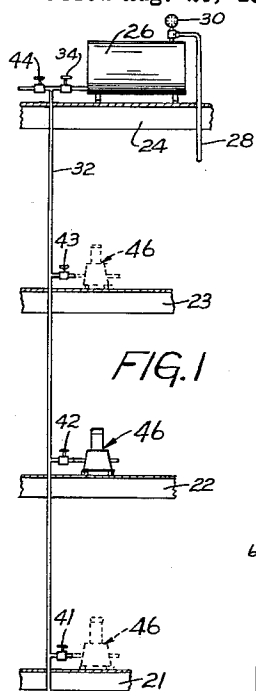
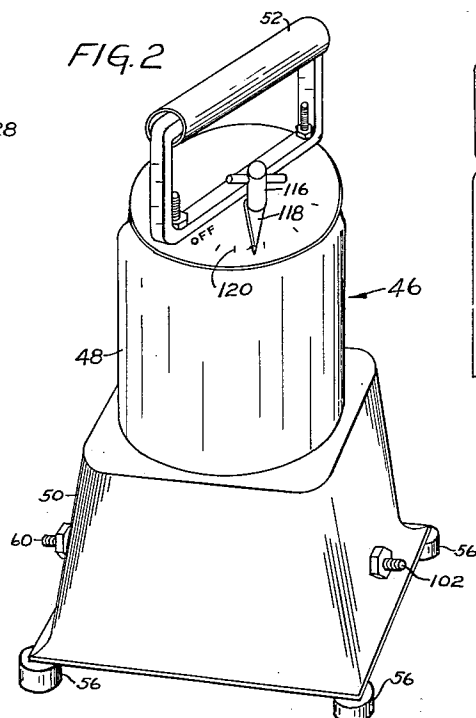
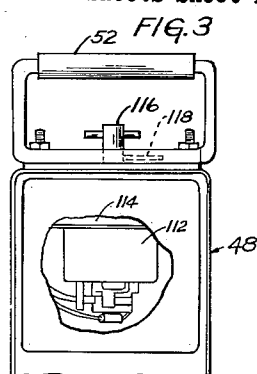
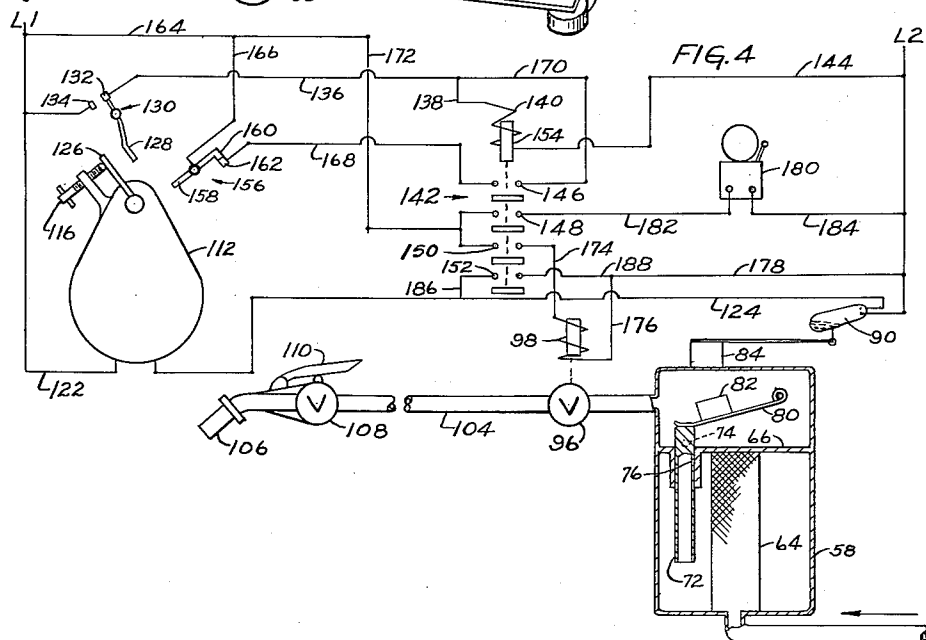


Filed Aug. 25, 1958

FUMIGANT APPLICATOR

2 Sheets-Sheet 1



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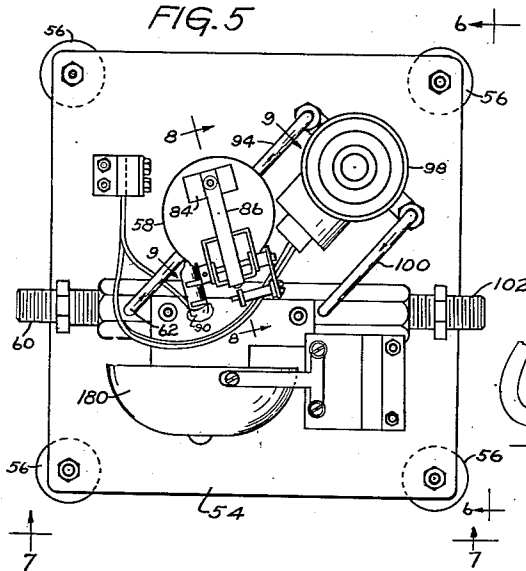
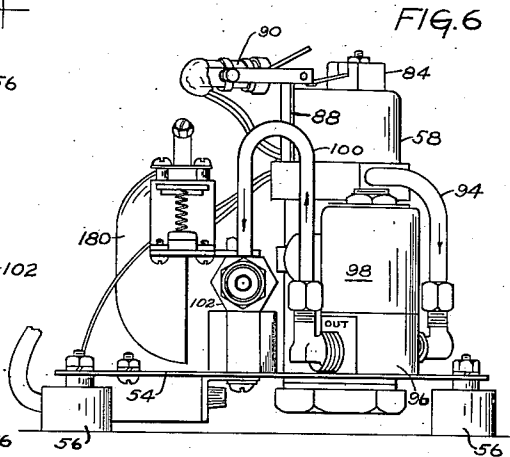
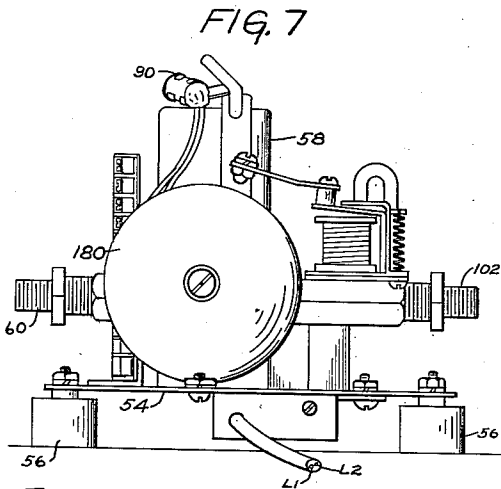
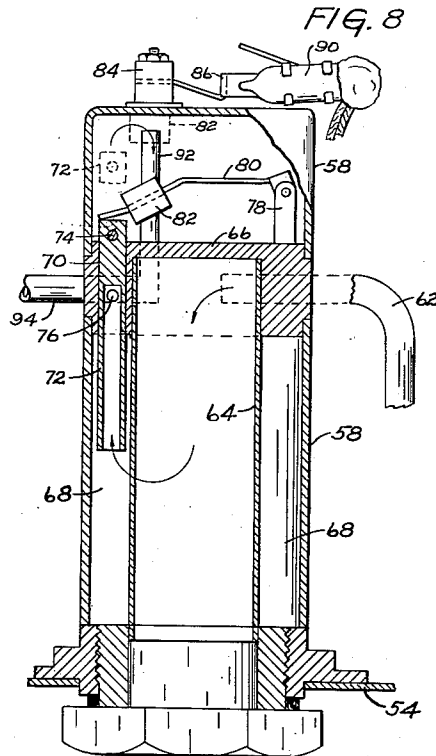
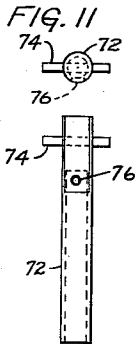
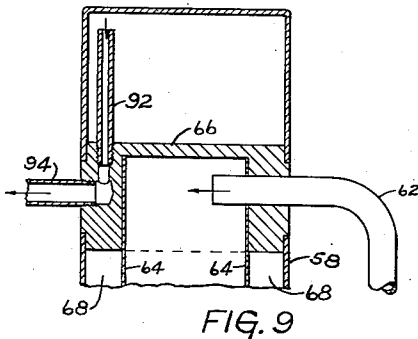
April 18, 1961

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FUMIGANT APPLICATOR

2,980,293

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2 Sheets-Sheet 2



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FUMIGANT APPLICATOR

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9 Claims. (Cl. 222—39)

This invention relates generally to fumigating apparatus for flour mills, and pertains more particularly to a local or spot fumigant applicator for applying liquid fumigant directly to milling machines, elevators, conveyors, bins and the like situated in various sections of the mill.

One object of the invention is to provide a portable fumigant applicator that can be moved about the mill for applying fumigants to various types of milling equipment.

A very important object is to provide an applicator of the foregoing type that can be depended upon to dispense the fumigant in controlled amounts, thereby avoiding waste of the insecticide.

Another feature of the invention resides in the employment of a sealed flow responsive means which renders the applicator completely leak-proof.

Another object of the invention is to provide portable fumigating apparatus employing a flexible hose that is devoid of controls at the discharge end other than an easily manipulatable hand valve. Stated somewhat differently, the invention contemplates the use of a manually operable valve that constitutes the sole mechanism that must be handled by the operator. In this way, not only can the flow of fumigant be shut off at any time without drippage should circumstances so dictate, but the lack of any wires leading to this manually controlled nozzle valve obviates the danger of short circuits. Also, the absence of wires eliminates the likelihood of catching on machinery as the hose is being moved about and being inserted into the milling equipment. Still further, the proposed arrangement greatly facilitates hose replacement.

Yet another object of the invention is to provide a low-cost fumigant applicator that is very simple and not likely to get out of order very readily. Regarding the maintenance of my applicator, it should be pointed out that the apparatus lends itself to easy and rapid cleaning.

A still further object is to provide a fumigant applicator that is usable with piping systems that have already been installed in the mill without modification thereof or the addition of equipment not contained in my portable applicator unit.

Other objects will be in part obvious and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereafter set forth and the scope of the application which will be indicated in the appended claims.

In the drawing:

Figure 1 is a view illustrating a vertical run of piping for conveying liquid fumigant under pressure to various floor levels of a flour mill, my portable applicator having been depicted in solid outline on the second level and in phantom outline in the first and third levels;

Figure 2 is a perspective view of my fumigant applicator;

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Figure 3 is a fragmentary view of the upper portion of the applicator, a portion of the housing having been broken away in order to reveal some of the operating parts;

Figure 4 is a schematic electrical diagram of my timing system;

Figure 5 is a plan view of the applicator but with the entire protective casing removed;

Figure 6 is a right-hand view of Figure 5;

Figure 7 is a front view of Figure 5;

Figure 8 is a sectional view of the sealed control and filter housing taken in the direction of line 8—8 of Figure 5;

Figure 9 is a fragmentary sectional view taken in the direction of line 9—9 of Figure 5 showing to better advantage the inlet and outlet tubing associated with the combined control and filter housing;

Figure 10 is an elevational detail view of the movable member that is responsive to fumigant flow through the control and filter housing, and

Figure 11 is a plan view of Figure 10.

Referring first to Figure 1, it can be assumed that this view depicts a floor level arrangement of a typical flour mill, the respective floors having been denoted by the reference numerals 21, 22, 23 and 24. Disposed on the upper floor level 24, although it might just as well be on one of the other levels, is a liquid fumigant supply tank or source 26. By way of an air line 28 leading from the mill compressor (not shown), air is supplied to the tank 26 via a regulating valve 30. A run of vertical pipe 32 extends downwardly through the various floors. A main shut-off valve 34 at the tank 26 permits the shutting off of fumigant so that it does not enter the piping 32. However, a series of take-off valves 41, 42, 43 and 44 are located on each floor level to allow selective attachment of my portable fumigant applicator, which has been designated in its entirety by the numeral 46. It will be understood that the tank 26, the piping 32, and the various manually actuatable take-off valves 41—44 are permanently installed fixtures of the flour mill.

The applicator 46 is provided with a casing composed of a cylindrical portion 48 and an outwardly flaring skirt portion 50. To the top of the casing portion 48 is bolted a carrying handle 52. Disposed beneath the skirt portion 50 is a base plate 54 to which are attached a plurality of resilient supporting feet 56.

Mounted on the base plate 54, as best viewed in Figure 8, is what will be termed a combination control and filter housing 58. The specific manner in which the housing 58 is mounted on the base plate 54 is not important to a comprehension of the invention, but it will be understood that the entire housing 58 must be liquid tight and is so constructed.

From Figures 2, 5 and 7 it will be discerned that a threaded coupling 60 is provided which is designed to be connected to any of the take-off valves 41—44. The liquid fumigant from the tank 26 therefore enters my applicator 46 through this coupling or union 60 from whence it passes upwardly through a tube 62 leading into the housing 58. The tube 62 actually extends into the interior of a cylindrical filter screen 64 which is centrally located within the housing. The upper end of the filter 64 is closed by a partition 66 dividing the interior of the housing into upper and lower compartments as clearly pictured in Figure 8.

The flow of liquid fumigant after exiting from the tube 62 is then downwardly and outwardly flowable into an annular region 68. The partition 66 is formed with a cylindrical passage 70 leading into the upper compartment of the housing 58.

Slidably disposed in the passage 70 is a plunger mem-

72 detailed in Figures 10 and 11. The upper end of the member 72 is closed and by means of a transverse pin 74 the downward gravitational movement of the plunger member is limited inasmuch as the projecting ends of the pin 74 will be arrested by the partition 66. The lower portion of the member 72 is in effect cup-shaped owing to its generally tubular configuration. However, a radially directed aperture 76 will allow the fumigant to pass into the upper compartment when the plunger member is lifted sufficiently to bring the aperture 76 to a level above the partition 66. The raising of the member 72 is due to the flow of fumigant and the way in which such flow is inaugurated will be explained hereinafter. At this stage of the description it is only necessary to understand that the plunger member 72 is flow responsive.

The partition 66 supports an upstanding post 78. Pivotaly mounted at one end on the post 78 is an arm 80, the free end of which engages the upper end of the plunger member 72. Carried adjacent this free end is a small magnet 82 which will be raised when the member 72 is lifted.

Although its specific role is better reserved for later discussion, it will now be explained that a second magnet 84 is located exteriorly of the housing 58 and is capable of being repelled by the first magnet 82 when said first magnet is elevated. The second magnet 84 is carried at the free end of an arm 86, said arm being pivotaly mounted at the upper end of a fixed bracket 88. Mounted for tiltable movement with the arm 86 is a mercury switch 90, the mercury switch being open when the arm 86 is horizontal which is the situation when the magnet 84 is in its lower position as it will be prior to repulsion thereof by the magnet 82.

As best viewed in Figure 9 the partition 66 supports a vertical tube 92 open at its upper end for the entrance of the liquid fumigant from the upper compartment of the housing 58. In direct communication with the tube 92 is a tube 94 curving downwardly to a valve 96 which is operated by a solenoid 98. The valve 96 is biased to open position so that the liquid fumigant normally passes therethrough to an inverted U-shaped tube 100 and thence to a coupling or union 102.

Appearing only in the schematic view of Figure 4 is a flexible hose 104 that connects directly to the coupling 102. The hose 104 may be of any preferred length, the length depending upon where the mill equipment to be serviced with insecticide is situated from the take-off valves 41-44. A nozzle 106 is attached to the discharge end of the hose 104 and associated with this nozzle is a manually actuatable valve 108 which is normally spring biased to closed position but which can be easily opened through the agency of a handle 110.

From Figure 3 it can be seen that a timing motor 112 appears, this motor depending from a horizontal support 114 located within the upper end of the cylindrical casing portion 48. Projecting upwardly through the top of this casing portion 48 is an adjustable stop element 116 that determines the period of operation of the motor 112, the stop element having a pointer 118 cooperable with indicia 120 on the casing portion 48 so that the appropriate timing period, and hence the amount of fumigant to be dispensed, can be readily selected.

The role played by the timing motor 112 is best understood by reference to Figure 4. In this diagrammatic figure a pair of supply lines L_1 , L_2 are shown. The timing motor 112 is connectable across these lines by way of the normally open mercury switch 90 and conductors 122 and 124. The mercury switch 90 will be rocked into a closed position by the repelling of the magnet 84 by the magnet 82. Such an occurrence results in a spring loaded arm 126 associated with the motor 112 being rotated in a clockwise direction as viewed in Figure 4. The initial position of the arm 126 is determined by the adjustable stop 116.

Sufficient rotation of the actuating arm 126 is instru-

mental in causing engagement with a switch arm 128 of a normally open switch 130. As schematically illustrated, the switch arm 128 carries a contact 132 cooperable with a fixed contact 134. The fixed contact 134 is connected directly to line L_1 , whereas the movable contact is connected via conductors 136, 138 to the operating coil 140 of a relay generally denoted by the reference numeral 142. The circuit through the coil 140 is completed through a conductor 144 leading to line L_2 .

To simplify the description the relay 142 has been depicted as having four sets of normally open contacts 146, 148, 150 and 152, although the functions of the contacts 148 and 150 might be consolidated in one pair in practice, if desired. It will be appreciated that all of these contacts 146-152 are actuated in unison by the armature, labeled 154, of the relay 142.

A normally closed switch denoted by the numeral 156 comprises a switch arm 158 carrying a contact 160 which is cooperable with a fixed contact 162. The switch arm 158 is also engageable by the actuating arm 126 of the timing motor 112, but only after an interval of approximately two seconds, as will presently be more fully discussed. At this stage of the description, though, it should be noted that the relay 142 will seal itself in through the normally closed contacts 160, 162 when the relay contacts 146 close, since a circuit is established over conductors 164, 166, 168, 170, and the previously mentioned conductors 138, 144 extending between the lines L_1 , L_2 , both the normally closed contacts 160, 162 and the coil 140 being in series with these conductors.

Inasmuch as it is intended that the normally open switch 130 will be closed by the timing motor 112 after the lapse of a predetermined length of time influenced by the setting of the adjustable stop 116, it will be perceived below that this period of time is utilized to control the amount of fumigant that is discharged through the nozzle 106. Accordingly, the relay contacts 150 are in circuit with the solenoid 98 that actuates the valve 96 into its closed position, it having already been stated that this valve is normally open. The energizing circuit for the solenoid 98 is via a conductor 172 having electrical connection with the already referred to conductor 164, the contacts 150, a conductor 174, a conductor 176 and another conductor 178 attached to the line L_2 . Closure of the solenoid valve 96 stops all further flow of fumigant.

Concurrently with the closing of the valve 96 is the sounding of a bell-type alarm 180, the bell 180 being in a serial relationship with the relay contacts 148 connected to the conductor 172, a conductor 182 and a conductor 184, the latter being connected directly to said line L_2 . Another thing that happens when the relay 142 picks up is that the mercury switch 90 is shunted whereby the continued running of the motor 112 is assured, even should the closing of the valve 96 and the concomitant stoppage of fumigant flow cause the mercury switch to open. The shunting of the mercury switch 90 takes place via a short conductor 186 extending between the conductor 124 and the contacts 152, and another short conductor 188 connecting with the conductor 178.

Continued running of the timing motor 112 for the additional two seconds brings the actuating arm 126 into engagement with the switch arm 158. Deflection of this switch arm, of course, opens the contacts 160, 162 to de-energize the relay 142. The dropping out of the relay 142 opens the contacts 146-152 with the consequence that the valve 96 reopens under its spring bias, the bell 180 ceases its ringing and the motor 112 stops running. The spring loading of the actuating arm 126 will then return the timing motor to its original position for a subsequent application of fumigant. It might be pointed out at this time that the purpose of the bell 180 is to inform the operator when the timing cycle has been terminated so that he can relax his grasp on the handle 110 to allow the manually operated valve 108 to close.

Although a considerable amount of operating detail

has been given in conjunction with the description pertaining to Figure 4, it will undoubtedly be of help at this time to review what transpires from the outset. Having connected the applicator 46 to the selected take-off valve 42, the operator places the nozzle 106 in whatever portion of the mill which is to be locally fumigated, whether it be a purifier, elevator, conveyor, bin, or spout or other equipment. Depression of the handle 110 will open the valve and since the valve 96 is already open, being a normally open valve, liquid fumigant under pressure immediately begins to flow through the housing 58. In so doing the plunger member 72 is lifted by the flow action through the passage 70 leading upwardly into the compartment above the partition 66. Upward movement is in this way imparted to the magnet 82.

Although the magnet 82 is sealed from the magnet 84 by the intervening top of the housing 58, the opposite pole orientation of the magnets produces a repulsive effect which urges the secondary magnet 82 in an upward direction away from the top of the housing. Whatever counter-balancing that is necessary to achieve this result may be provided. Such action closes the mercury switch 90 by causing the globule of mercury confined within the switch envelope to bridge the internal contacts connected in the circuit of the timing motor 112 which now extends between the lines L₁, L₂.

Next in the chain of events is the movement of the actuating arm 126 from the setting determined by the adjustable stop 116 to close the switch 130. It is during this interval that the fumigant will flow through the flexible hose 104 so as to be discharged from the nozzle 106. Immediately upon the arm 126 reaching the switch arm 128, however, the relay 142 picks up and thereby energizes the solenoid 98 to close the valve 96. Simultaneously with the closing of the valve 96, the bell 130 rings, thereby audibly informing the operator that the requisite quantity of fumigant has been discharged and that he should then permit the valve 108 to close.

The timing motor 112 then continues for what has been suggestively alluded to as two seconds, whereupon the switch 158 is opened to deenergize the relay 142. This completes one operational cycle, the actuating arm 126 then returning under the influence of its spring (not shown) to the stop 116 because the motor 112 has at this time been deenergized. In some instances the relay contacts 152 can be dispensed with if the mercury switch 90 is so mounted that the actuating arm 126 on the motor 112 is assured of reaching the switch arm 158. In the illustrated situation, the switch arm 158 must be engaged before the motor 112 will stop.

Thus, it can be seen that by opening the manual valve 108 the operational cycle is initiated in a completely automatic fashion. In this regard, attention is made to the fact that no wires whatsoever are necessary at the nozzle end of the hose 104. The advantages stemming from this arrangement have already been mentioned. Also, with a given pressure applied to the fumigant, the quantity dispensed is accurately determined for the particular time setting for the motor 112.

As many changes could be made in the above construction and many apparently widely different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

What is claimed:

1. In a fumigant applicator of the character described, conduit means for conducting fumigant under pressure

to an infested location from a fumigant supply source, a manually operated valve near the discharge end of said conduit means, an electrically controlled valve disposed in said conduit means between said manually operated valve and the source of fumigant to which the other end of the conduit means is intended to be connected, said electrically controlled valve being normally biased to open position, timing means, means responsive to the flow of fumigant under pressure caused by the opening of said manually operated valve for initiating operation of said timing means, and circuit means responsive to said timing means for energizing said electrically controlled valve to close same after said timing means has operated for a predetermined period of time.

2. A fumigant applicator in accordance with claim 1 in which said circuit means includes an alarm for signaling the operator when said electrically operated valve has been energized into its closed position, thereby informing the operator that he should then close said manually operated valve.

3. A fumigant applicator in accordance with claim 1 in which said timing means includes an electric timing motor and said flow responsive means includes a normally open switch in circuit with said motor and a member movable from one position to a second position due to the flow of fumigant thereby to close said switch and thus energize said motor to initiate said timing operation.

4. A fumigant applicator in accordance with claim 3 including a pair of magnets, one of which is shifted toward the other by said member thereby repelling said other magnet to actuate said switch.

5. A fumigant applicator in accordance with claim 4 including a housing having an inlet near the bottom thereof in communication with said source, an outlet near the top thereof connected to said conduit means and a vertical passage interconnecting said inlet and outlet, said member being disposed in said passage so as to be lifted by the flow of fumigant therethrough and said one magnet being contained in the upper portion of said housing so as to be raised by the upward movement of said member, the other of said magnets being located exteriorly of said housing and movable in a direction to actuate said switch when repelled by said one magnet.

6. A fumigant applicator in accordance with claim 5 in which said switch is a mercury switch tiltable by said other magnet into circuit closing position.

7. In a fumigant applicator of the character described, a fumigant supply source, a flexible hose for conducting fumigant under pressure to an infested location from said fumigant supply source, an outlet nozzle at the end of the hose remote from said source, a manually actuable valve adjacent said nozzle, a normally open valve located at the other end of said hose, a solenoid for actuating said normally open valve into closed position, a control housing having an outlet connected to said normally open valve and an inlet adapted to be connected to a source of liquid fumigant under pressure, said housing having a passage therein, a plunger member slidably disposed in said passage responsive to the flow of fumigant under pressure therethrough, a first magnet within said housing actuatable by the plunger member so as to be movable in accordance with the movement of said plunger member, a second magnet disposed for movement exteriorly of said housing under the repelling influence of said first magnet when moved by said plunger member, a normally open switch actuatable into closed position by said second magnet when repelled by said first magnet, a timing motor in circuit with said switch so as to be energized by said switch, and circuit means closed by said timing motor after a predetermined period of time resulting from closure of said switch by the second magnet for energizing said solenoid to thereby close said normally open valve.

8. A fumigant applicator in accordance with claim 7

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in which said circuit means includes a first pair of normally open contacts closable by said timing motor after said predetermined period of time, a relay in circuit with said first pair of contacts having first and second sets of normally open contacts, an electric signal in circuit with the first set of relay contacts, said solenoid being in circuit with said second pair of relay contacts.

9. A fumigant applicator in accordance with claim 8 in which said circuit means also includes a second pair of normally closed contacts openable by said timing motor after a preferred period of time subsequent to said predetermined period of time, said relay having a third set of normally open contacts in circuit with said second pair of contacts for sealing in said relay until

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said second pair of contacts have been opened by the timing motor.

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