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DISPERSING INSECTICIDES OR OTHER PESTICIDAL COMPOUNDS AS VAPORS

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Fig.1.

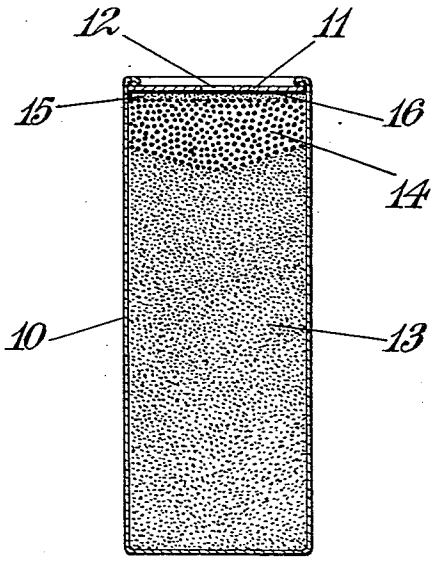
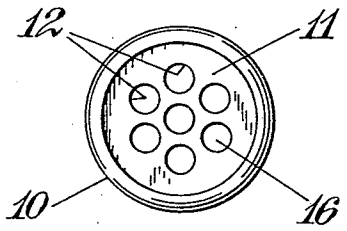


Fig.2.



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DISPERSING INSECTICIDES OR OTHER PESTICIDAL COMPOUNDS AS VAPORS

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9 Claims. (Cl. 167—40)

1

This invention relates to dispersing insecticides or other pesticidal compounds and is more particularly concerned with the method and means of dispersing insecticidal compounds by "smoke" generation, in which the pesticidal compound is admixed with a self-combustible composition which is capable of burning under confined conditions, and which on burning vaporises the pesticidal compound.

It is the usual practice to enclose a charge of the self-combustible composition with the pesticidal compound admixed in it in a container such as an aluminium or card-board tube which is open at one end, so that when the composition is ignited it burns slowly vaporising the pesticidal compound which issues from the open end of the container as a vapour or "smoke" in admixture with combustion gases produced by burning of the self-combustible composition.

It is well-known that the vapours generated by some compositions inflame unless special precautions are taken, that is, the vapours catch fire immediately on issuing from the container. The inflaming is thought to be due to the fact that the presence of a small quantity of air on the surface of the burning composition is sufficient to cause the vapours to ignite. For example, it is well-known that "smoke" generating compositions containing insecticide azobenzene (benzeneazo-benzene), which is used for killing Red Spider, are particularly subject to the disadvantage of inflaming.

It has therefore been proposed to provide a container in which the charge of the self-burning composition and pesticidal compound is separated from the ultimate outlet from the container by one or more mechanical baffles, formed for example from perforated metal sheets, so that the vapours and combustion gases cannot flow directly from the composition to atmosphere. Such an arrangement is disadvantageous in that with small containers the mechanical baffling means occupies a large proportion of the space within the container, thereby reducing the quantity of the composition that can be charged into a container, so that for a given size of container a relatively small space can be treated with the pesticidal compound.

This invention has for an object to provide improved means for dispersing pesticidal compounds in the form of vapours in which the necessity for such mechanical baffling to prevent inflammation of the vapours generated can be avoided.

It has been found that certain burning compositions instead of leaving a powdery ash when

2

burnt form a porous bonded mass through which the generated vapour or "smoke" can pass and which can itself act as a baffle, and this invention employs this fact to form a baffle between a composition, the vapours of which will inflame, and the outlet from a container.

Accordingly this invention provides generator means for dispersing a vaporisable insecticide comprising a container with an outlet at one end and a charge of self-combustible material in the container which charge is formed in two or more layers whereof the uppermost layer, that is the layer nearest the outlet, is a composition which forms on combustion a porous bonded mass permitting the passage of vapours through it and which does not generate an inflaming vapour, and whereof the other or one at least of the other layers is a pesticidal "smoke" generating composition the vapours of which will inflame.

In the use of the "smoke" generator according to this invention the uppermost layer burns first leaving the porous bonded mass bridging the outlet from the container so that when the lower layer or layers of the charge burn the vapours generated have to pass through the porous mass to the outlet; in this way on issuing into the atmosphere the vapours will be separated from their generating charge and cannot be caused to inflame due to burning of the charge. Moreover the porous bonded mass has a strength sufficient to withstand the gas pressures within the container without breaking up and being ejected from the container; this avoids a further disadvantage of known "smoke" generators, not having mechanical baffles, that hot fragments of the residue formed on combustion are often ejected from the container.

The uppermost layer need form only a small proportion of the total charge in the container so that even though the uppermost layer does not itself produce a pesticidal vapour, a large proportion of the container can be occupied by a pesticidal "smoke" generating composition. However according to a feature of this invention the uppermost layer may contain a vaporisable pesticidal composition and where this feature is adopted it will be seen that the whole of the container can be occupied by a pesticidal "smoke" generating composition.

In one preferred form of this invention the uppermost layer of the charge consists of a composition comprising hexamine, potassium chlorate or other suitable highly oxygenated inorganic compound, diatomaceous silica or kaolin which is preferably in a finely divided state (such as the

material known as colloidal kaolin) or finely divided native magnesium silicate (such as talc) or another chemically inert substance of like physical properties, and a material which is vaporised by the combustion of the hexamine with oxygen supplied by the highly oxygenated inorganic compound. The vaporisable material may be an insecticide or other pesticidal compound, for example D. D. T. or may be a substantially non-toxic compound such as hexachloroethane.

It has been found that, on combustion, a composition containing these substances produces a hard bonded mass having fine pores running through it, which mass can act as a baffle to prevent inflammation of the vapours generated by the combustion of the other pesticidal compound dispersing compositions.

The vaporisable compound such as D. D. T. or hexachloroethane may form the major portion of the composition forming the upper layer and it is preferred that the ratio of the quantity of vaporisable compound to the quantity of hexamine and highly oxygenated inorganic compound combined shall lie within the limits 1:1 and 3.0:1.

The quantity of highly oxygenated inorganic compound such as potassium chlorate present should be insufficient to cause complete combustion of the hexamine and is preferably present in a quantity having a ratio of 1.1:1 and 5.0:1 to the quantity of hexamine employed.

The chemically inert substance, such as diatomaceous silica or colloidal kaolin, appears to exert a controlling influence on the size of the pores running through the hard bonded mass and the quantity of this substance added to the composition may be varied. It is preferred, however, that the quantity of the chemically inert substance added shall lie within the range of 4% to 18% of the total weight of the composition from which the uppermost layer is formed.

One composition having a high efficiency as a baffle-forming composition comprises 57 parts by weight of D. D. T. or hexachloroethane, 20 parts by weight of potassium chlorate, 3 parts by weight of hexamine, 12 parts by weight of diatomaceous silica, and 3 parts of thiourea.

Another composition which is suitable for this purpose comprises 61 parts by weight of D. D. T. or hexachloroethane, 21 parts by weight of potassium chlorate, 9 parts by weight of hexamine and from 4 to 9 parts by weight of diatomaceous silica or colloidal kaolin.

Another composition which has been found to be suitable for forming the porous crust comprises as its essential constituents a vaporisable material, a highly-oxygenated inorganic compound, thiourea and urea. The urea acts as a moderant to prevent the thiourea from burning at an excessive rate and also acts as a stabilizer for the chlorate in the presence of impure D. D. T. One suitable composition of these constituents comprises—

61% D. D. T.
23% potassium chlorate
11% thiourea
and
5% urea

The thickness of the uppermost layer may be varied considerably but a minimum thickness is required to prevent inflammation of vapours generated from a composition below it, which minimum thickness is dependent on the size of the aperture in the container.

It will be clear that the invention is not limited to using a thickness of the uppermost layer just sufficient to form a baffle for the vapours generated by the lower layer or layers of the charge. For instance it is sometimes desirable to disperse azobenzene (benzeneazo-benzene) for killing Red Spider and D. D. T. for killing other insects and this may be achieved by partially filling the container with a self-combustible composition containing the azobenzene, the vapours of which readily inflame and cover this charge with a layer of a D. D. T. composition such as those above set forth, the depth of the layers being selected according to the desired ratio of the azobenzene and D. D. T.

According to a feature of this invention therefore means for dispersing vaporisable pesticidal compounds as above set forth may be employed for dispersing two or more pesticidal compounds, by incorporating a pesticidal compound in each of a number of the layers of the charge.

There will now be described a test carried out on a "smoke" generator prepared according to this invention, reference being made in the description to the accompanying drawings, in which:

Fig. 1 is a sectional view taken through the longitudinal axis of the generator; and

Fig. 2 is a view of the upper end of the generator.

Referring now to the drawings, the generator comprises an aluminum tube **10** 90 mm. long and 37 mm. in diameter, which tube is closed at one end and has at the other end a closure disc **11** perforated with a plurality of holes **12** each 6 mm. in diameter, there being a spacing of 8 mm. between the centres of each pair of adjacent holes, the tube **10** is partially filled with 82 grams of a powdered composition, indicated at **13**, comprising:

	Per cent by weight
Azobenzene	47
Potassium chlorate	20
Sucrose	21
and	
Colloidal kaolin	12

The vapours generated by this composition are highly inflaming that is without special baffling the vapours would ignite immediately on generation.

10 grams of a composition indicated at **14**, comprising:

57 parts by weight of D. D. T.
20 parts by weight of potassium chlorate
3 parts by weight of hexamine
12 parts by weight of diatomaceous silica
and
3 parts by weight of thiourea

is then spread evenly over the top of the azobenzene composition **13** to give a layer 1 cm. thick.

The surface of the layer of construction **14** is dusted with an igniter composition, indicated at **15**, comprising:

61% by weight D. D. T.
23% by weight potassium chlorate
11% by weight thiourea
5% by weight urea

and covered by a paper disc **16**. The apertured closure disc **11** is then placed in position.

On ignition of the charge the smoke generated is first a white smoke and then an orange smoke, showing that the azobenzene is being vaporised,

but no inflammation of the azobenzene vapour occurs.

When the container has cooled down the wall of the aluminium container is cut away and the upper layer is removed, it is found that the layer 14 is a hard cake having pores running through it. The residue of the azobenzene charge, however, readily crumples to powder form.

Similar results are obtained in tests in which the D. D. T. was replaced by hexachloroethane, and in which the diatomaceous silica was replaced by colloidal kaolin.

We claim:

1. Pesticidal smoke generating means having a container provided with an outlet at one end thereof, and a charge within the container, said charge comprising a self-combustible composition in admixture with a vaporisable pesticidal substance, said charge being formed in at least two layers having different compositions, the layer adjacent the outlet having a composition to form on combustion a porous bonded mass permitting the passage of vapours therethrough and generating a non-inflaming vapour, a layer remote from the outlet being arranged to generate on combustion an inflaming pesticidal vapour containing gas.

2. Pesticidal smoke generating means having a container provided with an outlet at one end thereof, and a charge within the container, said charge comprising a self-combustible composition in admixture with a vaporisable pesticidal substance, said charge being formed in a plurality of layers of differing compositions and containing differing vaporisable pesticidal substances, the end layer adjacent the outlet from the container having a composition to form on burning of the layer a porous bonded mass permitting the passage of vapours therethrough, at least another layer having a composition to generate on combustion an inflaming pesticidal vapour containing gas.

3. Pesticidal smoke generating means having a container provided with an outlet at one end thereof, and a charge within the container, said charge comprising a self-combustible composition in admixture with a vaporisable pesticidal substance, said charge being formed in at least two layers having different compositions, the layer adjacent the outlet having a composition to form on combustion a porous bonded mass permitting the passage of vapours therethrough and generating a non-inflaming vapour, a layer remote from the outlet being arranged to generate on combustion an inflaming pesticidal vapour containing gas, the layer adjacent the outlet comprising in admixture hexamine, a highly oxygenated inorganic compound in a quantity insufficient to cause complete combustion of the hexamine, a vaporisable substance, and a chemically inert substance which on burning of the composition assists in the formation of a porous bonded residue.

4. Pesticidal smoke generating means according to claim 3, wherein the ratio of the quantity of the vaporisable substance to the quantity of hexamine and highly oxygenated inorganic compound combined lies within the limits 1.3:1 and 3.0:1, and the ratio of the quantity of the highly oxygenated inorganic compound to the quantity of hexamine present lies within the limits of from 1.1:1 to 5.0:1.

5. Pesticidal smoke generating means according to claim 3, wherein the ratio of the quantity of the vaporisable substance to the quantity of hexamine and highly oxygenated inorganic compound combined lies within the limits 1.3:1 and 3.0:1, and the ratio of the quantity of the highly oxygenated inorganic compound to the quantity of hexamine present lies within the limits of from 1.1:1 to 5.0:1, and wherein the chemically inert substance is present in a proportion of from 4% to 18% by weight of the total weight of the composition forming the uppermost layer.

6. Pesticidal smoke generating means according to claim 1, wherein the layer adjacent the outlet comprises in admixture 57 parts by weight of D. D. T., 20 parts by weight of potassium chlorate, 8 parts by weight of hexamine, 12 parts by weight of diatomaceous silica and 3 parts by weight of thiourea.

7. Pesticidal smoke generating means according to claim 1, wherein the layer adjacent the outlet is formed by a composition comprising 61 parts by weight of D. D. T., 21 parts by weight of potassium chlorate, 9 parts by weight of hexamine, and from 4 to 9 parts by weight of colloidal kaolin.

8. Pesticidal smoke generating means according to claim 1, wherein the layer adjacent the outlet is formed by a composition comprising 61 parts by weight of hexachloroethane, 21 parts by weight of potassium chlorate, 9 parts by weight of hexamine, and from 4 to 9 parts by weight of diatomaceous silica.

9. Pesticidal smoke generating means according to claim 1, wherein the layer adjacent the outlet is formed from a composition comprising in admixture D. D. T., potassium chlorate, thiourea and urea, the latter acting as a moderant for the speed of burning of the thiourea and as a stabilizer in storage for the chlorate, with the said ingredients being present in proportion by weight of 61:23:11:5, in the order named.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,207,766	Katzenberger	Dec. 12, 1916
2,154,221	Taylor	Apr. 11, 1939
2,385,636	McLain	Sept. 25, 1945
2,440,082	Flanders	Apr. 20, 1948
2,488,776	Jones	Nov. 22, 1949

FOREIGN PATENTS

Number	Country	Date
397,238	Great Britain	Aug. 24, 1933