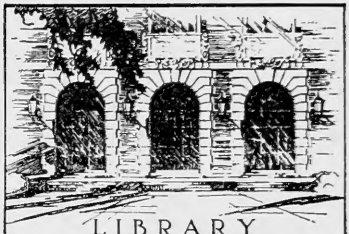

Outwitting Termites *in Illinois*

V. E. McCauley
V. P. Flint

Illinois Natural History Survey

STATE OF ILLINOIS
HENRY HORNER, *Governor*

Outwitting Termites in Illinois

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(54168—6M—5-38)

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The home that is built to discourage termite attack saves its owner worry, time and money.

OUTWITTING TERMITES *in Illinois*

W. E. McCAULEY
and W. P. FLINT*

TERMITES may seriously damage a building in six months, or they may live in it for six years or more without much damage. What they do depends on the measures taken to control them, on the material in and the construction of the building, on the surroundings and on the vigor of the termite colony.

Termites are progressively more common from the northern to the southern counties of Illinois. They are very abundant in all sections of the southern half of the state.

These insects are not new in Illinois; evidence indicates that they were here when the Indians roamed the prairies. At that time termites were not infesting homes, to be sure, but were present in their native habitat, the woodlands. They fed on an abundant supply of dead wood without complaint from anyone. As the woodlands were cleared and the natural source of food became reduced, termites attacked the wood in human dwellings that were built.

In bringing civilization to Illinois, man encouraged rather than hindered the spread and activity of termites. In areas where wood was at one time relatively scarce and where, for this reason, very little natural termite food was available, man built wooden structures, close together and row on row. Then he installed a centralized heating plant in many of his buildings so that the termites, once established, enjoyed the comforts of summer the year around and were thereby enabled to increase the amount of their damage.

This circular gives precautions that builders, contractors and householders should take to prevent termite infestation. It also gives simple directions for cleaning out infestations that are established. The most economical way to fight termites is to avoid having them. This can be done by taking a few simple

*The authors wish to express their appreciation to Dr. Carl O. Mohr and Mr. R. E. Favreau for making the drawings contained in this circular. They wish also to express thanks to Mr. H. L. White, Sanitary Engineer, University of Illinois, for use of photographs and for helpful suggestions.

precautions in the construction of buildings. Certainly all new homes should be built to reduce the possibility of termite attack.

TERMITES AND THEIR HABITS

What are termites?—Termites are social insects; that is, they live together in a colony or community of several colonies in which there is a great degree of specialization. The well established colony is composed chiefly of adult workers and immature individuals of several castes; the latter appear very similar

Fig. 1.—Termites at work in an infested board. Most of the termites visible are the workers or destructive members of the colony. A few young sexual forms, very similar to workers, may be seen.

to the workers. Thus, most of the termites seen when a colony is disturbed look like soft, dirty, white maggots with legs, fig. 1 and fig. 2B.

The workers are the destructive members of the colony, having chewing mouth parts with which they attack wood and wood products. They build the termite galleries or termite sheds characteristic of these insects. They care for the reproductives, the eggs, the very young and the soldiers, their duties being many and complex. Besides the workers, a well established colony of our Illinois termites contains soldiers and usually two and occasionally three forms of reproductives, or kings and queens.

The soldiers are probably the least important members in the colony. They attempt to protect the colony when a break occurs in its outside walls, but they are actually rather helpless against even a relatively small enemy. Nevertheless, several soldiers may, with their heads, successfully block a small break in a wall until repairs can be made by the workers.

The reproductives, or kings and queens, are very important members of the society. They occur in one of three forms, the most common form being the black, winged individuals com-

monly called "flying ants," often seen emerging from infested wood. Usually throughout Illinois, termite swarms occur in the spring. The earliest swarms emerge within heated buildings,

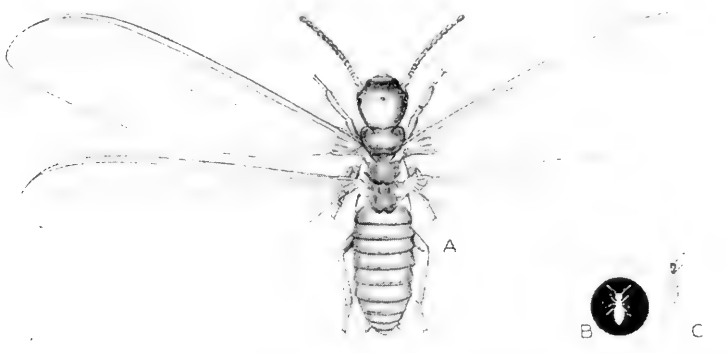

Fig. 2.—The kind of termite found in Illinois, *Reticulitermes flavipes* (Kollar). A. First form queen with wings spread, many times natural size. B. Worker nymph, natural size. C. First form queen, natural size, with wings in normal resting position.

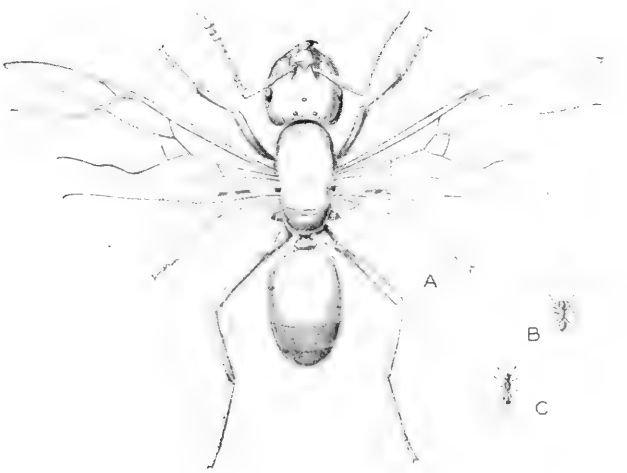

Fig. 3. A harmless winged ant, the yellow ant, *Lasius interjectus* Mayr, with which the winged termite is often confused. A. Queen with wings spread, many times natural size. B. Worker ant, natural size. C. Queen, natural size, with wings partially closed and as usually seen. The ant has a narrower waist and shorter wings than the termite.

most often during February. The later swarms emerge out of doors during late May or early June in the northern part of the state, and earlier in the southern part.

Since it is important to distinguish winged termites from the harmless winged ants, the two insects are contrasted here. As shown in figs. 2 and 3 these insects differ conspicuously. The wings of the termite, nearly uniform in length, are in sharp contrast with the long forewings and the short hind wings of the ant. The relative length of the wings of each may be compared with the length of the hind portion of the body; the wings of the termite are almost twice as long, while the wings of the ant are but little longer than the hind part of the body. Then too, there is considerable difference in the shape of the body; the body of the termite is almost uniform in width while that of the ant narrows sharply between the fore and hind parts.

How do termites reproduce?—Each mating pair of the winged termites or "swarmers," as they are sometimes called, is capable of starting a new colony. However, most of these "swarmers" fall prey to birds, toads or other natural enemies, and still others fail to locate suitable nest sites and subsequently perish; but a few fortunate pairs locate a suitable place, and each couple dig a little cell into which they crawl after breaking off their wings. Mating follows shortly thereafter and the queen, as the female is usually called, soon begins laying eggs.

During the first year, only a few eggs are laid, as the king and queen must do all the work connected with maintaining the colony as well as raising the young. After the first year, reproduction gains momentum very rapidly, the workers raised the first year taking over the duties of the colony. By the end of the third year the colony may be producing thousands of termites annually. Some of these are winged reproductives which swarm and fly away to start other colonies.

Besides these winged reproductives there are, in most well established colonies, wingless individuals which carry on reproduction activities much as do the first form or original pair which established the colony. Thus, the life of the colony is almost guaranteed in that the parent king and queen may be destroyed without weakening very much the reproductive powers of the colony. Wingless reproductives not needed in the colony to supplement or replace the king and queen crawl away some distance and establish branches of the original centralized colony. Thus, instead of a colony as we think of it in relation to

Fig. 4.—Very large termite tubes extending through a poorly constructed concrete floor over a concrete basement wall.

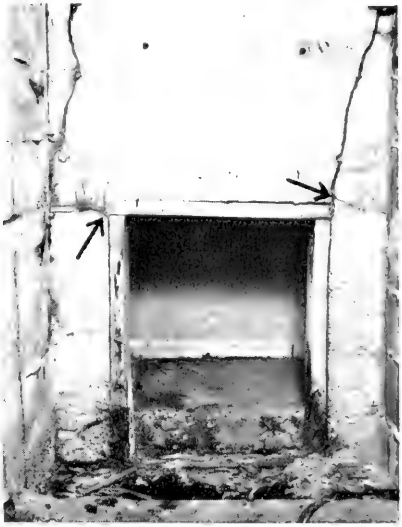

Fig. 5.—Termite tubes extending out over concrete from the wooden frame of a basement window, the lower part of which is close to the ground.

Fig. 6.—Termite tube built up on the outside of the concrete foundation of a house. This tube is small and rather difficult to detect. The foundation must be carefully examined to locate such inconspicuous tubes.

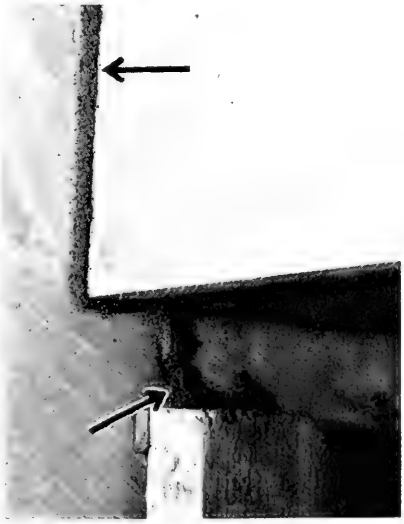

Fig. 7.—Termite tube extending from a wooden door frame up over the outside of a concrete beam to the wood timbers of a house. The figure does not show the wood above the concrete beam to which the tube leads.

ants or bees, we have in the case of the termites a whole community. Since the progeny of these wingless reproductives never have wings, buildings may be infested without a swarm of the winged reproductives ever appearing on the surface.

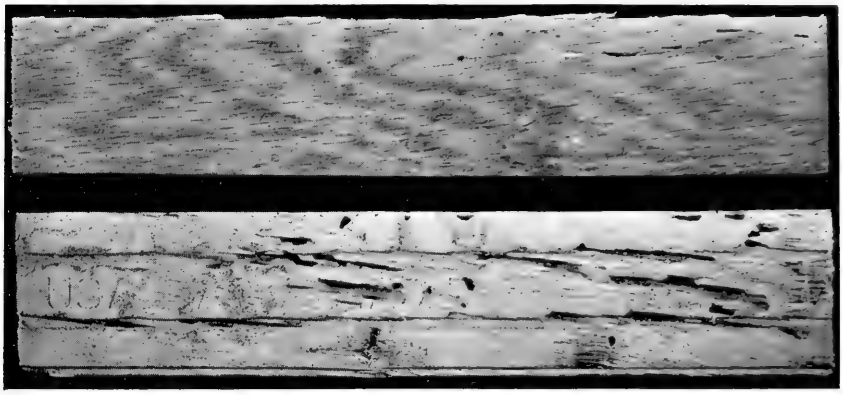

Fig. 8.—Oak flooring damaged by termites. The top view shows the varnished surface of the flooring. The lower view shows the concealed damage to the same board done by termites. This illustrates the difficulty of detecting termite damage on exposed surfaces. Often entire boards are destroyed except for the very thin exterior layer of wood.

It is not uncommon for an old, established colony temporarily to cease sending out swarmers as a result of the loss of its original queen. This may explain why some buildings are incorrectly thought to be free of termites simply because swarming has ceased.

Although it is good practice to destroy the swarming termites, their destruction does not reduce the power of the colony to continue to damage infested property.

Where do termites live?—Termites such as occur in Illinois usually live beneath the surface of the soil; hence, the name subterranean termites. The scientific name of the only important species in Illinois is *Reticulitermes flavipes* (Kollar). These termites may be found underground to depths of five feet, feeding on plant products which are present. On the other hand, they may sometimes be found quite a distance above the ground, the workers foraging 100 feet or more from the nest.

Since the soft-bodied termites are not able to withstand drying effects of the atmosphere, they never occur in the open, but, instead, they build elaborate tubes and galleries which they use as passageways, figs. 4, 5, 6, 7. They practically always

feed on material in such a way that the exterior is left intact; thus, serious damage often occurs without external evidence of termite activity, fig. 8. Since termites work mostly under cover, it is important to know telltale signs of their presence. Semi-

Fig. 9. –Termite injury to the frame of a large school building. In this case the entire sill had been honeycombed and largely destroyed by termites, which had built their tunnels in it.

annual inspections of susceptible property should be made to guard against serious damage. (See cover.)

How may termites be detected?—Examinations of wood which rests on or near the ground may reveal the workers. Unpainted yellow pine stakes may be driven in the ground about a building to check for the presence of termites. If the insects are abundant in the vicinity, they will attack the stakes within a period of about 60 days. Although termites may occur in the soil about a building without infesting the structure itself, if they are found close to a building, the owner should be alert for signs of their attack.

Wood which is near the ground, as that in cellar window frames, steps, lattices or supporting timbers, may be checked for soundness by being tapped or probed with an ice pick or screw driver. If the wood is found to be hollow, termites may be suspected.

The inside of termite tunnels is covered with dull, clay-like plaster spots. These tunnels, fig. 9, are not filled with frass or wood powder, as are the tunnels of powder post beetles and

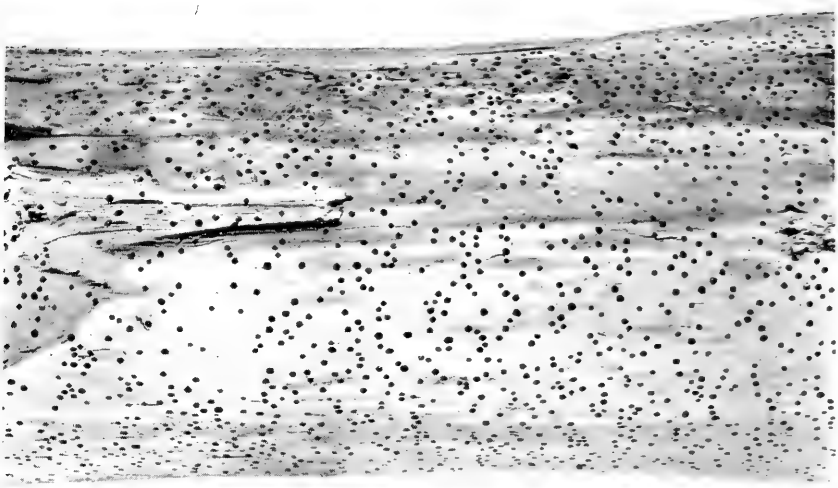

Fig. 10. Appearance of wood damaged by powder post beetles. The small holes are typical of damage by these insects, each hole representing an emergence opening of an adult beetle. Often small bits of powdered wood are found beneath timbers infested with these insects, which should not be confused with termites.

other wood-boring insects. Nor does the exterior of wood attacked by termites contain small, round holes, as does the exterior of wood attacked by powder post beetles, fig. 10.

Where wood which does not rest on the ground has been attacked by termites, brown shelter tubes may be found connecting the wood with the soil. These may also be found over foundation or other walls, either inside or outside, figs. 4, 5, 6 and 7, over piers and sometimes on the surface of the wood itself.

Besides the above-mentioned signs of termite activity, the occurrence of the swarm already discussed is an indication that a colony is present, but, as mentioned before, termites may be present without the occurrence of the swarm.

It is sometimes difficult to locate termite damage, especially where the insects can penetrate foundations in such a way that they are able to build tubes up to the wood through the wall without being in evidence on wall surfaces. Since termites usually favor the inside of foundations for building their tubes, these surfaces should be accessible for frequent inspection.

How do termites enter buildings? –Termites enter buildings (1) through wood which is directly on or in the ground, (2) through shelter tubes which they construct in cracks or crevices

in masonry, fig. 17, or (3) through tubes built over the surface of any material which reaches from the soil to the wood, figs. 4, 5, 6 and 7. Thus, it is obvious that control of termites is chiefly a matter of breaking their soil connections and keeping them broken.

How may termites be controlled?—In all recommendations for termite control, people of two different classes should be kept in mind: (1) those who have buildings which are known to be infested yet who do not feel financially able to meet the cost of sufficient alteration to insure permanently against future termite attack and (2) those who are planning to erect new buildings or to alter old ones in such a way that the structures will be termite proof. Since structural control of termites constitutes the only permanent and usually the most economical way to prevent damage by them, this method will be discussed first.

STRUCTURAL CONTROL OF TERMITES

Primary measures.—Structural methods for preventing termite attack on buildings are based upon the fact that Illinois termites must have contact with the soil or other source of moisture. Any method that will break the contact of the termites with the soil or other source of moisture will prevent all damage. Methods are as important as materials in accomplishing this purpose. Careful attention must be given to detail, as a slight defect or oversight may result in failure.

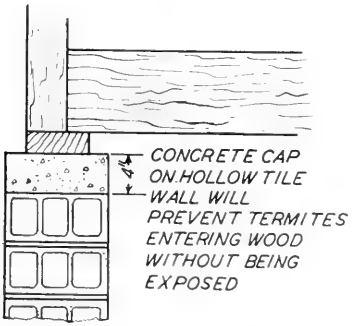

Fig. 11.—Passage of termites through or between hollow unit masonry foundation into wood sills above may be prevented by capping such a wall with four inches of good concrete. The termites may build tubes over this concrete, but, when they do this, their presence is easily detected.

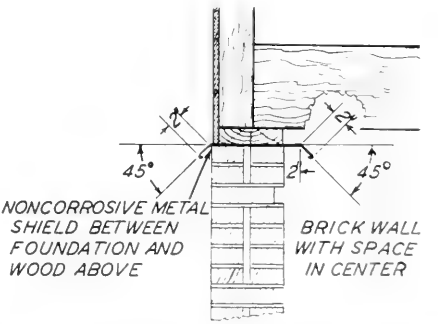

Fig. 12.—A metal termite shield correctly placed over the top of a brick foundation wall. This prevents termites from entering wood above. Special attention should be given to the 45 degree angle at which the shield is bent down. The crimped edge is not essential but aids in strengthening the shield.

1.—Building sites should be cleared of all old wood whether it be tree roots, stumps, posts or debris. Any evidence of termites should be noted and treatment made if live termites are found.

2.—Foundations of concrete should be reinforced with steel rods at points of stress to prevent cracking.

3.—Foundations of stone, brick or hollow unit masonry should be laid with cement mortar, care being taken that all joints are filled with this mortar. Such walls should be capped with four inches of cement mortar, fig. 11, unless shields, fig. 12, are used.

4.—All forms and other waste wood should be removed before grading in is done around the foundation. The covering of waste wood or refuse in filling or back-filling about foundation walls should be avoided, figs. 17 and 19.

5.—Cellar hatchways should be of solid concrete and, if possible, built as an integral part of the foundation to prevent cracks. If these hatchways are built separately, they should be isolated from the building by use of metal shielding.

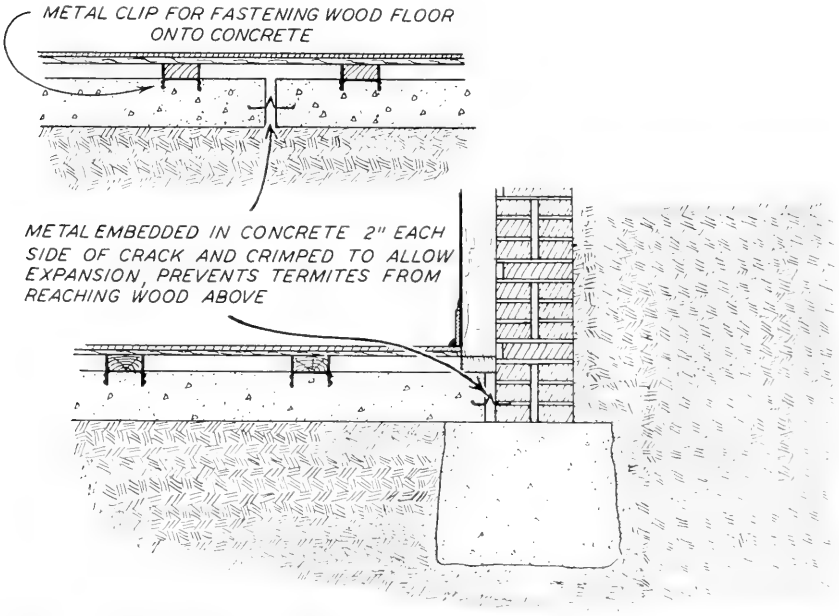

Fig. 13. —Metal expansion joints installed to prevent entry of termites in union between concrete floor and wall and between two sections of concrete floor. Many modern buildings are infested through these unprotected points. The sleepers are held by metal clips instead of being embedded in the concrete, as is usual. An alternative type of joint is shown in fig. 14.

6.—Cellar windows should have metal or pressure-treated wood frames. (See cover.) Airways should be free of trash.

7.—Pipes should be set in a collar packed with coal tar pitch or other repellent material where they pass through basement floors or walls. They should be so located that inspection for termite galleries can be made without difficulty.

8.—Basement floors should be reinforced to prevent cracking. All joints in the concrete or between the concrete floor and masonry side walls should be sealed by the use of a non-corrosive metal expansion joint, fig. 13, or with repellent coal tar pitch, as shown in fig. 14. Failure to seal these joints results in thousands of infested homes every year.

9.—Concrete supports for basement partitions should be built at least four inches above the floor level, and all cracks or joints should be sealed as suggested above.

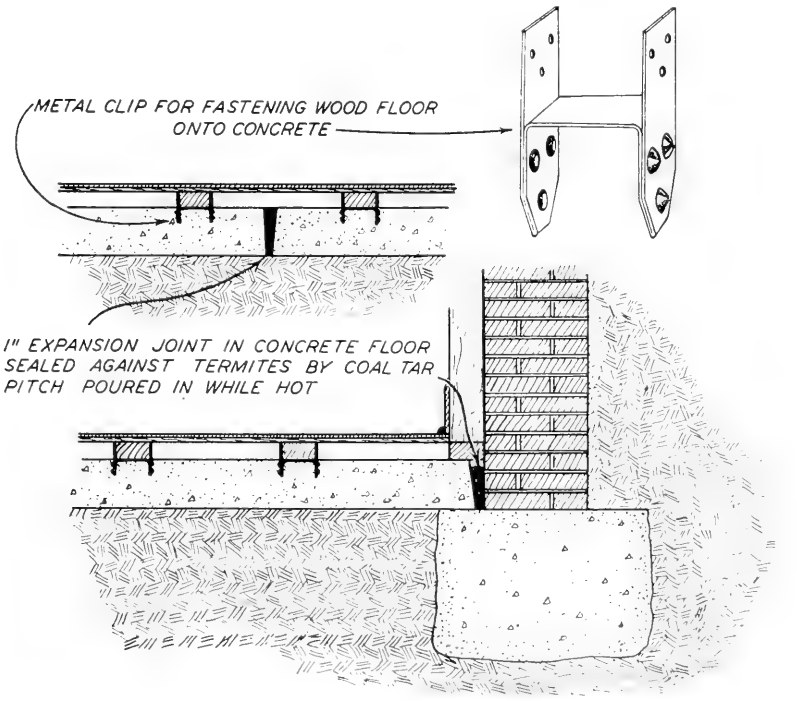

Fig. 14.—Expansion joints between sections of concrete and between concrete and masonry wall sealed against termite entry with hot coal tar pitch. This type of seal is very simple yet effective in protecting a building at a common point of termite entry. The clip illustrated is one of many types manufactured for the purpose of fastening sleepers to concrete floors, thereby eliminating the older method of embedding these timbers in concrete. An alternative type of joint is shown in fig. 13.

10.—The use of wood in basement construction should be avoided as much as possible. Wood should never extend through or into concrete or masonry floors, fig. 14. Built-in shelving or cupboards should not be joined to the floor above.

11.—Where it is necessary to lay wood floors on concrete, all grade stakes should be removed when concrete is poured.

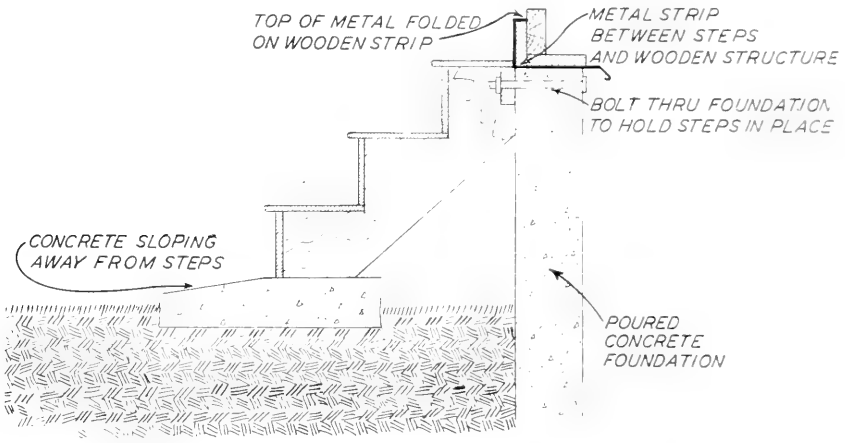

Fig. 15.—A satisfactory method of installing wood steps to minimize the danger from termite attack.

All sleepers should be of treated wood. They should not be embedded in the concrete but fastened with metal clips, fig. 14. Preferably the rough flooring should also be of treated wood.

12.—No untreated wood should be closer to exposed soil than 18 inches unless it is protected by non-corrosive metal termite shields, fig. 12. Wood steps should rest on solid concrete which projects at least four inches above the soil line, to allow inspection for termites. The steps should be separated from the rest of the building by a metal shield, fig. 15. Lattices should be hung from above, and should swing clear of soil and piers at least two inches, fig. 16.

13.—Ends of joists or girders should never project into concrete walls unless ventilation is provided. They may be hung in metal stirrups or rested on masonry bearing surfaces.

14.—Ventilation should be provided beneath unexcavated portions of buildings. Sufficient clearance and entrance opening should be provided to make inspection possible. Openings in the foundation should be screened with 16-mesh copper wire to prevent entrance of insects or animals.

15.—Provision should be made for inspection twice a year of *both* sides of basement and foundation walls.

a.—These walls should be so constructed that, to reach the wood, termites must build their galleries in exposed places. The walls may be built solidly or capped with concrete, fig. 11, or metal shields may be used, fig. 12.

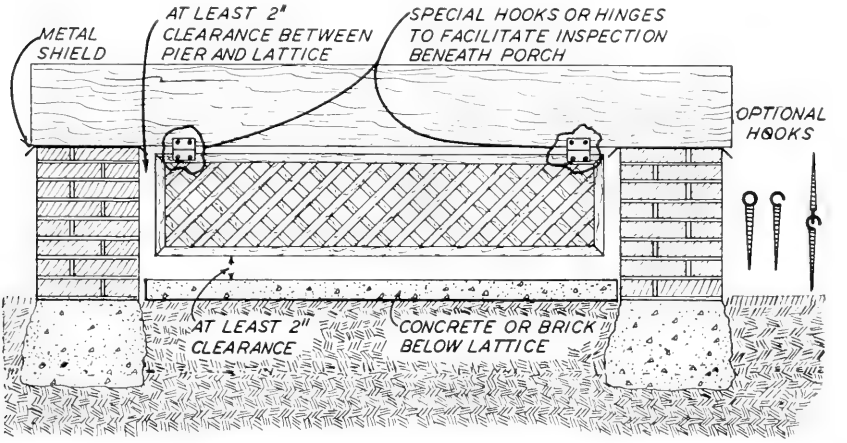

Fig. 16.—Recommended method of attaching porch lattice, which should hang on hinges to facilitate frequent inspection. Optional hooks shown may be used to allow easy removal of lattice. A clearance of at least two inches at sides and bottom is provided to prevent possible entry of termites from soil or piers.

b.—Plants should not be allowed to grow so close to the foundation that ventilation is prevented or inspection made impossible.

16.—A thorough inspection with the aid of a good light should be made at least twice annually; more often if termites are known to be present. (See cover.) Any termites discovered should be destroyed by application of chemicals.

Supplementary measures.—Termite resistant construction is the logical, the most economical and the only enduring method of combating these insects. Nevertheless, there is a need for supplementary methods of termite control especially suited to buildings which are infested with termites and which are not of sufficient value to warrant the spending of funds for reconstruction.

Some chemical measures may need to be used as a supplement to structural methods, figs. 17 and 18. For example, it is advisable to destroy termite colonies whenever they are found, whether on a building site or under a termite resistant building.

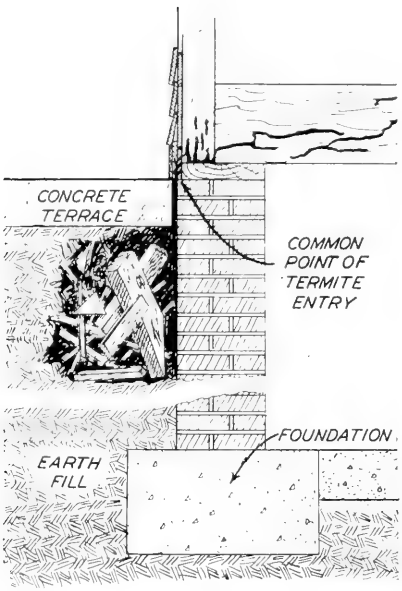

Fig. 17.—Earth filled terraces are a common source of termite attack. Waste wood covered with soil and kept moist from water seeping through crack at point of union with foundation makes an ideal condition for termites, which attack the superstructure through the same crack as that which supplies the moisture. Conditions shown here should be contrasted with those in fig. 18.

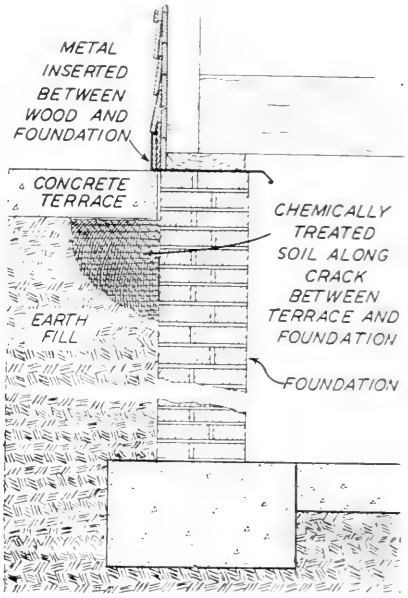

Fig. 18.—Earth filled terrace as illustrated in fig. 17 except that the waste wood has been removed, the termite colony has been treated chemically through a hole in the terrace, with materials suggested in the text, and the superstructure has been protected with a metal guard. New terraces of this type should not cover unprotected wood where they meet the main structure.

It is wise to destroy the termite colony beneath or about a building even though structural alterations are made to render it termite resistant. Such treatment will prevent spread of the termites to near-by structures.

CHEMICAL CONTROL OF TERMITES

Effectiveness of chemicals.—Use of chemicals in termite control was at first confined largely to treatment of wood. Chemicals may be used also for treating soil about buildings to prevent termite attack. Because of the relative ease with which chemicals are applied to soil, there is a tendency to neglect the more lasting structural methods of control. The relatively short time that chemical treatment of soil, or soil poisoning, has been used is responsible for a lack of fundamental information on the subject. Several soil treatment test plots have been

established, one of which is located at Urbana. The projected tests will require at least 10 years for completion.

Besides being used for wood and soil treatment, chemicals have been applied as fumigants and dusts to combat termites. These latter uses of chemicals have not been successful under Illinois conditions.

Effectiveness of wood treatment.—Treated wood may be purchased from some of the lumber companies in Illinois. Where wood must be depended upon to withstand termite attack in buildings, only commercially treated lumber should be used.

Several agencies are attempting to control termites by treating wood that is already in place in buildings. The best information available on the subject indicates this method alone is generally not satisfactory.

Methods of wood treatment.*—Posts or other wood to be treated should be (1) peeled of all bark, (2) seasoned and dry, (3) free of decay and (4) cut to final form as nearly as possible.

Several chemicals are in use as wood preservatives. The one best adapted for treatment of fence posts or other rough timbers, not to be painted, is coal tar creosote meeting specifications of the American Wood Preservers' Association.

Creosote or creosote products, because they are readily absorbed, are the only materials worthwhile for home treatment of wood. Only a very small amount of most other treating materials is absorbed by wood. The effectiveness of the treatment is in almost direct proportion to the amount of the chemical taken up by the wood.

Brush treatment or spraying is the simplest method of application, although not the most effective. Hot creosote will penetrate better, and is therefore more desirable, than cold material. Two coats should be applied. Approximately 10 gallons of creosote for each 1000 square feet surface of rough lumber will be absorbed. Penetration will usually be less than one-sixteenth of an inch, and the life of the lumber or timber may not be extended more than two or three years.

Dipping lumber in a bath of creosote oil at 200 degrees F. for a short time (10 to 15 minutes), then removing the wood and allowing the excess oil to drain back into the tank is only slightly better than brushing.

*Hunt, G. M., Wood Preservatives, U. S. Department of Agriculture Forest Service, Forest Products Laboratory, in Cooperation with the University of Wisconsin, Madison, Wis. Feb., 1933.

The most effective treating method adaptable to farm conditions is the hot and cold bath process. The wood is heated to 210 degrees F. for several hours in a bath of creosote preservative. Then it is either quickly submerged in a bath of cold creosote for some time (long enough to cool) or allowed to cool in the hot bath after the heat has been removed. This latter method is more easily employed than the first where only one vat is available, but it is slower. The temperature should not be allowed to rise above 220 degrees F. as some of the creosote may volatilize at this temperature. Care must be taken that the creosote does not catch fire. The amount of penetration may be regulated to some extent by the length of time the wood is left in the bath. Sapwood is usually more easily penetrated than heartwood, and the amount of penetration and absorption will vary to some extent in different types of wood.

Effectiveness of soil treatment.—Soil treatment by chemicals affords only temporary termite control. The exact duration of the effectiveness of such treatments is not known, but their life will vary with soil and climatic conditions, amounts, materials and method used. Because of their temporary nature, chemicals should never be depended upon where their cost approaches that of structural control.

It is often advisable to kill termites with chemicals in addition to making structural changes. For this purpose, where repellence is not necessary, a good material to use is orthodichlorobenzene, 1 gallon in 2 gallons of fuel oil or kerosene. The mixture should be used at the rate of 1 gallon for approximately 10 cubic feet of soil to be treated. This mixture may be poured directly on the termites or into holes near places where termites are present. It will kill the termites but will not leave the soil repellent for any great length of time. It will kill all plant growth.

The kerosene alone will kill all termites it contacts, but will not give a fumigating effect under the soil surface, nor will it leave a repellent residue in the soil. Cases are known, however in which termites have been eradicated by careful and persistent use of kerosene. In the use of kerosene, the fire hazard should be taken into consideration.

Methods of soil treatment.—For situations where termites are present, and where repellency of chemicals rather than structural features must be depended upon for control, the

following materials and methods are suggested. (See fig. 19 and cover.)

1.—All wood contacts with the soil should be first eliminated.

2.—All points where foundation walls or piers touch the soil should be treated so that they are completely surrounded by approximately a foot of treated soil, fig. 19.

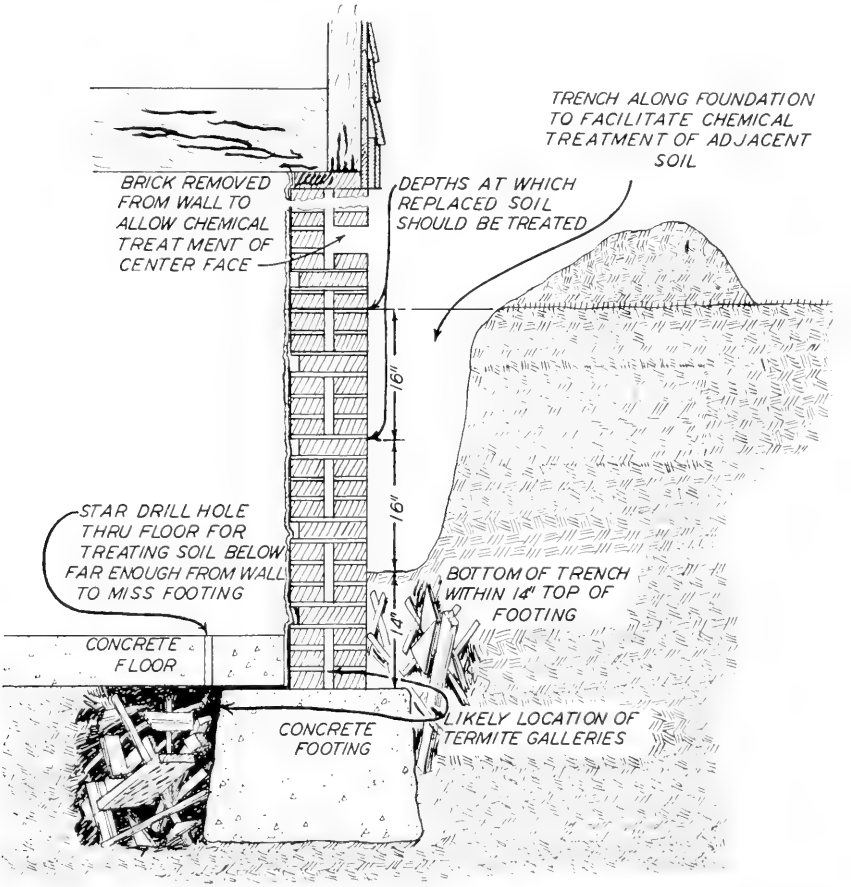

Fig. 19.—Details of points which should receive attention in the application of chemicals about a building for the control of subterranean termites. Every building offers some specific problems, but the principles involved are always similar to those shown here. The type of soil will influence the depth of the trench and the number of chemical applications necessary for thorough penetration. Clay soils require deeper trenching and a greater number of applications than more porous soils. Chemicals should not be applied to wet soil. It is important that the center face of the foundation receive attention.

a.—Trenches should be dug along foundation piers to a depth of 12 to 14 inches above the top of the footing, fig. 19.

b.—Points beneath concrete, terra cotta or brick should be treated with the chemical poured through a funnel or pumped into holes made with a chisel or star drill, fig. 19.

c.—Walls of hollow unit masonry or walls having a hollow center space should be treated with the chemical to eliminate termites which may be present.

3.—A mixture of grade 1 creosote oil, meeting specifications of the American Wood Preservers' Association, 2 parts, and orthodichlorobenzene, 1 part, applied at the rate of approximately 1 gallon for 10 cubic feet of soil, will kill all termites and will prevent their recurrence for several years. Chemicals should not be applied to abnormally moist soil, or they will leach away. Leaching of chemicals may be minimized by slightly mounding the treated soil.

It is not necessary to treat along all the foundations of a building if termites are found active in only one part. Spot or partial treatment may be made and followed by subsequent treatments at other points if termites appear.

Thoroughness is necessary for success in this work. All soil along the foundation piers where the infestation occurs must be treated. The soil which has been removed by trenching, as described above, should be treated usually at 16 inch levels as it is replaced in the trench, fig. 19. Soil type will influence the frequency of treatments to be made as the soil is replaced. Clay soils require deeper trenching and more frequent application of chemicals than more porous soils. The chemicals are very toxic to plants and will kill them if used in contact with the root system. Valuable plants should be removed from the vicinity of the trench.

An important point to be remembered is that, after this type of treatment has been used about an infested building, those termites present in the structure above the ground line will soon die *if they have no access to moisture above the soil.* However, they will attempt to construct bridging galleries back to the soil. These should be detected and destroyed. *All connections to other moisture must be broken.*

The operator should take precautions to prevent getting the chemical mixture on himself, as it will burn his skin upon

contact. For handling this mixture beneath buildings, a hose has been found convenient, one operator, outside the building, pouring the mixture through a funnel into one end of the hose, and the other, beneath the building, making the application by moving the other end of the hose. Spray pumps are convenient for this application, if they are available.

Although chemicals are temporarily effective, their use is not recommended where permanent structural changes seem more practical.

Applications of chemicals may be made by property owners or by reliable termite exterminating contractors, several of whom are operating in this state.

UNIFIED ACTION AGAINST TERMITES

Although it is possible for an individual to eliminate all termites from his premises, termite control is a community problem. Cities should adopt certain structural requirements to make new buildings termite resistant. It should be unlawful to sell termite infested property knowingly, without informing the purchaser. The management of public institutions, as schools and churches, should instruct their caretakers or others responsible to be on the alert for termites. A constant vigil against termites may mean the saving of thousands of dollars to the home owners and other taxpayers in a community. The finding of termites need not be the cause for great fear or alarm, but definite steps should be taken to eliminate them as soon as they are discovered.

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