Control of Powder-post Beetles

complete kills of Lyctus beetles infesting hardwood floors achieved in 5–10 minute applications of infrared radiation

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Exposure time required for the fast, efficient heat of infrared radiation to kill Lyctus powder-post beetles—in all stages of development—is governed by the thickness of the infested hardwood floor. Once the floor thickness has been determined and the exposure time known, 100% mortality of the Lyctus beetles can be expected under every square inch of area covered by a recently developed infrared unit.

Repeated laboratory tests revealed a five-minute exposure is required to kill Lyctus beetles in 3/8" hardwood flooring, seven minutes for 1/2", and 10 minutes for 13/16".

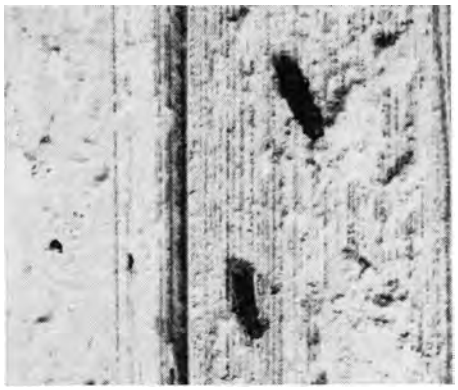
Infrared radiation has many industrial uses in processing operations—such as baking, drying, heating—and the advent of the commercial self-contained infrared lamp made it possible to treat insect infested stored food products with a reasonable degree of success.

The properties of infrared radiation result from its spectral characteristics. Infrared is a band of invisible radiant energy lying between the shorter wave lengths of the red end of the visible spectrum and the longer wave lengths of the outer band of radio frequencies. The great penetrating power of the infrared causes uniform heating and fast temperature rise throughout much of the depth of many substances. Heat transfer by radiation is caused by heated bodies emitting radiant energy to their surroundings. Differing from visible light only in wave length, the heat radiation needs no solids, gases, or liquids for its transmission. A form of this radiant energy is harnessed in the infrared lamp and may be transferred through air with minimum heat loss.

The destruction of wood-infesting insects by infrared radiation becomes possible when the wave lengths of energy—rays—from an infrared lamp come into contact with the wood surface. The wood absorbs the rays and the resulting usable heat is transferred through the wood by conduction.

An inexpensive and simple infrared unit—using the radiation *principle*—was designed to control Lyctus beetles infesting hardwood floors.

The habit of powder-post beetles of confining their activities within the limited thickness of hardwood flooring



Adult powder-post beetles—*Lyctus planicollis*—on damaged wood.

makes controlling them through infrared a method of great convenience.

Initial laboratory experiments were made with the test insects in shallow plastic cages that were inserted in a cavity carved out of the subfloor surface. Hardwood flooring of predetermined thickness was laid over the depressed cages and nailed down to simulate actual floor conditions.

Exposures were made to learn the time required to kill all developmental stages of the beetles.

Adult beetles appear to succumb to shorter exposures than do the soft-bodied larvae. This may result primarily from the dark chitinous covering of the adult beetles, which absorbs radiation more rapidly and retains it longer. Inasmuch as the eggs are laid in cracks on the floor surface, they and the early instar larvae are the first to receive radiation.

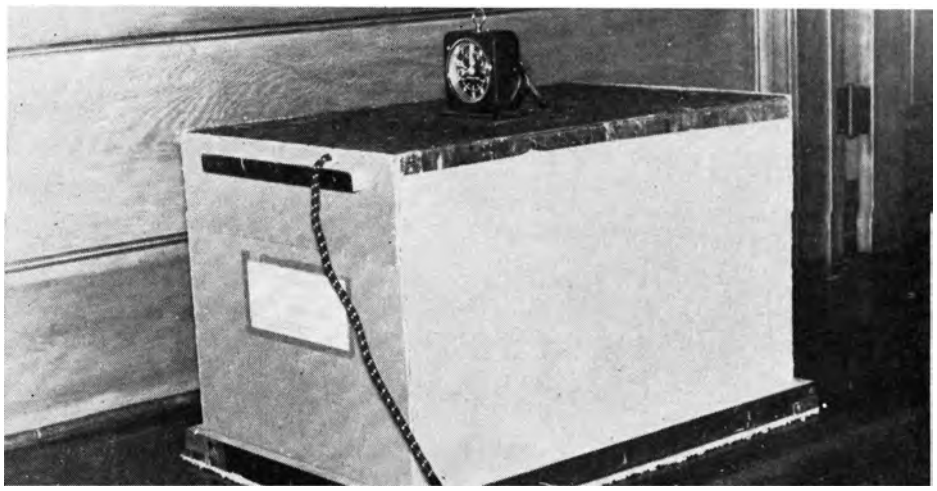
Moist heat is a better killing agent than dry heat and therefore infrared treatment of floors in the coastal areas—especially during an overcast day when increased humidity is apparent—will result in a complete kill in a shorter time than in the interior areas where lower humidity prevails. Wood—like a sponge—will absorb moisture from the air.

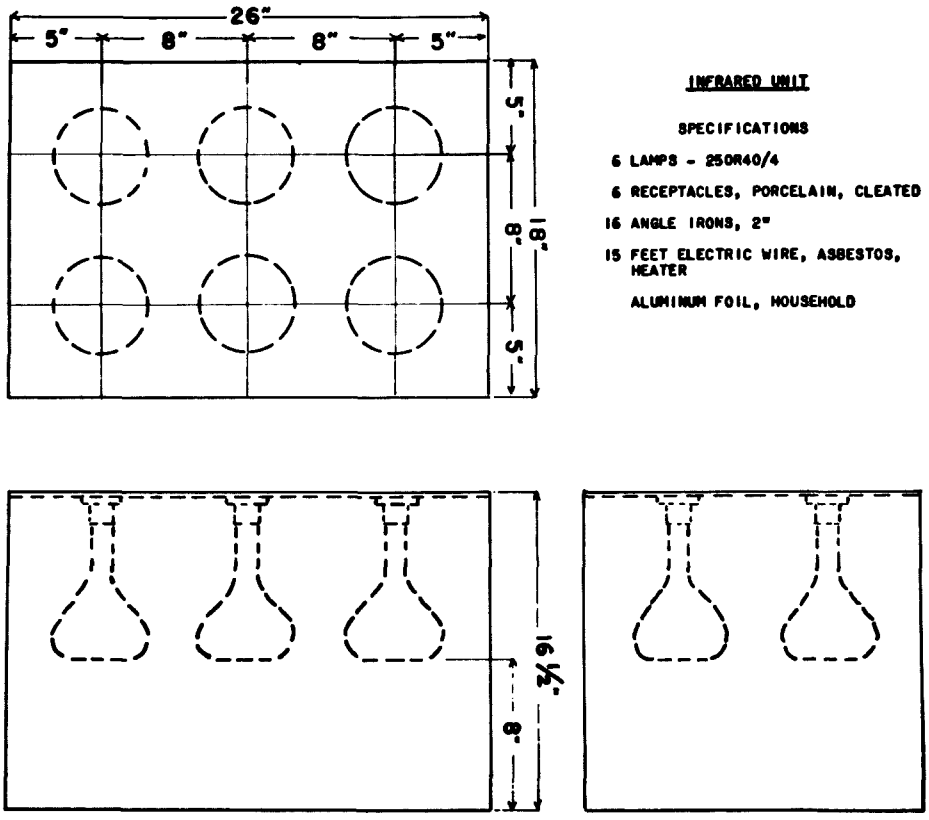
The infrared unit is a simple, light wooden cabinet 26" × 18" × 16½". A battery of six standard 250-watt R-40 lamps with medium skirted base—in standard cleated porcelain receptacles—are spaced with their centers 8" apart and their surfaces 8" above the floor when the unit is in position for exposures.

The proper location of the lamps inside the unit is essential because wood is a poor conductor of heat, and uniform radiation is required over every square inch of the floor surface covered by the unit. Considerable heat is generated by each lamp, so safety precautions require asbestos heater cord—such as that for electric irons—to wire the receptacles. The entire inside surfaces, including all wiring, are covered with aluminum foil. The foil is an excellent reflective surface and insulates the cabinet against excessive heating. One side of the cabinet has a flat surface all the way to the base to enable the unit to be placed tightly against any wall where infestation occurs at the juncture of floor and wall. Thin strips of felt are fastened to the bottom edges of the cabinet to prevent scratching of floor finishes as the unit is slid from one location to another.

The framework of the cabinet is made of 1" × 1" wooden strips with corner irons to strengthen the frame. The sides may be made of heavy paper chipboard

Infrared unit in operation, showing over-all size and general external design.





Schematic drawing of infrared unit, showing arrangement and spacing of lamps. Wiring—not shown—is arranged in parallel.

or thin plywood, depending on the lightness desired. The top of the cabinet should be of heavier material—¼" plywood or masonite—because of the weight of the receptacles and lamps. The completed unit need not weigh more than 12 or 15 pounds.

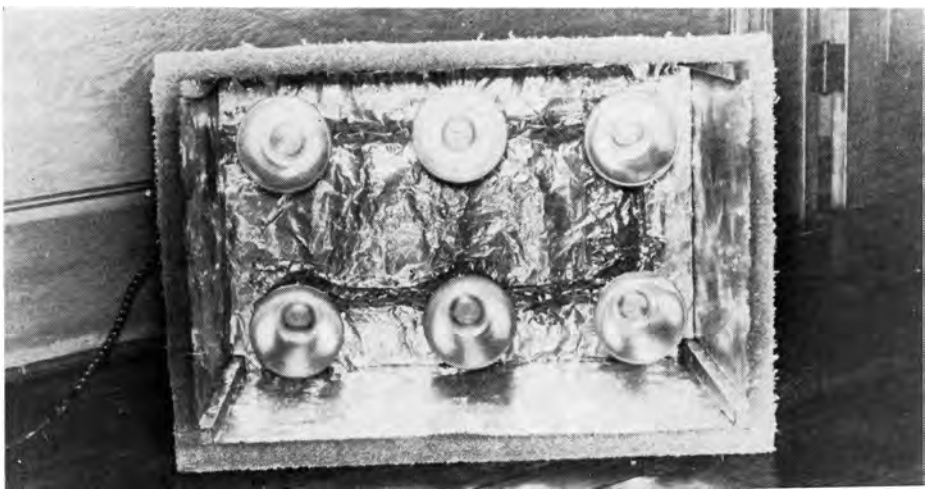
Exposure time required for a complete kill may vary as much as a minute—in some extreme cases—so it is better to operate at the determined time periods. Also, because those time values were arrived at from beetle mortality found at the subfloor level, it is safe to assume that all exposures are slightly in excess of what would be required if infestations do not occur in the farthest depths of the wood. Some variation is to be expected in the treatment of 13/16" flooring, but 10 minutes should be the minimum exposure. Where flooring is laid directly on the joists—without subflooring—the cooling circulation of air from beneath may require longer exposures. Because 13/16" flooring is not as common as ½" and ⅜", less experience has been gained with that size.

The physical properties of infrared and its characteristic of transferring heat through wood by conduction cause a continued action of the heat energy stored within the wood after radiation ceases. After a five-minute exposure of a section of ⅜" hardwood floor, the unit is quickly moved to a new location. The energy impounded in the exposed area continues functioning until the room temperature begins to cool the treated area. At the subfloor level the temperature continues to rise—after the unit has been turned off—until it is gradually cooled by the lower outside temperatures. Therefore it is always necessary to move the unit as soon as the correct exposure has been reached.

Exposures have been carefully worked out in the laboratory and put to trial in dwellings under actual field conditions, but variables may be found in different geographical locations and climatic conditions. However, the powdering on the floor surface caused by the Lyctus beetles can serve as an indicator of exposure time. Once powdering has ceased after a set exposure, a complete kill may be assumed. Should powdering continue, treatment should be repeated—using a slightly longer exposure—until no further activity becomes evident.

Another feature of the infrared unit is its ability to warn of infestations immediately beyond the treated areas. Lateral transfer of heat energy—beyond the limits of the unit—often excites heretofore unnoticed larvae to break to the surface.

Inside view of infrared unit, showing arrangement of lamps and aluminum foil.



Precautions

Certain precautions must be exercised in the use of the infrared unit.

Varnished floors in areas of high humidity should not be treated—unless refinishing is contemplated—because varnish is a seal and internal vapors created by high external temperatures may cause blisters under the finish. Even with floors finished in shellac and wax—where the porosity of the finish may permit internal vapors to escape through the surface without visible effects—treatments should be avoided on rainy or very damp days. Excessive release of vapors may cause a slight roughening of even the most porous surface.

The total pull on an electric circuit required for a six-lamp infrared unit amounts to 1,500 watts. Therefore, to avoid overloading a standard 110 volt, 15-ampere fused circuit, no more than one unit should be operated at a time.

Prolonged exposure of a treated area may result in a darkening of the flooring. Field tests to date have indicated no change in wood color is evident when recommended exposures are followed; however, laboratory tests have proven that over-exposure will result in darkening of wood colors and may in some cases cause a slight raising of loosely nailed strips.

An infrared unit is a simple piece of equipment that may be built quickly and inexpensively for use where spot treatments are warranted in the control of Lyctus powder-post beetles in hardwood floors.

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