transparent or

semi-transparent gas-permeable film that closes the aperture of the container body, while the container body closed by the gas-permeable film has an air reservoir for preventing the gas-permeable film from touching the bottom of the container body as the transpiration of the transpiring liquid progresses. With this constitution, the heat transpiration container does not lose the function of indicator when the remaining amount of the transpiring liquid decreases so that the amount of remaining transpiring liquid can be precisely known and the amount of transpiration remains also stable.

The heat transpiration container may have such a constitution that comprises the container body that opens at the top and contains the transpiring liquid therein, and the transparent or semi-transparent gas-permeable film that closes the aperture of the container body, wherein the container body has, on one end thereof, an extended portion that is formed to protrude in the direction of depth and/or direction of width of the container body for forming the air reservoir. Providing the extended portion makes it possible to set the liquid level in the container higher and prevent the appearance of the apparatus as the commercial value from being degraded while ensuring the predetermined volume of the air reservoir.

In the heat transpiration container of the present invention, it is preferable that the bottom surface of the extended portion is inclined so that the transpiring liquid flows down from the inside of

the extended portion toward the bottom of the container body, while the container body is set in vertical or inclined posture with the extended portion located in an upper position. In this posture, since the transpiring liquid does not remain in the extended portion
5 when the heat transpiration container is held in a vertical or tilted posture, the amount of the remaining transpiring liquid can be more precisely known and the transpiring liquid can be used up to the end without waste.

The heat transpiration apparatus of the present invention is
10 characterized in that the heat transpiration container is placed or held in the vertical or tilted posture on the heater surface so that the transpiring liquid makes contact with the gas-permeable film.

The heat transpiration apparatus of the present invention is characterized in that the heat transpiration container is heated in
15 vertical or tilted posture so that the transpiring liquid makes contact with the gas-permeable film, to transpire the transpiring liquid.

Examples of the transpiring liquid of the present invention include insecticides, vermin repellents, fragrances, deodorants,
20 bactericides, antifungal agents and mothproofing agents. The transpiring liquid is preferably used in the form of the effective component (for example, insecticide component) per se like the insecticidal technical product.

(VI)

25 The present invention provides a heat transpiration

apparatus that can maintain the chemical agent such as the insecticidal technical product under such a condition that it can be transpired efficiently, and is convenient for use. This object of the invention can be achieved by the following constitution.

- 5 (1) A heat transpiration apparatus for heating a transpiring liquid holding body in a tilted posture by means of a heating section to transpire a chemical, comprising an instrument body that incorporates the heating section and a lid provided on the instrument body so as to cover the entire transpiring liquid holding
10 body, wherein a plurality of elongated apertures are formed in the lid surface that faces the outside when the lid is closed on the instrument body, proportion of the plurality of apertures to the area of the lid surface is set to 40% or more, and each of the apertures is formed to be 5 mm or smaller along the shorter side thereof.
- 15 (2) A heat transpiration apparatus for heating a transpiring liquid holding body by means of a heating section to transpire a chemical, comprising an instrument body that incorporates the heating section and a lid provided on the instrument body so as to cover the transpiring liquid holding body, wherein aperture section is formed
20 in the lid surface that faces the outside when the lid is closed on the instrument body, while proportion of the aperture section to the area of the lid surface is set to 40% or more, and maximum size of the aperture section is formed to be 5 mm or smaller.
- 25 (3) The heat transpiration apparatus according to (1), wherein the plurality of apertures are formed in such a manner as the length of

the shorter side becomes larger toward the transpiring liquid holding body.

(4) The heat transpiration apparatus according to (3), wherein the lid has a plurality of pillars that delimit the plurality of apertures
5 in the longitudinal direction and each of the pillars has triangular cross section.

(5) The heat transpiration apparatus according to (1), wherein the transpiration aperture is formed in the gap between the instrument body and the upper end of the lid , and/or in the instrument body,
10 when the lid is closed on the instrument body.

(6) The heat transpiration apparatus according to (5), wherein the transpiration aperture is provided so as to open vertically upward on the top end of the transpiring liquid holding body.

(7) The heat transpiration apparatus according to (1), wherein a
15 first air intake port is formed in the gap between the instrument body and the upper end of the lid, and/or in the instrument body when the lid is closed on the instrument body, and the first air intake port opens at a position lower in the vertical direction than the lower end of the transpiring liquid holding body.

20 (8) The heat transpiration apparatus according to (1), wherein a second air intake port is formed at a position opposite to the lid in substantially horizontal direction in the instrument body.

The heat transpiration apparatus according to the present invention has such a constitution as the heating section is covered
25 by the lid that has aperture occupying a predetermined proportion

of the surface area.

Specifically, the plurality of elongated apertures occupy 40% or more of the surface area of the lid. This configuration enables it to avoid such a situation as the transpired chemical deposits and
5 remains in the gap of the aperture and the air flow is hampered resulting in a decrease in the rate of transpiration which may occur when the proportion of aperture is less than 40%. Thus the transpiration efficiency of the chemical can be maintained at a satisfactory level by setting the proper proportion of aperture.

10 Length of the plurality of elongated apertures along the shorter side thereof is set to 5 mm or less. This configuration prevents a foreign matter from passing through the aperture and touching the heating section or the transpiring liquid holding body that has been heated. Moreover, since the lid has such a
15 construction that can be opened and closed, a foreign matter that has stuck in the aperture can be prevented from touching the heating section by opening the lid. Thus the present invention provides the heat transpiration apparatus that can be conveniently used while maintaining the transpiration efficiency of chemical at a
20 satisfactory level.

The heat transpiration apparatus of the present invention may also be made in such a constitution as the plurality of elongated apertures occupy 40% or more of the surface area of the lid and the maximum dimension of the aperture is 5 mm or less.

25 Thus the transpiration efficiency of the chemical can be

maintained at a satisfactory level by employing such a constitution as the proportion of aperture area is 40% or higher, for a reason similar to that described above.

Moreover, foreign matter can be prevented from passing
5 through the aperture regardless of what shape the aperture has, being not limited to slit, as long as the apertures are formed with maximum dimension not larger than 5 mm in addition to the constitution described above. In addition, since the lid can be opened and closed, a foreign matter that has stuck in the aperture
10 can be prevented from touching the heating section by opening the lid. The opening may be formed in such a shape as, for example, square, rectangle, triangle, pentagon or other polygonal shape, circle or oval.

The lid may also be, instead of open/close construction, such
15 that can be removed and reattached.

In the heat transpiration apparatus described above, the plurality of apertures are preferably formed so that the length along the shorter side thereof increases toward the transpiring liquid holding body. This construction makes it unlikely that the
20 transpired chemical (liquid) deposits in the gap of the aperture and enables it to maintain the transpiration efficiency of chemical at a satisfactory (normal) level. The lid has a plurality of pillars that delimit the plurality of apertures in the longitudinal direction and each of the pillars may be formed to have, for example, triangular
25 cross section (section of the pillar that is revealed when the pillar is

cut perpendicular to the longitudinal direction) with the base thereof lying on the front or back side of the lid.

In the heat transpiration apparatus described above, the transpiration aperture is preferably formed either between the instrument body and the upper end of the lid when the lid is closed on the instrument body, or in the instrument body. The transpired chemical tends to deposit particularly heavily on a portion of the instrument body located above the transpiring liquid holding body. When the transpired chemical deposits and accumulates on the portion located above the transpiring liquid holding body, rate of transpiration decreases as a part of the accumulating chemical sticks also onto the lid and hampers the air flow. Providing the transpiration aperture at this upper position enables the transpired chemical to diffuse to the outside of the instrument body through the transpiration aperture without accumulating. Thus the transpiration efficiency of chemical of the heat transpiration apparatus does not decrease.

The transpiration aperture is preferably provided so as to open facing upward in the vertical direction over the upper end of the transpiring liquid holding body.

In the heat transpiration apparatus described above, the first air intake port is preferably formed either between the instrument body and the lower end of the lid when the lid is closed on the instrument body, or in the instrument body. With this construction, since air is introduced through the first air intake port into the

instrument body, the transpiration efficiency of chemical can be improved further.

It is preferable that the second air intake port is formed at a position opposite to the lid in substantially horizontal direction in
5 the instrument body. With this construction, since air is introduced through the second air intake port into the instrument body, the transpiration efficiency of the chemical can be improved further.

The instrument body may also be provided with a retainer
10 that elastically retains the transpiring liquid holding body. While there is no limitation on the form of the retainer, for example, leaf spring, coil spring, elastic resin plate, rubber, sponge or the like may be employed.

For the transpiring liquid holding body, besides the form of
15 mat, such a form may also be employed as the container that contains the transpiration liquid is closed on the mouth thereof with a gas-permeable film.

The heating section may have such a configuration, for example, as the transpiring liquid holding body is heated on the
20 back so as to transpire the chemical from the front surface of the transpiring liquid holding body. Such a heating section is preferably used that heats the transpiring liquid holding body over a certain extent of surface. Disposing the heater surface that involves the heating section at an angle of 45° with respect to the
25 horizontal plane makes it possible to use both a power outlet and a

table-tap receptacle unit having a power outlet in the top surface thereof. Also a movable plug may be provided so that both a power outlet and a table-tap receptacle unit having a power outlet in the top surface thereof can be used.

5 (VII)

According to the present invention, such a transpiring liquid bag may also be used as the heat transpiration container or the transpiring liquid holding body that is made of a flexible gas-permeable film on at least one side thereof and is filled with the
10 transpiring liquid and is sealed. The transpiring liquid bag is preferably transparent or semi-transparent at least in a part thereof.

During use, the transpiring liquid bag is heated so that the transpiring liquid is transpired through the gas-permeable film
15 provided at least on one side thereof. The transpiring liquid is heated and transpired while in contact with the gas-permeable film that is provided on one side.

[BRIEF DESCRIPTION OF THE DRAWINGS]

20 Fig. 1(a) is a plan view showing an example of heat transpiration container according to the present invention and Fig. 1(b) is a sectional view thereof along line X-X.

Fig. 2 is a sectional view showing the heat transpiration container sealed with a gas-permeable film that is in use.

25 Fig. 3(a) is a sectional view showing the gas-permeable film

and the insecticidal technical product brought into contact with each other, and Fig. 3(b) is a sectional view showing the recess without the gas-permeable film attached on top thereof.

Fig. 4(a) is a sectional view showing the heat transpiration
5 container made in such a structure as the insecticidal technical product is less likely to spill over, and Fig. 4(b) is a plan view of the container with the gas-permeable film removed from the top thereof.

Fig. 5 is a sectional view showing the heating instrument for heating the insecticidal technical product and the heat
10 transpiration container that is housed in the heating instrument.

Fig. 6 is a perspective view showing the heating instrument for heating the insecticidal technical product.

Fig. 7(a) and Fig. 7(b) are sectional views showing another form of the heat transpiration container.

15 Fig. 8 is a schematic diagram showing the heat transpiration apparatus according to the second aspect of the present invention.

Fig. 9 is a perspective view showing an embossed pattern provided on the inner film used in the heat transpiration container of the present invention.

20 Fig. 10 is a schematic diagram showing an example where the heat transpiration container of the present invention is held on a heater surface that is erected vertically.

Fig. 11 is a plan view showing the heat transpiration container according to another embodiment of the present invention.

25 Fig. 12(a) to (d) are plan views showing the heat

transpiration container according to further another embodiment of the present invention.

Fig. 13(a) to (d) are schematic diagrams showing the method of producing the heat transpiration container of the present
5 invention.

Fig. 14 is a sectional view showing an example of a case where the heat transpiration container of the present invention is used in horizontal posture.

Fig. 15(a) is a plan view showing an example of heat
10 transpiration container according to the present invention and Fig. 15(b) is a sectional view thereof along line X-X.

Fig. 16 is a sectional view showing the heat transpiration container sealed with a gas-permeable film that is in use.

Fig. 17 is a schematic sectional view showing the heat
15 transpiration apparatus according to one embodiment of the present invention.

Fig. 18(a) is a plan view showing an example of the container body according to the present invention and Fig. 18(b) is a sectional view thereof along line X-X.

20 Fig. 19(a) to (c) are plan views showing another example of the container body.

Fig. 20(a) to (f) are plan views showing another example of the container body.

Fig. 21(a) to (c) are plan views showing another example of
25 the container body.

Fig. 22(a) to (c) are plan views showing another example of the container body.

Fig. 23(a) and (b) are plan views showing another example of the container body.

5 Fig. 24(a) to (c) are plan views showing another example of the container body.

Fig. 25(a) to (c) are plan views showing another example of the container body.

10 Fig. 26 is a sectional view along the side showing another example of the heat transpiration container.

Fig. 27 is a schematic sectional view showing the heat transpiration apparatus according to the present invention holding the heat transpiration container on the heater surface erected vertically.

15 Fig. 28 is a schematic sectional view showing the heat transpiration apparatus according to another embodiment of the present invention.

Fig. 29 is a schematic sectional view showing the heat transpiration apparatus according to the present invention wherein
20 the transpiration aperture is erected vertically.

Fig. 30 is a schematic sectional view showing the heat transpiration container according to the present invention and the heat transpiration apparatus using the same.

Fig. 31 is a plan view showing an example of the container
25 body of the present invention.

Fig. 32(a) to (c) are explanatory diagrams showing the process of the insecticidal technical product in the heat transpiration container being transpired.

Fig. 33 is a schematic sectional view showing a case where
5 the heat transpiration container of the present invention is held on the heater surface that is erected vertically.

Fig. 34 is a schematic sectional view showing the heat transpiration container of the present invention of which container body does not include an extended portion being held in an inclined
10 posture.

Fig. 35 is an overall perspective view showing a first embodiment of the heat transpiration apparatus according to the present invention.

Fig. 36(a) shows the heat transpiration apparatus of Fig. 1
15 with the lid opened, and Fig. 36(b) is a sectional view of the lid shown in Fig. 36(a).

Fig. 37 is a perspective view showing an example of the transpiring liquid holding body.

Fig. 38 shows the transpiring liquid holding body attached to
20 the lid.

Fig. 39 is an overall sectional view the heat transpiration apparatus with the transpiring liquid holding body mounted thereon.

Fig. 40 is a sectional view of the heat transpiration apparatus viewed in the direction of arrow A of Fig. 39.

25 Fig. 41 is a rear view of the heat transpiration apparatus.

Fig. 42 is an overall perspective view showing a second embodiment of the heat transpiration apparatus according to the present invention.

Fig. 43 is an overall perspective view showing a third
5 embodiment of the heat transpiration apparatus according to the present invention.

Fig. 44 is a longitudinal sectional view of the heat transpiration apparatus of Fig. 43.

Fig. 45 shows the transpiring liquid holding body of the heat
10 transpiration apparatus shown in Fig. 44.

Fig. 46(a) shows the transpiring liquid holding body of Fig. 45, Fig. 46(b) shows a variation of the transpiring liquid holding body of Fig. 46(a), and Fig. 46(c) shows another variation of the transpiring liquid holding body of Fig. 46(a).

15 Fig. 47(a) is a plan view showing the heat transpiration container used in third and fourth embodiments, and Fig. 47(b) is a sectional view thereof along line Z-Z.

Fig. 48 is a plan view showing the sample container used in example 9.

20 Fig. 49(a) to (c) are plan views showing the sample container used in Example 10.

Fig. 50(a) to (c) are plan views showing the sample container used in Example 11.

Fig. 51(a) is a plan view showing the container body used in
25 Example 12, and Fig. 51(b) is a sectional view thereof along line Y-Y.

Fig. 52 is a plan view showing the shape of the recess of the container body used in Example 17.

Fig. 53(a) to (c) are schematic sectional views of a conventional heat transpiration container disposed in an inclined posture, showing a film brought into contact with the bottom of the container body as the transpiring liquid is consumed.

[BEST MODE FOR CARRYING OUT THE INVENTION]

(I)

10 The insecticidal technical product, that can be used in the present invention, may be transpired by heating and exerts a control effect on noxious insects. Examples of the insecticidal technical product include, but are not limited to, transfluthrin, "S-1264" {common name: metofluthrin, manufactured by Sumitomo
15 Chemical Industries Co., Ltd.}, vaporthrin, furamethrin, d-T80-furamethrin, empenthrin, phenothrin, resmethrin, phthalthrin, d-T80-phthalthrin, (1S)-1-ethynyl-2-methyl-2-pentenyl-(1R)-trans-3-(2,2-dichloroethenyl)-2,2-dimethylcyclopropanecarboxylate, 1-ethynyl-2-methyl-2-pentenyl-3-(2,2-dichloroethenyl)-2,2-
20 dimethylcyclopropanecarboxylate, and isomers thereof, and "S-1864" {manufactured by Sumitomo Chemical Industries Co., Ltd.}, Stackle (trade name of dinotefuran), bifenthrin and Amidoflumet. The insecticidal technical product may be in the form of liquid or solid, and preferably liquid. In case of the liquid, vapor pressure of the
25 insecticidal technical product is preferably 4.8×10^{-6} (25°C) mmHg

or higher, and more preferably from 4.8×10^{-6} to 6.0×10^{-3} (25°C) mmHg.

Examples of additives to be added to the modified insecticidal technical product in the present invention include stabilizers,
 5 antioxidants, ultraviolet inhibitors and colorants. If necessary, one or more kinds of these additives are added.

Examples of the antioxidants include 3,5-di-*t*-butyl-4-hydroxytoluene, 3-*t*-butyl-4-hydroxyanisole, 3,5-di-*t*-butyl-4-hydroxyanisole, mercaptobenzimidazole, dilauryl-thio-di-propionate,
 10 2-*t*-butyl-4-methoxyphenol, 3-*t*-butyl-4-methoxyphenol, 2,6-di-*t*-butyl-4-ethylphenol, stearyl- β -(3,5-di-*t*-butyl-4-hydroxyphenyl)propionate, α -tocopherol, ascorbic acid, erythorbic acid, 2,2'-methylene-bis(6-*t*-butyl-4-methylphenol), 2,2'-methylene-bis(6-*t*-butyl-4-ethylphenol), 4,4'-methylene-bis(2,6-di-*t*-butylphenol),
 15 4,4'-butylidene-bis(6-*t*-butyl-3-methylphenol), 4,4'-thio-bis(6-*t*-butyl-3-methylphenol), 1,1-bis(4-hydroxyphenyl)cyclohexane, 1,3,5-trimethyl-2,4,6-tris(3, 5-di-*t*-butyl-4-hydroxybenzyl)benzene, tris(2-methyl-4-hydroxy-5-*t*-butylphenyl)butane, tetrakis[methylene(3,5-di-*t*-butyl-4-hydroxyhydrocinnamate)]methane, octadecyl-3,5-di-*t*-
 20 butyl-4-hydroxyhydrocinnamate, phenyl- β -naphthylamine, N,N-diphenyl-*p*-phenylenediamine, 2,2,4-trimethyl-1,3-dihydroquinoline polymer, 6-ethoxy-2,2,4-trimethyl-1,3-dihydroquinoline and tetrakis[methylene3-(3,5-di-*t*-butyl-4-hydroxyphenyl)propionate]methane.

25 The colorant can be selected from azo dyes, anthraquinone

dyes and combinations of two or more kinds of them. Specific examples thereof include Blue No. 403 Orange No. 403, Green No. 202, Violet No. 201, Red No. 225 and Yellow No. 204.

The amount of these additives may be an irreducible
5 minimum amount. The amount of the stabilizers is preferably about 5% by weight or less, the amount of the antioxidant is about 5% by weight or less and the amount of the ultraviolet inhibitor is preferably about 5% by weight or less, based on the total amount of the modified insecticidal technical product. The amount of the
10 colorant is from 0.001 to 0.1% by weight, and preferably from 0.01 to 0.1% by weight, based on the total amount. Consequently, an adverse influence is not exerted on transpiration properties of the insecticidal technical product and it becomes easier to visually recognize so that the liquid level can be easily checked from a
15 distance and it becomes easier to know when the insecticidal technical product has been used up.

In addition, there can be optionally added commonly used various additives such as effectiveness increasing agents, transpiration regulators, particle size regulators, transpiration rate
20 improvers, deodorizers and aromatic agents. Examples of the effectiveness increasing agent include piperonyl butoxide, N-propylisome, MGK-264, Synepirin 222, Synepirin 500, Lethan 384, IBTA, S421, amphipathic materials that exert a sufficient effectiveness increasing effect in case of transpiration by heating,
25 and aliphatic hydrocarbons; examples of the transpiration rate

improver include phenethyl isothiocyanate and high-mix acid dimethyl; examples of the deodorizer include lauric acid methacrylate (LMA); and examples of the aromatic agent include citral and citronellal.

5 The insecticidal technical product or the modified insecticidal technical product (hereinafter represented by the insecticidal technical product) is housed in the container and is transpired by heating the container. The heat transpiration container to be used may be any type as long as the container has a structure that allows
10 the insecticide component to transpire.

 An example of the heat transpiration container as described above is shown in Fig. 1. The heat transpiration container comprises a heat resistant sheet 1 made of a metal such as aluminum or a heat resistant resin having a recess 2 formed at the
15 center thereof, so as to contain the insecticidal technical product in the recess 2.

 According to the present invention, as shown in Fig. 2, the heat transpiration container may have such a structure as the transpiration aperture at the top of the recess 2 that contains the
20 insecticidal technical product 3 is closed by the gas-permeable film 4. This structure prevents the insecticidal technical product 3 from spilling from the container 5 and makes it easier to handle including transportation.

 To use the heat transpiration container 5, it is placed on a
25 radiation plate 7 having a heating section 6 disposed below thereof

as shown in Fig. 2, so as to heat the insecticidal technical product 3 contained inside by the heated from the radiation plate 7. The insecticide component that has transpired from the insecticidal technical product 3 diffuses through the gas-permeable film 4
5 (transpiration of the insecticide component is indicated by arrows).

The amount of the insecticidal technical product 3 housed in the container 5 is not specifically limited because it is appropriately decided according to transpiration properties of chemicals to be used, transpiration amount per hour and target transpiration duration
10 time, and is commonly from about 0.05 to 3 ml, and preferably from about 0.1 to 1 ml. The amount of the insecticidal technical product 3 is commonly from about 75 to 4500 mg, and preferably from 100 to 1500 mg. If the transpiration amount of the insecticide transfluthrin is 1.67 mg/2 hours and if transpiration is conducted by
15 the heat transpiration method of the present invention for 12 hours per day, the amount of the insecticidal technical product 3 for 30 days is about 300 mg, while the amounts of the insecticidal technical products for 60 days and 120 days are respectively about 600 mg and 1200 mg. By the way, the effective transpiration
20 amount of transfluthrin is preferably at least 0.15 mg/2 hours so as to control mosquito.

While there is no limitation on the depth and capacity of the recess 2 which depend on the amount of the insecticidal technical product contained therein, depth of the recess 2 may be set in a
25 range from 0.3 to 5 mm, preferably from 0.5 to 4 mm according to

the amount of the insecticidal technical product.

The gas-permeable film 4 is not specifically limited as far as it can pass the chemical component transpired from the insecticidal technical product therethrough. Examples of the gas-permeable
5 film 4 include those made of oriented or cast polypropylene, polyethylene (for example, linear low-density polyethylene, low-density polyethylene, etc.), polyethylene terephthalate and polymethylpentene. These films may be used alone, or two or more kinds of them may be laminated with each other.

10 A microporous film having multitude of tiny holes formed therein by means of laser beam may also be used individually as the gas-permeable film or in combination with another gas-permeable film being laminated therewith. Moreover, a porous film having holes formed by piercing with a needle or the like may also be used
15 individually as the gas-permeable film or in combination with another gas-permeable film being laminated therewith. Thickness of the gas-permeable film 4 is in a range from about 10 to 100 μm , preferably from 30 to 70 μm . For the microporous film or the porous film, a film impermeable to gas such as nylon may also be
20 used besides the gas-permeable film.

The gas-permeable film 4 to be used is preferably such that is effective in evaporating the chemical and does not undergo significant change in the appearance (degradation such as swelling and breakage and crystallization (powder formation) of the effective
25 component on the film surface). As such a film, for example,

composite film comprising two or more kinds of film laminated together may be used. For example, composite film comprising a sealant layer made of polyethylene or cast polypropylene, and an oriented polypropylene film, a polyterephthalate film or a
5 perforated film (such as perforated polyterephthalate film) laminated on the outside thereof may be used. The sealant film herein refers to a film that is directly bonded onto the heat transpiration container 5 so as to ensure close contact with the heat transpiration container 5 and liquid tightness. Thickness of the
10 composite film may be the same as that of the gas-permeable film 4 in a range from about 10 to 100 μm . The sealant layer may also be provided individually on top surface of the container 5 (adhering surface with the film 4).

In order to prevent the gas-permeable film 4 from touching
15 the bottom of the recess 2 when a negative pressure develops in the recess as the chemical transpires, an air intake port (not shown) may be provided in the heat transpiration container 5 so that air is supplied into the recess 2 that is sealed by the gas-permeable film 4. Such an air intake port is provided, for example, in a part of the
20 gas-permeable film 4.

While the insecticidal technical product may be brought into direct contact with a heat source to heat and transpire the insecticidal technical product, the insecticidal technical product may also be heated by placing the container 5 on the heater such as
25 the radiation plate 7 or by providing a gap or other intermediate

object between the container 5 and the heater.

While there is no limitation on the heating temperature of the insecticidal technical product which may be set to any level that is high enough to transpire the effective amount of the insecticide component, the heater temperature (for example, surface temperature of the radiation plate 2) is normally in a range from about 50 to 170°C, preferably from 70 to 130°C, in the case of the heating method described above that uses the container.

Alternatively, the surface temperature of the gas-permeable film 4 may be set in a range from about 40 to 160°C, preferably from 60 to 120°C. Temperature of the insecticidal technical product during heating the container 5 is in a range from about 45 to 165°C, preferably from about 65 to 125°C. The heating temperature may be determined according to the effective amount of insecticide component to be transpired required to get rid of vermin such as mosquitoes.

Thus according to the present invention, the insecticide component can be transpired continuously over a long period of 30 days or longer, by heating the insecticidal technical product to such a temperature as effective amount of the insecticide component is transpired for about 12 hours per one day.

When heating the chemical to transpire, it is preferable to hold the container 5 and the radiation plate 7 in a tilted posture so that the insecticidal technical product 3 and the gas-permeable film 4 come into contact with each other before or when the apparatus is

used. This makes it easier to check the decrease in the amount of insecticidal technical product in the container 5 based on the change in the liquid level of the insecticidal technical product, so that the container serves as an indicator of the remaining amount of the insecticidal technical product and the amount of transpiration can be stabilized over a long period. Tilting angle of the container 5 from the horizontal surface is in a range from 10 to 90°, preferably from 40 to 60°.

According to the heat transpiration method of the present invention, such a method may be employed as the heat transpiration container, as shown in Fig. 3(a), comprising the heat resistant sheet 1 (container body) that has the recess 2 containing the insecticidal technical product 3 and the gas-permeable film 4 that touches the liquid surface of the insecticidal technical product 3 is used, so as to heat and transpire the insecticidal technical product 3 under the condition that the gas-permeable film 4 that touches the liquid surface of the insecticidal technical product 3, or as shown in Fig. 3(b), the insecticidal technical product 3 is heated under the condition that the liquid surface of the insecticidal technical product 3 is exposed to the transpiration space, namely without the gas-permeable film 4 placed thereon, which further increases the amount of the insecticide component transpired.

In the case shown in Fig. 3(a), in order to keep the gas-permeable film 4 in contact with the insecticidal technical product 3 even when only a small amount of the insecticidal technical product

3 remains with the transpiration of the insecticide component, for example, the gas-permeable film 4 may be slackened in advance, a insecticidal technical product supply means (not shown) that maintains the liquid level constant may be provided, or the
5 container body may be held in a tilted posture (from 10 to 90°, preferably from 40 to 60°) from the horizontal surface. In the case of the heat transpiration container 5 that is held horizontally as shown in Fig. 2, the gas-permeable film 4 can be brought into contact with the liquid surface of the insecticidal technical product
10 3 by tilting the container 5 with respect to the horizontal surface at least during heating and transpiration, even if the gas-permeable film 4 is not in contact with the liquid surface of the insecticidal technical product 3 in the horizontal posture.

In the case shown in Fig. 3(a), those listed above as the
15 examples may be used as the gas-permeable film 4. When a film through which the insecticidal technical product 3 can easily permeate and transpire from the surface thereof is used, the amount of insecticide component transpired can be increased. Such a liquid-permeable film through which the insecticidal technical
20 product 3 can permeate may be composed of polypropylene, polyethylene or copolymer of ethylene and propylene. These films may be used either alone or in combination of two or more kinds being laminated together. Thickness of the gas-permeable film 4 is an important factor that is related to the ease of the insecticide
25 component to permeate and the amount of transpiration, and is

preferably from about 10 to 100 μm , and more preferably from about 25 to 75 μm .

In the case shown in Fig. 3(b), where the gas-permeable film 4 is not used, since the recess 2 opens at the top (insecticidal
5 technical product 3 is exposed to the transpiration space) as shown in the drawing, it is preferable to use a heat transpiration container 11, for example, as shown in Fig. 4(a) and (b).

Fig. 4(a) and (b) are a sectional view of the heat transpiration container 11 having such a structure that the insecticidal technical
10 product 3 is unlikely to spill over, and a plan view of the heat transpiration container 11 with a film 14 removed, respectively. As shown in Fig. 4(a) and (b), the heat transpiration container 11 comprises a container body 12 formed in a box shape from a metal such as aluminum or a heat resistant resin and a lid 13 thereof, and
15 contains the insecticidal technical product 3 in the container body 12. The lid 13 has an inclined portion 13a that inclines from the upper end of the rim of the container body 12 downward to the inside, and an transpiration aperture 13b at the center of the inclined portion 13a. A film 14 that is not gas-permeable is
20 attached to the top surface of the lid 13, and transpiration of the insecticide component is enabled by peeling off the film 14 before use. The lid 13 may be simply placed on the container body 14, but it is preferable to integrate the lid and the container body by
25 integrated molding.

When the heat transpiration container 11 is used, a heating instrument 21 may be used for heating the insecticidal technical product 3 as shown in Fig. 5 and Fig. 6. The heating instrument 21 is a box-shaped object that comprises a recess 25 that detachably
5 accommodates the heat transpiration container 11, a heater 22 mounted at the bottom of the recess 25 for heating the heat transpiration container 11 and an electric plug 23 for supplying electric power to the heater 22. The heating instrument 21 has a window 24 for checking the liquid level of the insecticidal technical
10 product 3 in the surface opposite to the side where the electric plug 23 is provided. Thus the remaining amount of the insecticidal technical product 3 can be easily checked through the window 24. Accordingly, if the heating instrument 21 is used, the heat transpiration container 11 is preferably made of a transparent or
15 semi-transparent heat resistant resin.

During thermal transpiration, the insecticidal technical product 3 is heated by the heat from the heater 22 under the condition that the heat transpiration container 11 is accommodated in the recess 21, so that the insecticide component transpires
20 through the transpiration aperture 13b. When all of the insecticidal technical product 3 in the heat transpiration container 11 has been consumed through transpiration, the heat transpiration container 11 is taken out of the heating instrument 21 and replaced with new heat transpiration container 11 filled with the insecticidal
25 technical product 3. Alternatively, the insecticidal technical

product 3 may be replenished into the heat transpiration container 11 of which insecticidal technical product 3 has been used up.'

The heating instrument 21 may be provided with an open/close lid or detachable lid (not shown) to close the top of the
5 heat transpiration container 11 when not in use. The heat transpiration container 11 and the heating instrument 21 may have polygonal or circular shape instead of rectangular in the plan view.

The heat transpiration container may have a construction other than that comprising the box-shaped container body 12 and
10 the lid 13 shown in Fig. 4(a) and (b), as long as transpiration aperture 33, 34 is provided on top of container 31, 32 as shown in Fig. 7(a) and (b), for example, so that the liquid surface of the insecticidal technical product can be exposed to the transpiration space. There is no limitation on the shape of the container 31, 32
15 in plan view, which may be rectangular, polygonal other than rectangular or circular shape.

The heat transpiration method of the present invention can be applied for control of various noxious insects that should be controlled, for example, sanitary noxious insects or blood-sucking
20 noxious insects, such as cockroach, fly, mosquito, biting midge, horsefly, flea and bedbug; clothing noxious insects such as clothes moth and *Tineola bisselliell*s; stored grain noxious insects such as rust-red flour beetle and rusty grain beetle; mites such as *Ornithonyssus*, *Cheyletidae* and *Acaridae*; and ant, termite and slug.

25 Therefore, the heat transpiration method of the present

invention can be used in various locations, and can be preferably used in the living room, the kitchen or the dining room of a home, livestock barn, kennel, green house, clothes storage such as closet or wardrobe, food cellar, etc.

5 While the foregoing description has dealt with cases where the insecticidal technical product or the modified insecticidal technical product is heated to transpire, the insecticidal technical product or the modified insecticidal technical product may be volatile at normal temperature, in which case the insecticidal
10 technical product or the modified insecticidal technical product (for example, the compound A or B described previously) may be exposed to open air so as to spontaneously transpire at the normal temperature.

(II)

15 The heat transpiration apparatus, the heat transpiration container and the method of producing the same according to the present invention will now be described below by way of example where the insecticidal technical product is used as the transpiring liquid. The insecticidal technical product is similar to that
20 described previously and may include the additive.

 When a colorant such as pigment is added to the insecticidal technical product (transpiring liquid), in particular, it becomes easier to visually recognize so that the liquid level can be easily checked from a distance and it becomes easier to know when the
25 insecticidal technical product has been used up. The colorant is

preferably such that does not affect the transpiration of the insecticidal technical product, does not experience color fading due to exposure to heat or light over the period of use, and can be easily seen from a distance so that it can be known when the insecticidal technical product has been used up.

Such a colorant can be selected from azo dyes, anthraquinone dyes, and combinations of two or more kinds of these dyes. Specific examples thereof include dyes such as Orange No. 403, Green No. 202, Violet No. 201, Red No. 225 and Yellow No. 204. The amount of the colorants is commonly for 0.001 to 0.1% by weight, and preferably from 0.01 to 0.1% by weight, based on the total amount. Consequently, an adverse influence is not exerted on transpiration properties of the insecticidal technical product and it becomes easier to visually recognize so that the liquid level can be easily checked from a distance and it becomes easier to know when the insecticidal technical product has been used up.

Fig. 8 is a schematic diagram showing the heat transpiration apparatus according to this embodiment. As shown in Fig. 8, the heat transpiration apparatus 50 has a heat transpiration container 41 that comprises a container body 46 which contains insecticidal technical product 45, inner film 47 and outer film 51 which are laminated with each other and close the transpiration aperture of the container body 46 and a liquid introducing port 52 (supplying means) provided on the inner film 47 for supplying the insecticidal technical product 45 between the films 47, 51, and a heater 43 that

heats the container body 46.

The heater 42 comprises a heating element 43 and a radiation plate 44. The radiation plate 44 is installed inside of the inclined wall 48 of the heat transpiration apparatus 50, and forms the
5 bottom of the recess 49 that is formed in the wall 48. The heat transpiration container 41 is dropped into the recess 49 so that the heat transpiration container 41 is held on the heater surface 40.

The outer film 51 may be composed of any gas-permeable film that does not allow the liquid insecticidal technical product 45 to
10 permeate but allows gaseous chemical component transpired from the insecticidal technical product 45. For the outer film 51 that is permeable to gas, a material similar to the gas-permeable film 4 may be used.

For the inner film 47, on the other hand, a film not
15 permeable to gas that does not allow the liquid insecticidal technical product 45 and the chemical component that has transpired therefrom to permeate may be used, in addition to a gas-permeable film similar to the outer film 51. Thickness of the inner film 47 is in a range from about 10 to 100 μm , and preferably from
20 30 to 70 μm . The inner film 47 is preferably such that does not change the properties during use, similarly to the outer film 51.

The inner film 47 has a liquid introducing port 52 (supplying means) for supplying the insecticidal technical product 45 between the inner and outer films 47, 51 as shown in Fig. 8. The liquid
25 introducing port 52 is formed at a position where the inner film 47

touches the insecticidal technical product 45 when the container body 46 is held at such an angle as the insecticidal technical product 45 makes contact with the inner film 47. While there is no limitation on the diameter of the liquid introducing port 52, it is
5 preferably around 0.5 to 2 mm.

The container body 46 is made of a metal such as aluminum or a heat resistant resin having a recess 46a formed at the center thereof, so as to contain the insecticidal technical product 45 therein, and a flange 46b is provided on the periphery of the
10 transpiration aperture of the recess 46a. The inner film 47 is placed so that the periphery thereof is located on the flange 46b, which are bonded by thermal fusing or the like, and the outer film 51 is placed so that the periphery thereof is located on the fused portion, which are bonded by thermal fusing or the like.

15 Other than the periphery, the inner film 47 and outer film 51 are simply placed one on another so as to allow the capillary phenomenon of the insecticidal technical product 45, and are not bonded. In order to allow the capillary phenomenon of the insecticidal technical product 45 between the inner film 47 and
20 outer film 51, the inner film 47 and outer film 51 may be bonded together on the periphery so that the films will not be wrinkled or slackened and the gap between the films does not expand excessively. If the gap becomes too large, it makes it difficult for the capillary phenomenon to occur, and the insecticidal technical
25 product 45 may not be able to contact the inside of the outer film 51

over a sufficient area.

When placing the inner film 47 and outer film 51 one on another, a spacer comprising a film may be interposed between the films along the periphery to ensure a predetermined gap between
5 the inner and outer films 47, 51 so that capillary phenomenon occurs satisfactorily.

At least one of the inner film and outer film may be embossed to form a pattern of projection and recess so as to provide channel for supplying the liquid. Fig. 9 is a perspective view showing the
10 embossed pattern formed on the inner film 47. As recess 53 and projection 54 are formed at predetermined intervals between the inner and outer films 47, 51 as shown in the drawing by embossing, the insecticidal technical product 45 can be supplied stably by the capillary phenomenon. Also because the contact area between the
15 insecticidal technical product 45 and the outer film 51 can be adjusted, the amount of the insecticidal technical product 45 transpired can be controlled. There is not limitation on the pattern of projection and recess as long as the insecticidal technical product 45 is obstructed from spreading over the inner surface of the outer
20 film 51, and grating, slit or other shape may be employed. The gap thus formed is preferably 1 mm or smaller.

The inner film 47 and outer film 51 are preferably transparent or semi-transparent, which makes it possible to easily recognize the liquid level of the insecticidal technical product 45 in
25 the heat transpiration container 41, and easily check the remaining

amount of the insecticidal technical product 45 after a period of thermal transpiration. Visual recognition of the liquid level can be improved further by adding a colorant as described previously.

Angle θ of inclination of the heater surface 40 from the
5 horizontal surface shown in Fig. 8 is preferably such as the transpiring liquid makes contact with the inner film 47, specifically from 10 to 90°, preferably from 40 to 60° and more from 45 to 55°. When the angle θ of inclination is in the range described above, even when the insecticidal technical product 45 decreases, the
10 insecticidal technical product 45 can be supplied through the liquid introducing port 52 between the inner and outer films 47, 51 so that the insecticidal technical product 45 makes contact with the outer film 51 over a large surface area by capillary effect. With this configuration, since contact area between the outer film and the
15 transpiring liquid does not decrease with the decrease of the transpiring liquid in the container body after a long period of use, transpiration can be sustained over a long period of time. When the angle θ of inclination is less than the range described above, it becomes difficult to supply the insecticidal technical product 45
20 through the liquid introducing port 52 between the inner and outer films 47, 51 when amount of the insecticidal technical product 45 decreases.

There is no limitation on the amount of the insecticidal technical product 45 contained in the heat transpiration container
25 41 which may be determined by taking into consideration the

transpiration performance of the chemical that is used, amount of transpiration per unit of time and the target duration of transpiration, and is usually from about 0.05 to 3 ml, preferably from about 0.5 to 5 ml.

5 Target temperature of heating the insecticidal technical product is determined by taking into consideration the amount of insecticide component transpired per unit of time, and is set so that the heater temperature (temperature on the heater surface 40) is from about 50 to 170°C, preferably from 70 to 130°C.

10 While the heat transpiration container 41 is held in the recess 49 formed in the wall 48 around the heater surface 40 in the embodiment described above, the holding means may be anything that can place or hold the heat transpiration container 41 on the heater surface 40 and, for example, a stopper such as a projection
15 may be provided on the inclined heater surface or at an end of the heater surface so as to place or hold the heat transpiration container.

Fig. 10 shows an example of holding the heat transpiration container 41 on the heater surface 40 that is erected vertically.

20 This form also makes it possible to supply the insecticidal technical product 45 through the liquid introducing port 52 between the inner and outer films 47, 51 so that the insecticidal technical product 45 is brought into contact with the outer film 51 over substantially the entire area thereof by the capillary phenomenon, similarly to the
25 case of inclined heater surface. With other respect, this

embodiment is the same as that shown in Fig. 8, and description will be omitted with the identical reference numerals assigned to the corresponding components.

Fig. 11 is a plan view showing another embodiment of the
5 heat transpiration container of the present invention. In Fig. 11, only the inner film 47' is shown while omitting the outer film 51 for the convenience of explanation. As shown in Fig. 11, the inner film 47' has two liquid introducing ports 52a, 52b (supplying means) provided near the opposing wall surfaces of the container body 46
10 for supplying the insecticidal technical product 45 between the inner and outer films 47' and 51. With this configuration, the object can be achieved regardless of which of the liquid introducing port 52a, 52b of the heat transpiration container 41' is located at the lower position. The liquid introducing port located at the upper
15 position can serve the function of degassing from the container body 46.

The liquid introducing port used in the heat transpiration apparatus 50 is not limited to the forms shown in Fig. 8, Fig. 10 and Fig. 11, and may also be such as shown in Fig. 12(a) to (d). The
20 outer film is not shown in Fig. 12(a) to (d), similarly to Fig. 11. The liquid introducing port 55a, 55b shown in Fig. 12(a) consist of notches provided along lateral lines on top and bottom of the inner film 47a when it is placed in the heat transpiration apparatus 50. The liquid introducing port 56a, 56b shown in Fig. 12(b) consist of
25 notches provided along longitudinal lines on the left and right sides

of the inner film 47b. The liquid introducing port 57 shown in Fig. 12(c) consists of notches provided along longitudinal line at the center of the inner film 47c. The liquid introducing port 58 shown in Fig. 12(d) consists of a plurality of holes provided in the inner
5 film 47d to such an extent as the liquid does not spill.

For the method of heating the insecticidal technical product 45, besides placing the heat transpiration container 41 on the radiation plate 44 as in the embodiment described above, a gap or other intermediate object may be provided between the heat
10 transpiration container 41 and the radiation plate 44.

Now the method of producing the heat transpiration container 41 may be described below. Fig. 13(a) to (d) are schematic diagrams showing the method of producing the heat transpiration container 41.

15 First, the container body 46 having the recess 46a provided at the center thereof and the inner film 47 are prepared. The inner film 47 is placed with the periphery thereof located on the flange 46b of the container body 46, and the flange and the film are bonded by thermal bonding or the like so as to close the transpiration
20 aperture of the container body 46 with the inner film 47 (Fig. 13(a)). Then a feeder nozzle 59 that supplies the insecticidal technical product 45 is put into the container body 46 by piercing the inner film 47, and the insecticidal technical product 45 is supplied through the feeder nozzle 59 into the container body 46 (Fig. 13(b)).
25 After supplying a predetermined amount of insecticidal technical

product 45, the feeder nozzle 59 is pulled out of the container body 46. The hole that is left after pulling the feeder nozzle 59 out of the container body 46 can be used as the liquid introducing port 52 (feeding means) (Fig. 13(c)). Then the outer film 51 that is
5 permeable to gas is placed on the outside of the inner film 47, and the two films are bonded by thermal bonding or the like along the periphery thereby to seal the container body 46 (Fig. 13(d)). Thus, the heat transpiration container 41 is obtained. Tip diameter of the feeder nozzle 59 may be determined according to the size of the
10 liquid introducing port 52. Instead of using the hole made by the feeder nozzle 59 as the liquid introducing port 52 as described above, the liquid introducing port 52, 13a, 13b, 55a, 55b, 24a, 24b, 25, 26 may be provided in the inner film 47 as shown in Fig. 8 and Fig. 10-5 before or after bonding the inner film 47 with the container body
15 46.

While the embodiment described above is a case where the liquid introducing port 52 is used as the feeding means, an end of one of the inner film and outer film that are placed one on another and immersed in the insecticidal technical product may also be used
20 as the means of supplying the insecticidal technical product between the inner and outer films. That is, when the end of the inner film and outer film is immersed in the insecticidal technical product, the insecticidal technical product rises through the immersed portion to spread between the inner and outer films by the capillary
25 phenomenon, so that the insecticidal technical product can be

brought into contact with the outer film over a large area of the inner surface thereof. This enables it to use the container body 46 while being placed horizontally.

According to the present invention, for example, unwoven
5 fabric or woven fabric made of a polymer that has high capability to absorb oil, blotting paper or other liquid absorbing film may be use as the inner film 47. Since such a liquid absorbing film absorbs the insecticidal technical product 45, the insecticidal technical product can be caused to infiltrate the inner film 47 over a large area
10 thereof, by tilting the container body 46 or otherwise bringing the insecticidal technical product 45 into contact with a part of the inner film 47. Thus the insecticidal technical product can be brought into contact with the outer film 51 that is put on the inner film 47, over a large area of the inner surface thereof.

15 While the inner film 47 (liquid absorbing film) and the outer film 51 (gas-permeable film) are bonded along the periphery thereof onto the flange 46b of the container body 46 also in the case of using the liquid absorbing film as described above, it is preferable that the inner film 47 is bonded with the outer film 51 in a part (the
20 portion that covers the transpiration aperture of the container body 46) other than the periphery or over the whole area of the inner film 47, and it is more preferable that the whole area of the inner film 47 is bonded with the outer film 51. This makes it possible to bring the insecticidal technical product 45 into stable contact with the
25 outer film 51 over a larger area of the inner surface thereof, since

there is no gap created between the inner film and outer film.

Thus when a liquid absorbing film is used as the inner film 47, the inner film 47 may or may not be provided with the liquid introducing port 52.

5 When a liquid absorbing film is used as described above, the container body 46 can be used while being placed in horizontal posture. An example of using the container body 46 in horizontal posture is shown in Fig. 14. In this heat transpiration container 41e, as shown in Fig. 14, a piece 47e formed by tearing the inner
10 film 471 from an end thereof is hang down so as to immerse in the insecticidal technical product 45. By using the liquid absorbing film for the inner film 471, it is made possible to suck up the insecticidal technical product 45 by means of the piece 47e and cause the insecticidal technical product 45 to infiltrate the inner
15 film 471 over a large area thereof. Thus the insecticidal technical product 45 can be caused to make contact with the outer film 51 that is placed on the inner film 471 over a large area of the inner surface of the outer film 51. When tearing the piece 47e, a part of the outer film 51 may be torn at the same time to hang these pieces
20 that are put one on another into the insecticidal technical product 45.

Even when the inner film 471 is not a liquid absorbing film, if the piece 47e of the inner film 471 and the inner surface of the recess 46a are located near to each other, the insecticidal technical
25 product 45 can be sucked up and supplied between the inner and

outer films 471 and 51 by the capillary phenomenon generated between the inner surface and the piece 47e.

The heat transpiration apparatus of the present invention and the heat transpiration container used therefor can be applied
5 for control of noxious insects that should be controlled, for example, sanitary noxious insects or blood-sucking noxious insects, such as cockroach, fly, mosquito, biting midge, horsefly, flea and bedbug; clothing noxious insects such as clothes moth and *Tineola*
bisselliell; stored grain noxious insects such as rust-red flour beetle
10 and rusty grain beetle; mites such as *Ornithonyssus*, *Cheyletidae* and *Acaridae*; and ant, termite and slug. Therefore, the heat transpiration apparatus and the heat transpiration container of the present invention can be used in various locations, and can be
preferably used in the living room, the kitchen or the dining room of
15 a home, livestock barn, kennel, green house, clothes storage such as closet or wardrobe, food cellar, etc.

According to the present invention, besides the insecticidal technical product described in the embodiments described above, aromatic agents, deodorizers and mothproofing agents may also be
20 used as the transpiring liquid. The transpiring liquid used in the present invention may have such a degree of fluidity as the capillary phenomenon occurs.

While the foregoing description has dealt with cases where the transpiring liquid is heated to transpire, the transpiring liquid
25 may be volatile at normal temperature, in which case the

transpiring liquid may be exposed to open air so as to spontaneously transpire at the normal temperature.

(III)

An example of container used for heating and evaporating the insecticidal technical product is shown in Fig. 15. The container 61 comprises a heat resistant sheet made of aluminum or other metal or a heat resistant resin having a recess 62 formed at the center thereof, so as to contain the insecticidal technical product therein, and a flange 63 is provided on the periphery of the aperture of the recess 62. The container 61 may be reinforced as required by providing a rib 69 protruding from the bottom of the recess 62 toward the inner space of the recess 62.

The container 61 is preferably used by covering the aperture (transpiration aperture) opening at the top of the recess 62 that contains the insecticidal technical product 68 with a gas-permeable film 64 as shown in Fig. 16. This structure prevents the insecticidal technical product 68 from spilling from the container 61 and makes it easier to handle including transportation. The gas-permeable film 64 may be made of the same material as the gas-permeable film 4 described previously.

To use the container 61, it is placed on a radiation plate 67 having a heating section 68 disposed below thereof as shown in Fig. 16, so as to heat the insecticidal technical product 68 contained inside by the heated from the radiation plate 67. The insecticide component that has transpired from the insecticidal technical

product 68 diffuses through the gas-permeable film 64
(transpiration of the insecticide component is indicated by arrows).

There is no limitation on the amount of the insecticidal
technical product 68 contained in the container 61 which may be
5 determined by taking into consideration the rate of transpiration of
the chemical that is used, amount of transpiration per unit of time
and the target duration of transpiration, and is usually from about
0.05 to 3 ml, preferably from about 0.1 to 1 ml.

Target temperature of heating the insecticidal technical
10 product is determined by taking into consideration the amount of
insecticide component transpired per unit of time, and is set so that
the heater temperature (surface temperature of the radiation plate
67) is from about 50 to 170°C, preferably from 70 to 130°C. What
is important is the temperature of the container 61, particularly the
15 surface temperature of the recess 62, and the amount of insecticide
component transpired varies as the surface temperature varies.

The surface temperature of the recess 62 is not necessarily the same
as the heater temperature and is subjected to significant fluctuation
depending on the heat conduction to the flange 63 and heat
20 dissipation into the atmosphere. An advantageous use can be made
of this phenomenon by changing the depth of the recess or the size
of the flange 63 so as to change the heat conduction to the flange 63
and/or heat dissipation into the atmosphere thereby to control the
surface temperature of the recess 62 even when the heater
25 temperature remains constant. Amount of transpired insecticide

component can be controlled in this way.

Factors that affect the surface temperature variation of the recess 62 include the depth h of the recess 62, whether the flange 63 is provided or not and, if provided, size (surface area) of the flange 63 and, in case the rib 69 is formed in the recess 62, size (volume) of the rib 69.

Depth " h " of the recess 62 can be set within a range from about 0.3 to 5 mm, preferably from about 0.5 to 4 mm, so that surface temperature of the recess 62 becomes an optimum level.

10 Surface temperature of the recess 62 becomes lower as the depth " h " is larger, and conversely becomes higher as the depth " h " is smaller.

Size (surface area) of the flange 63 can be set so as to obtain the optimum surface temperature of the recess 62. When the size of the flange 63 is represented in terms of the proportion to the total area ($D1 \times D2$) in the plan view shown in Fig. 15, proportion of the flange 63 may be set in a range from 0 to about 85%, and preferably from 0 to about 70%. Proportion of the flange 63 being 0 means that there is no flange. Usually, the larger the flange 63, the lower the surface temperature of the recess 62, and the smaller the flange 63, the higher the surface temperature of the recess 62.

20 There is not limitation on the shape of the flange 63.

Size (volume) of the rib 69 can be set so as to obtain the optimum surface temperature of the recess 62. Size of the rib 69 is preferably represented in terms of the volume. Height of the rib 69 is usually approximately equal to the depth " h " of the recess 62, but

25

may be larger than or smaller than the depth "h". When height of the rib 69 is usually approximately equal to the depth "h" of the recess 62, proportion of the horizontal cross sectional area of the rib 69 (namely the area of the cross section that is parallel to the
5 bottom of the recess 62) to the horizontal cross sectional area of the recess 62 may be set in a range from 0 to about 30%, and preferably from 0 to about 25%. Proportion of the rib 69 being 0 means that there is no rib. Usually, the larger the volume of the rib 69, the lower the surface temperature of the recess 62, and the smaller the
10 volume of the rib 69, the higher the surface temperature of the recess 62. There is no limitation on the shape of the rib 69.

Temperature of the insecticidal technical product when heating the container 61 is set to an optimum temperature in a range from about 45 to 165°C, preferably from about 65 to 125°C as
15 described above. Specifically, the heating temperature is determined by taking into consideration the effective amount of the chemical required for exterminating the vermin such as mosquitoes and the target duration of transpiration.

The surface temperature of the container 61 is changed, and
20 accordingly the amount of evaporating insecticide component can be controlled by changing the depth h of the recess 62, size of the flange 63 and size of the rib 69. Thus the optimum amount of evaporating insecticide component can be set according to the insecticidal technical product in use, and it is made possible to
25 provide the heat transpiration container that can be set to various

duration of transpiration such as 30 days, 60 days and more by adjusting the rate of transpiration even when the heater temperature remains constant (the number of days described above are based on such a usage as the insecticidal technical product is
5 heated for about 12 hours a day).

When heating the chemical to transpire, it is preferable to hold the container 61 and the radiation plate 67 in a tilted posture so that decrease in the amount of the insecticidal technical product 68 held in the container 61 through transpiration can be easily
10 known from the change in the liquid level of the insecticidal technical product, namely the container serves as an indicator of the remaining amount of the insecticidal technical product. Tilting angle of the container 5 from the horizontal surface is in a range from 40 to 60°.

15 (IV)

The heat transpiration apparatus, the heat transpiration container and the method of producing the same according to the present invention will now be described below by way of example where the insecticidal technical product is used as the transpiring
20 liquid. The insecticidal technical product is similar to that described previously and may include the additive described before. When a colorant such as pigment is added to the insecticidal technical product (transpiring liquid), in particular, it becomes easier to visually recognize so that the liquid level can be easily
25 checked from a distance and it becomes easier to know when the

insecticidal technical product has been used up.

Fig. 17 is a schematic sectional view showing an embodiment of the liquid level indicating structure of the heat transpiration container according to the present invention. As shown in Fig. 17, 5 the heat transpiration container 72 is held on a heater surface 71 that is inclined to such an angle that the transpiring liquid 76 touches the gas-permeable film 78. The heat transpiration container 72 comprises a container 77 that contains the insecticidal technical product 76 and a transparent or semi-transparent gas- 10 permeable film 78 that closes a transpiration aperture formed at the top of the container 77.

The heater 73 has a heating element 74 and a radiation plate 75. The heater 73 is installed inside of the inclined wall 79 of the heat transpiration apparatus, and forms the bottom of the recess 80 15 that is formed in the wall 79. The heat transpiration container 72 is dropped into the recess 80 so that the heat transpiration container 72 is held on the heater surface 71.

Under this condition, as shown in Fig. 17, since the heat transpiration container 72 is held on the heater surface 71 in a 20 tilted posture, the liquid level 76a of the insecticidal technical product 76 can be visually checked easily through the gas-permeable film 78. Thus the remaining amount of the insecticidal technical product 76 can be easily known.

The gas-permeable film 78 may be made of a material similar 25 to that of the gas-permeable film 4 mentioned above.

The container body 77 comprises a heat resistant sheet made of aluminum or other metal or a heat resistant resin, that has a recess 77a formed at the center thereof, so as to contain the insecticidal technical product 76 therein, and a flange 77b is
5 provided on the periphery of the transpiration aperture of the recess 77a. The gas-permeable film 78 is placed with the periphery thereof located on the flange 77, and bonded together by thermal fusion or the like.

Fig. 18(a) and (b) are a plan view of the container body 77
10 and a sectional view thereof along line X-X, respectively. The recess 77a of the container body 77 has a transpiration aperture of hexagonal shape. When one end A of the transpiration aperture 77c shown in Fig. 18(a) corresponds to the lower end of the container body 77, for example, the lower end portion becomes
15 narrower toward the end. Therefore, as the remaining liquid dwindles, lowering speed of the liquid surface 76a of the insecticidal technical product 76 increases and it becomes easier to know the end of the heat transpiration. In the case of the transpiration aperture 77c shown in Fig. 18(a), it is also made easier to check the
20 liquid amount at the start of use since the upper end becomes narrower toward the tip, too.

Tilting angle θ of the heater surface 71 from the horizontal plane as shown in Fig. 17 is in a range from 10 to 90°, preferably from 40 to 60°. When the tilting angle θ is smaller than the range
25 described above, it becomes difficult to check the liquid level of the

Table 5

Intermittent 12-hour heating

Sample No.	Amounts transpired				
	Unit	Period from 0 hours to 12 hours after the start of heating	Period from 120 hours to 132 hours after the start of heating	Period from 240 hours to 252 hours after the start of heating	Period from 360 hours to 372 hours after the start of heating
10—①	mg/12hours	9.16	9.99	10.12	9.19
10—②		9.25	9.81	8.17	7.39
10—③		11.79	8.31	8.79	7.19
Average	mg/hour	0.84	0.78	0.75	0.66
Average	mg/12 hours	10.07	9.37	9.03	7.92

Table 6

Intermittent 8-hour heating

Sample No.	Amounts transpired				
	Unit	Period from 0 hours to 8 hours after the start of heating	Period from 120 hours to 128 hours after the start of heating	Period from 240 hours to 248 hours after the start of heating	Period from 360 hours to 368 hours after the start of heating
10-①	mg/8 hours	7.67	6.68	5.95	5.92
10-②		7.17	6.81	5.37	5.12
10-③		6.15	6.53	5.67	5.81
Average		7.00	6.67	5.66	5.61
Average	mg/hour	0.87	0.83	0.71	0.70
Average	mg/12 hours	10.50	10.01	8.49	8.42

Table 7

Intermittent 3-hour heating

Sample No.	Amounts transpired				
	Unit	Period from 0 hours to 3 hours after the start of heating	Period from 120 hours to 123 hours after the start of heating	Period from 240 hours to 243 hours after the start of heating	Period from 360 hours to 363 hours after the start of heating
10-①	mg/3 hours	1.52	2.10	2.34	2.21
10-②		1.91	2.55	2.44	2.34
10-③		1.83	2.20	1.83	1.91
Average		1.75	2.28	2.20	2.15
Average	mg/hour	0.58	0.76	0.73	0.72
Average	mg/12 hours	7.00	9.13	8.81	8.60

Table 8

continuous heating

Sample no.	Amounts transpired						
	Unit	Period from 0 hours to 2 hours after the start of heating	Period from 5 hours to 7 hours after the start of heating	Period from 10 hours to 12 hours after the start of heating	Period from 120 hours to 122 hours after the start of heating	Period from 240 hours to 242 hours after the start of heating	Period from 360 hours to 362 hours after the start of heating
—①	mg/2 hours	0.93	1.52	1.61	1.31	1.37	1.26
—②		0.93	1.39	1.42	1.27	1.49	0.85
—③		0.79	1.45	1.53	1.75	1.71	1.39
Average		0.88	1.45	1.52	1.44	1.52	1.17
Average	mg/hour	0.44	0.73	0.76	0.72	0.76	0.58
Average	mg/12 hours	5.29	8.71	9.11	8.64	9.13	6.99

[II] 60-day use setting

(1) Test condition

a. Content liquid: A shown in Table 1

b. Heat transpiration container: The same container as that

5 for sample No. 1 shown in Tale 2

c. Gas-permeable film: OPP20/PE30 (described previously)

d. Amount injected: 600 mg

e. Set temperature of heater: 85°C

f. Number of samples: 3

10 g. Transpired amount measuring period: As shown in tables
in (2).

(2) Test results

Table 9

Intermittent 12-hour heating

Sample No.	Amounts transpired				
	Unit	Period from 0 hours to 12 hours after the start of heating	Period from 240 hours to 252 hours after the start of heating	Period from 480 hours to 492 hours after the start of heating	Period from 720 hours to 732 hours after the start of heating
1 1 —①	mg/12 hours	10.88	10.33	9.09	8.29
1 1 —②		9.90	9.61	9.35	9.19
1 1 —③		11.84	10.47	8.05	7.31
Average	mg/hour	0.91	0.84	0.74	0.69
Average	mg/12 hours	10.87	10.14	8.83	8.26

Table 10

Intermittent 8-hour heating

Sample No.	Amounts transpired				
	Unit	Period from 0 hours to 8 hours after the start of heating	Period from 240 hours to 248 hours after the start of heating	Period from 480 hours to 488 hours after the start of heating	Period from 720 hours to 728 hours after the start of heating
1-①	mg/8 hours	6.70	6.09	5.49	5.21
1-②		6.33	6.92	5.98	5.98
1-③		6.08	7.90	5.27	4.85
Average		6.37	6.97	5.58	5.35
Average	mg/hour	0.80	0.87	0.70	0.67
Average	mg/12 hours	9.56	10.45	8.37	8.02

Table 11

tinent 3-hour heating

Sample No.	Amounts transpired				
	unit	Period from 0 hours to 3 hours after the start of heating	Period from 240 hours to 243 hours after the start of heating	Period from 480 hours to 483 hours after the start of heating	Period from 720 hours to 723 hours after the start of heating
—①	mg/3 hours	1.93	2.40	2.24	2.30
—②		1.82	1.93	1.88	2.03
—③		1.78	2.38	2.11	2.16
average		1.84	2.24	2.08	2.16
average	mg/hour	0.61	0.75	0.69	0.72
average	mg/12 hours	7.38	8.95	8.31	8.66

Table 12

Continuous heating

Sample no.	Amounts transpired						
	Unit	Period from 0 hours to 2 hours after the start of heating	Period from 5 hours to 7 hours after the start of heating	Period from 10 hours to 12 hours after the start of heating	Period from 240 hours to 242 hours after the start of heating	Period from 480 hours to 482 hours after the start of heating	Period from 720 hours to 722 hours after the start of heating
—①	mg/2 hours	1.07	2.11	1.86	1.52	1.55	1.45
—②		1.07	1.97	1.64	1.37	1.55	1.37
—③		1.22	1.83	1.66	1.29	1.49	1.35
average		1.12	1.97	1.72	1.40	1.53	1.39
average	mg/hour	0.56	0.99	0.86	0.70	0.76	0.70
average	mg/12 hours	6.73	11.82	10.32	8.37	9.17	8.35

[III] 120-day use setting

(1) Test condition

a. Content liquid: A shown in Table 1

b. Heat transpiration container: The same container as that

5 for sample No. 1 shown in Tale 2

c. Gas permeable film: OPP20/PE30 (described previously)

d. Amount injected: 1200 mg

e. Set temperature of heater: 85°C

f. Number of samples: 3

10 g. Transpired amount measuring period: As shown in tables
in (2).

2) Test results

Table 13

Intermittent 6-hour heating		Amounts transpired				
Sample No.	Unit	Period from 68 hours to 74 hours after the start of heating	Period from 192 hours to 198 hours after the start of heating	Period from 468 hours to 474 hours after the start of heating	Period from 678 hours to 684 hours after the start of heating	Period from 828 hours to 834 hours after the start of heating
1 2 - ①	mg/6 hours	4.23	6.53	6.39	5.75	4.42
1 2 - ②		4.20	6.35	4.76	4.07	3.51
1 2 - ③		3.00	3.60	3.76	2.96	2.69
Average		3.81	5.49	4.97	4.26	3.54
Average	mg/hour	0.64	0.92	0.83	0.71	0.59
Average	mg/12 hours	7.62	10.98	9.94	8.52	7.08

Tables 5 to 13 show that the heat transpiration method of the present invention that uses the insecticidal technical product causes stable transpiration of the insecticide component regardless of whether transpiration is carried out intermittently or continuously.

5 Tables 9 to 13 also show that the present invention causes stable transpiration of the insecticide component even in a long period of transpiration for 360 hours or more.

Example 3

(Influence of gas-permeable film on transpiration rate)

10 Rate of transpiration was compared between a case in which the gas-permeable film 4 was laminated on the heat transpiration container 35 shown in Fig. 47 and a case without lamination, and rate of transpiration was compared between a case in which the gas-permeable film 4 was in contact with the content liquid 3 and a case
15 without contact, by evaporating the insecticidal technical product under the following conditions and determining the amount of transpiration similarly to Example 1.

(1) Test condition

a. Content liquid: A shown in Table 1

20 b. Heat transpiration container: The heat transpiration container 35 shown in Fig. 47(a) and (b) was used. The heat transpiration container has the shape shown in Fig. 47(a) and (b), measuring 33 mm by 25 mm having a recess 36 measuring 26 mm by 17 mm by 3 mm in depth. With other respects, the container was
25 the same as that used in Example 1.

c. Gas-permeable film: Cast polypropylene film 50 μm in thickness

d. Amount injected: As shown in Table 14.

e. Set temperature of heater: 104°C

5 With this setting, surface temperature of the gas-permeable film and temperature of the content liquid were as shown in Table 14. Surface temperature of the gas-permeable film was measured at the top surface and near the center of the film, and temperature of the content liquid was measured near the center of the content liquid.

10 f. Number of samples: 3 for each sample.

g. Transpired amount measuring period: From 6 hours to 12 hours after the start of heating.

h. Placement of heat transpiration container during heating:
Horizontal

15 (2) Test results

Table 14

Sample No.	Amount of content liquid (Amount injected) (mg)	Existence of Gas-permeable Film	Temperature of content liquid (°C)	Surface temperature of Gas-permeable film (°C)	Amounts transpired (Period from 6 hours to 12 hours after the start of heating) (mg/6 hours)
1 3 - ①	1700	※ (1) Existence	92.1	87.7	9.47
1 3 - ②					11.98
1 3 - ③					11.70
Average					11.05
1 4 - ①	300	※ (2) Existence	93.2	78.2	2.96
1 4 - ②					2.81
1 4 - ③					1.95
Average					2.57
1 5 - ①	1700	Nothing	92.6	—	10.56
1 5 - ②					10.15
1 5 - ③					8.92
Average					9.88

※ (1) : Film comes into contact with content liquid.

※ (2) : Film does not come into contact with content liquid.

From Table 14, it can be seen that the amount transpired was higher in the sample No. 13 in which the film 4 was in contact with the content liquid 3 and in sample No. 15 in which the film 4 was not laminated, than in sample No. 14 in which the film 4 was not in
5 contact with the content liquid 3.

Example 4

(Transpiration performance of various insecticidal technical product)

Transpiration performance was compared between three
10 kinds of insecticidal technical product by evaporating the insecticidal technical product under the following conditions and determining the amount of transpiration similarly to Example 1.

(1) Test condition

- a. Content liquid: A shown in Table 15.
- 15 b. Heat transpiration container: The same container as that used in Example 3.
- c. Gas-permeable film: Cast polypropylene film 50 μm in thickness was used for every sample. The test was conducted with the gas-permeable film 4 in contact with the content liquid 3 as
20 shown in Fig. 3(a).
- d. Amount injected: 1700 mg.
- e. Set temperature of heater: 104°C
- f. Number of samples: 3 for each sample.
- g. Transpired amount measuring period: From 12 hours to 24
25 hours after the start of heating.

h. Placement of heat transpiration container during heating:

Horizontal

(2) Test results

Table 15

Sample No.	Content liquid	Amounts transpired Period from 12 hours to 24 hours after the start of heating (mg/12 hours)
1 6-①	Transfluthrin : 100 wt%	24.1
1 6-②		28.3
1 6-③		27.7
Average		26.7
1 7-①	「S-1264」 : 100 wt% (manufactured by Sumitomo Chemical Co., Ltd.)	18.0
1 7-②		18.9
1 7-③		17.2
Average		18.0
1 8-①	Empenthrin : 100 wt%	70.7
1 8-②		69.4
1 8-③		62.2
Average		67.4

From table 15, it can be seen that stable transpiration of the insecticidal technical product to release the insecticide component was achieved in all samples Nos.16 to 18.

Example 5

5 (Investigation of gas-permeable film)

1. Gas-permeable film

Composite films were prepared laminating two or three kinds of film as shown in Table 16. LLDPE, LDPE or CPP was laminated as a sealant layer directly on the heat transpiration container.

- 10 “LLDPE/perforated LDPE/CPP” of sample No. 22 is made by laminating the films in this order, and the same applies to sample No. 23. Proportion of aperture in Table 16 refers to the ratio of total area of fine apertures made by laser beam to the area of the entire PET film.

Table 16

Sample No.	Quality of material	Thickness	Others
20	OPP/LLDPE	OPP 20 μ m LLDPE 40 μ m	
21	OPP/CPP	OPP 20 μ m CPP 40 μ m	
22	LLDPE/perforated PET/LLDPE	LLDPE 30 μ m perforated PET 12 μ m LLDPE 30 μ m	Proportion of aperture : 10.4%
23	CPP/perforated PET/CPP	CPP 30 μ m perforated PET 12 μ m CPP 30 μ m	Proportion of aperture : 10.4%
24	PET/LLDPE	PET 20 μ m LLDPE 20 μ m	
— 25	PET/CPP	PET 20 μ m CPP 20 μ m	

- (i) LLDPE: Linear low density polyethylene
- (ii) CPP: Cast polypropylene film
- (iii) OPP: Biaxially oriented polypropylene film
- (iv) PET: Polyethylene terephthalate

5 2. Heat transpiration container

The heat transpiration container 35 as shown in Fig. 47 was used. An aluminum plate measuring 42 mm by 38 mm by 0.1 mm in thickness having a recess 2 (measuring 26 mm by 17 mm by 3 mm in depth) was used as the heat resistant sheet 1 (container body).

10 The recess 2 of this container as filled with transfluthrin containing 0.01% by weight of a pigment (Green No. 202) and was covered with the gas-permeable film 4 shown in Table 16 at the top.

3. Test method

With the heat transpiration container of which heater
15 temperature (surface temperature of the radiation plate 7) was set to 100°C, the modified insecticidal technical product was transpired by heating the heat transpiration container 35 tilted by 50° from the horizontal plane on the entire surface of the bottom, and the amount of the effective component transpired similarly to Example 1.

20 Change in the appearance by the thermal transpiration was visually evaluated. In Table 17 that shows the test results, "A" and "B" indicate that the film can be practically used as the gas-permeable film.

Table 17

Sample No.	Material	Change in the appearance			Amounts transpired (mg/12 hours)
		swelling	breakage	crystallization on the film surface	
20	OPP/LLDPE	O	O	O	10.2
21	OPP/CPP	Δ	O	O	9.8
22	LLDPE/perforated PET/LLDPE	O	O	O	6.3
23	CPP/perforated PET/CPP	O	Δ	O	5.2
24	PET/LLDPE	O	O	O	1.8
25	PET/CPP	O	O	O	2.0

From Table 17, it can be seen that the gas-permeable film made in a composite film of two or three layers by using LLDPE or CPP as sealant layer and laminating such a film as OPP, perforated PET and PET thereon is suitable for thermal transpiration since
5 such problems are less likely to occur as swelling or breakage due to heating and crystallization of the insecticide component on the film surface.

(II)

Example 6

10 The following test was conducted by using the heat transpiration apparatus 50 shown in Fig. 47, so as to determine the effect of the change in liquid amount of the insecticidal technical product 45 in the heat transpiration container 41 on the amount transpired.

15 1. Fabrication of heat transpiration container

The films (single film or composite film of two or three layers) shown in Table 18 were prepared for use in the samples. CPP, OPP, PE and PET in Table 18 represent the following materials.

CPP: Cast polypropylene film

20 OPP: Biaxially oriented polypropylene film

PE: Low density polyethylene

PET: Polyethylene terephthalate

"CPP/PET/CPP" of the outer film of sample No. 3 is a composite film made by laminating CPP, PET and CPP in this order, and the same
25 applies to other samples. The inner film was provided with two

liquid introducing port 52a, 52b formed therein as shown in Fig. 11.

Aluminum container having recess 46a measuring 26 mm by 17 mm by 3 mm in depth and flange 46b measuring 33 mm by 25 mm was used as the container body 46. The transpiration aperture of the container body 46 was covered by the inner film 47. Then the container body 46 was filled with a predetermined amount of insecticidal technical product 45 (transfluthrin) by using a feeder nozzle 59 shown in Fig. 13 assuming the early stage and latter stage of transpiration. The heat transpiration container 41 was made by placing the outer film 51 on the inner film 47 and sealing. The flange 46b and the periphery of the inner film 47, and the periphery of the inner film 47 and the periphery of the outer film 51 were bonded together by thermal fusion.

2. Test method

With the heat transpiration apparatus 50 shown in Fig. 47 of which heater 42 temperature (surface temperature of the radiation plate 5) was set to 100°C, the insecticidal technical product 45 was transpired by heating the heat transpiration container 41 tilted by 45° from the horizontal plane on the entire surface of the bottom. Amount of the insecticidal technical product 45 transpired in the period from 24 hours to 36 hours after heating was measured (n = 5). Results of measurements (mean values) are shown in Table 18. The decreasing rate shown in Table 18 was calculated by the following equation from the amount transpired assuming that the container held 1200 mg of insecticidal technical product 45 at the start of

transpiration and 150 mg of the insecticidal technical product 45 at the end of transpiration.

$$\text{Decreasing rate (\%)} = \{(\text{Amount transpired in early stage}) -$$

5 $(\text{Amount transpired in latter stage})\} / (\text{Amount transpired in early stage}) \times 100$

<Method to measure the amount transpired>

Insecticide component transpired from the heat transpiration

10 container 41 was collected in a silica gel column. The insecticide component was extracted from the silica gel with chloroform and concentrated, before quantitative analysis with gas chromatograph to determine the amounts transpired over a period of 12 hours.

Table 18

Sample No.	Inner film	Outer film	Amount of the insecticidal technical product (mg)	Amount transpired (mg/12 hours)	Decreasing rate (%)
1	CPP (50)	CPP (50)	1200	13.4	11.9
			150	11.8	
2	OPP (20)/PE (40)	PET (20)/CPP (40)	1200	13.0	8.5
			150	11.9	
3	OPP (20)/PE (40)	CPP (50)/PET (15)/CPP (50)	1200	8.2	18.3
			150	6.7	

* Numbers of parentheses of each film shows thickness of films (unit: μ m).

From Table 18 it can be seen that decreasing rate of the amount of transpiration is low even when the remaining insecticidal technical product 45 becomes small and the amount of transpiration is stable over the period from early stage to latter stage of

5 transpiration in samples Nos.1 to 3 in which contact area between the insecticidal technical product 45 and the outer film was made larger by the use of capillary phenomenon.

Example 7

The inner film and outer film made of the materials with
10 thickness shown in Table 19 with grating pattern of projections and recesses shown in Fig. 9 formed by embossing on the contact between the inner film and outer film were used. Aluminum container having recess 46a measuring 25 mm by 17 mm by 3 mm in depth and flange 46b measuring 33 mm by 25 mm was used as the
15 container body 46. The amount of transpiration of the insecticidal technical product 45 and the decreasing rate were measured similarly to Example 6, except that each container body 46 held 1200 mg and 200 mg of the insecticidal technical product 45, respectively, with assuming the early stage and latter stage of
20 transpiration.

The insecticidal technical product 45 was heated continuously for 36 hours, and the amount of transpiration of the insecticidal technical product 45 in a period from 24 hours to 36 hours after starting to heat was measured ($n = 3$), with the decreasing rate
25 determined similarly to Example 6. Results of measurements

(mean values) are shown in Table 19. The embossed pattern formed on the inner film 47 consists of projections 54 measuring 1.5 mm by 1.5 mm and recesses 53 measuring 0.5 mm in width and 0.5 mm in depth formed between the projections 54. OPP and PE in

5 Table 19 represent the following materials.

OPP: biaxially oriented polypropylene film

PE: Low density polyethylene

Table 19

Sample No.	Inner film	Outer film	Amount of the insecticidal technical product (mg)	Amount transpired (mg/12 hours)	Decreasing rate (%)
4	OPP (50 μ m)/PE (40 μ m) Formed by embossing	OPP (50 μ m)/PE (40 μ m)	1200	14.7	22.4
			200	11.4	

* Numbers of parentheses of each film shows thickness of films (unit: μ m).

CLAIMS

1. A heat transpiration method for the extermination of vermin,
which comprises heating an insecticidal technical product or a
5 modified insecticidal technical product containing an additive so as
to transpire.
2. The heat transpiration method according to claim 1, wherein the
insecticidal technical product or the modified insecticidal technical
10 product is put into a container and the container is heated so as to
transpire the insecticidal technical product or modified insecticidal
technical product.
3. The heat transpiration method according to claim 1 or 2, wherein
15 the insecticidal technical product or the modified insecticidal
technical product is transpired while a gas-permeable film is put
into contact with the liquid surface of the insecticidal technical
product or modified insecticidal technical product.
- 20 4. The heat transpiration method according to claim 1 or 2, wherein
liquid surface of the insecticidal technical product or the modified
insecticidal technical product is exposed to the transpiration space.
5. A heat transpiration container used in the heat transpiration
25 method of any one of claims 1 to 3, comprising a container body that

contains an insecticidal technical product or a modified insecticidal technical product and a gas-permeable film that closes a transpiration aperture of the container body.

5 6. A heat transpiration container used in the heat transpiration method of any one of claims 1 to 3, comprising a container body that contains an insecticidal technical product or a modified insecticidal technical product containing an additive and a gas-permeable film that makes contact with the liquid surface of the insecticidal
10 technical product or the modified insecticidal technical product at least during heat transpiration.

7. A heat transpiration apparatus comprising a container body that contains a transpiring liquid, an inner film and an outer film that
15 are put one on another and close a transpiration aperture of the container body, feeding means for supplying the transpiring liquid between the inner film and the outer film and a heater for heating the container body, wherein at least the outer film among the inner film and the outer film is a gas-permeable film.

20

8. The heat transpiration apparatus according to claim 7, wherein the feeding means is a liquid introducing port located at a position where the inner film touches the transpiring liquid when the container body is held at such an angle as the transpiring liquid
25 touches the inner film.

9. A heat transpiration container comprising a container body that contains a transpiring liquid and an inner film and an outer film that are put on one another and close a transpiration aperture of
5 the container body, wherein at least the outer film among the inner film and the outer film is a gas-permeable film.

10. The heat transpiration container according to claim 9, wherein at least one of the inner film and the outer film is embossed to form
10 a channel for supplying liquid.

11. A method of producing a heat transpiration container, which comprises closing a transpiration aperture of a container body with an inner film, piercing the inner film by a feeder nozzle that enters
15 the container body for supplying a transpiring liquid, supplying the transpiring liquid through the feeder nozzle into the container body, and laminating an outer film onto the outer surface of the inner film for sealing.

20 12. The method of producing the heat transpiration container according to claim 11, wherein a through hole that is left after removing the feeder nozzle from the container body is used as the liquid introducing port of claim 8.

25 13. A heat transpiration apparatus comprising a container body that

contains a transpiring liquid, an inner film and an outer film that are placed one on another and close a transpiration aperture of the container body and a heater for heating the container body, wherein the inner film is a liquid absorbent film, the outer film is a gas-

5 permeable film and a part of the inner film makes contact with the transpiring liquid.

14. A heat transpiration container comprising a container body that contains a transpiring liquid and an inner film and an outer film

10 that are put one on another and close a transpiration aperture of the container body, wherein the inner film is a liquid absorbent film and the outer film is a gas-permeable film.

15. The heat transpiration container according to claim 14, wherein

15 the liquid absorbent film is an unwoven fabric.

16. A method for controlling a heat transpiration temperature, which comprises controlling the surface temperature in the recess by means of depth of the recess, in case that the container having

20 the recess that contains the transpiring liquid is heated so as to transpire the transpiring liquid.

17. A method for controlling a heat transpiration temperature, which comprises controlling the surface temperature in the recess

25 by means of the area of a flange, in case that the container having

the flange provided along the periphery of the recess that contains the transpiring liquid is heated so as to transpire the transpiring liquid.

5 18. A method for controlling a heat transpiration temperature, which comprises controlling the surface temperature in the recess by means of the volume of a rib, in case that the container having the rib provided to protrude from the bottom of the recess that contains the transpiring liquid into the recess space is heated so as
10 to transpire the transpiring liquid.

19. The method for controlling the heat transpiration temperature according to any one of claims 16 to 18, wherein the transpiring liquid is an insecticidal technical product.

15

20. A heat transpiration apparatus comprising a heat transpiration container comprising a container body that contains a transpiring liquid and a transparent or semi-transparent gas-permeable film that closes a transpiration aperture of the container body, which is
20 placed or held on a heater surface at such an angle as the transpiring liquid touches the film.

21. A heat transpiration apparatus comprising a heat transpiration container comprising a container body that contains a transpiring
25 liquid and a transparent or semi-transparent gas-permeable film

that closes a transpiration aperture of the container body, which is placed or held on a heater surface that has such an angle as the transpiring liquid touches the film.

5 22. The heat transpiration apparatus according to claim 21, wherein the heat transpiration container is placed or held on the heater surface that has an angle of 10 to 90° from the horizontal plane.

23. The heat transpiration apparatus according to any one of claims
10 20 to 22, wherein the transpiration aperture of the container body has an inclined lower end that becomes narrower toward the end.

24. The heat transpiration apparatus according to any one of claims
15 20 to 23, wherein the transpiring liquid is an insecticidal technical product.

25. The heat transpiration apparatus according to any one of claims 20 to 24, wherein the transpiring liquid contains a colorant.

20 26. A heat transpiration method, which comprises placing or holding a heat transpiration container comprising a container body that contains a transpiring liquid and a transparent or semi-transparent gas-permeable film that closes a transpiration aperture of the container body is placed or held on the heater surface at such an
25 angle as the transpiring liquid touches the film, and heating the

transpiring liquid so as to transpire.

27. A heat transpiration container comprising a container body that opens at the top and contains a transpiring liquid therein and a
5 transparent or semi-transparent gas-permeable film that closes the aperture of the container body, wherein there is provided, in the container body that is closed by the gas-permeable film, an air reservoir that prevents the gas-permeable film from touching the bottom of the container body as the transpiring liquid transpires.

10

28. A heat transpiration container comprising a container body that opens at the top and contains a transpiring liquid therein and a transparent or semi-transparent gas-permeable film that closes the aperture of the container body, wherein an extended portion is
15 provided to protrude in the direction of depth and/or the direction of width of the container body at one end of the container body, so as to form an air reservoir.

20

29. The heat transpiration container according to claim 28, wherein a lower surface of the extended portion is formed in an inclined surface so that the transpiring liquid flows from within the extended portion to the lower end in the container body when the container body is placed in a vertical or tilted posture with the extended portion located at the top.

25

30. The heat transpiration container according to claim 29, wherein the angle between the lower surface of the extended portion and the bottom surface of the extended portion is larger than 90° and less than 180°.

5

31. A heat transpiration apparatus comprising a heater and the heat transpiration container of any one of claims 27 to 30 which is placed or held on the heater surface in a vertical or tilted posture so that the transpiring liquid touches the gas-permeable film.

10

32. A heat transpiration method which comprises heating the heat transpiration container of any one of claims 27 to 30 in a vertical or tilted posture so that the transpiring liquid touches the gas-permeable film to transpire the transpiring liquid.

15

33. A heat transpiration apparatus for heating a transpiring liquid holding body in a tilted posture by means of a heating section to transpire the liquid, comprising an instrument body that incorporates the heating section and a lid provided on the

20 instrument body so as to cover the entire transpiring liquid holding body, wherein a plurality of elongated apertures are formed in the lid surface that faces the outside when the lid is closed on the instrument body, proportion of the plurality of apertures to the area of the lid surface is set to 40% or more, and each of the apertures is
25 formed to be 5 mm or smaller along the shorter side thereof.

34. A heat transpiration apparatus for heating a transpiring liquid holding body by means of a heating section to transpire the liquid, comprising an instrument body that incorporates the heating

5 section and a lid provided on the instrument body so as to cover the transpiring liquid holding body, wherein aperture section is formed in the lid surface that faces the outside when the lid is closed on the instrument body, while proportion of the aperture section to the area of the lid surface is set to 40% or more, and maximum size of
10 the aperture section is formed to be 5 mm or smaller.

35. The heat transpiration apparatus according to claim 33, wherein each of the plurality of apertures becomes larger in length along the shorter side toward the transpiring liquid holding body.

15

36. The heat transpiration apparatus according to claim 35, wherein the lid has a plurality of pillars that divide the plurality of apertures along the longitudinal direction thereof and each of the pillars has triangular cross section.

20

37. The heat transpiration apparatus according to claim 33, wherein a transpiration aperture is formed in the gap between the instrument body and the upper end of the lid, and/or in the instrument body when the lid is closed on the instrument body.

25

38. The heat transpiration apparatus according to claim 37, wherein the transpiration aperture is provided so as to open vertically upward at the top end of the transpiring liquid holding body.

5 39. The heat transpiration apparatus according to claim 33, wherein a first air intake port is formed in the gap between the instrument body and the upper end of the lid, and/or in the instrument body when the lid is closed on the instrument body, and the first air intake port opens at a position lower in the vertical direction than
10 the lower end of the transpiring liquid holding body.

40. The heat transpiration apparatus according to claim 33, wherein a second air intake port is provided at a position substantially opposite to the lid in the horizontal direction in the instrument body.

insecticidal technical product 76.

There is no limitation on the amount of the insecticidal technical product 76 contained in the heat transpiration container 72 which may be determined by taking into consideration the transpiration performance of the chemical that is used, amount of transpiration per unit of time and the target duration of transpiration, and is usually from about 0.05 to 3 ml, preferably from about 0.1 to 1 ml. Depth of the recess 77a is preferably determined within a range from 0.5 to 5 mm depending on the kind of insecticidal technical product 5 contained therein. Amount of the insecticidal technical product is from about 75 to 4500 mg in weight, preferably from 150 to 1500 mg.

Target temperature of heating the insecticidal technical product is determined by taking into consideration the amount of insecticide component transpired per unit of time, and is set so that the heater temperature (surface temperature of the heater 71) is from about 50 to 170°C, preferably from 70 to 130°C.

The transpiration aperture of the container body according to the present invention preferably has such a shape that allows easy recognition of the changing liquid amount of the transpiring liquid 76, enables large transpiration area and can be formed easily. Fig. 19 to Fig. 25 shows various shapes of the transpiration aperture other than that of the transpiration aperture 77c shown in Fig. 18. Any of these transpiration apertures can be used in the present invention. In each case shown in the drawing, lower end of the