and a careful program of disking at time periods to kill seed germination was followed for the purpose of killing out volunteer weeds, to insure as nearly as possible weed-free fairways. No manure was used, because compost was unobtainable. The year's time required for manure's activity was not available, and freedom from the seed therein was desired. Gypsum to insure aeration, milorganite, nitrophoska, sulphur and similar chemical fertilizers with immediately available reagents were employed, and the results have been very satisfactory. It is also believed that the use of these chemical fertilizers is more economical, for though the cost per ton is higher than manure, the quantities needed are smaller and the reactions more certain.

Greens were planted with Washington bent grass in September, 1927. Fairways were sown with a 70:30 mix of selected blue grass and red top, and a good stand has resulted.

The major physical engineering features in connection with the golf course aside from the grading of fairways and building of greens, tees, traps and bunkers, were an earth-fill dam about 750 feet long, with a concrete spillway 40 feet wide, creating a lake with an area of about 4½ acres, with an average depth of 5 feet, impounding about 8,000,000 gallons of water; upwards of 80,000 feet of drain tiling; 4,500 feet of 10- and 12-inch sanitary sewer, with manholes and a two-chamber septic tank of about 9,000 gallons capacity; 25,000 feet of irrigation piping and 8500 feet of piping for drinking water to fountains on the course. A two-stage centrifugal pump has been installed with a capacity of 300 gallons per minute against a 200-foot head, this directly connected to a 35 h. p., 1,450 r. p. m., 4-cylinder gasoline engine supplemented with a similar pump electrically driven.

Irrigation water will be taken normally from the lake, and drinking water from the St. Louis County mains, but there is provision for connecting irrigation lines with county water in case of failure of pumps. Cast iron pipe was used for 3-, 4-, and 6-inch water mains, and genuine wrought iron for the smaller lines; galvanized steel used to a small extent as a filler-out where enough wrought iron pipe had not been ordered. These specifications on pipe are indicative of the "looking ahead" policy for lessening deterioration and maintenance charges.

Lots of light, plenty of air, and every facility for service are in men's locker-rooms

Women's bath section plentifully supplied with dressing tables

The lake has been well stocked with fish. It also is an important detail in the club's winter sport program.

Country atmosphere in charm and comfort of bed-rooms

Cost Division

Cost of ground development for the golf courses including engineering and inspection has been roundly $125,000 of which allocation can be roughly stated at $25,000 for irrigation, $25,000 for drains and sewers, $15,000 for fertilizers, seeds and stolons, $5,000 for excavation of lake and dam construction, $3,500 for bridges, and $50,000 for grading, greens and tee construction, soil erosion prevention, and general work. The irrigation and drainage is very extensive and the value of drainage is already clearly evident. Irrigation covers fairways as well as greens and tees, there being 230 outlets on the system of which about 175 are for hose connection, the remainder being to drain the system to prevent winter freezing.

27 Holes on Course

The golf course is laid out in three 9-hole units, any two of which can be combined. This layout gives the club its choice of three yardages; one approximately 7,000, another around 6,400 and a third about 6,600. First tees and ninth holes of each unit are grouped around the clubhouse. Though winter rules prevailed last summer, the greens were in fine shape, and play was heavy. No difficulty, according to Rosen, was experienced in handling the course traffic. Tees are unusually large, with the three first tees having hoseless watering.

Due to the rolling character of the topography considerable difficulty was experienced with erosion. Westwood believes it has this trouble whipped now. Approximately $600 was spent in straw matting to prevent erosion. Another detail of this work was the use of small board embankments on the down grades. Turf was laid up to this and when the turf gets firmly established around these spots, the boards will be rotted and be pressed deeper into the ground, according to the expectations. Chicken wire netting was necessary in many places to keep the turfed spots from washing away.

Clubhouse Is Complete

The clubhouse is estimated to cost upwards of $425,000 furnished. It is of English Baronial design, with stone walls, random rubble, selected for color; concrete second floor slab; staggered shingled roof; and is practically fire-proof except for the roof. It has large, airy, well lighted rooms, ample locker rooms, seventeen sleeping rooms, seven with bath, and a dormitory for men with two large shower rooms on the second floor. Outside terraces and swimming pool were developed as a part of the building plan. On the major axis the clubhouse is 400 feet long, with a 350-foot ell for the men's department which has been designed for practically complete segregation from the balance of the building. All locker rooms and showers are on the main floor. The basement is used only for storage purposes, refrigerating and heating plant, cold storage rooms, and similar features. The total floor area is about 45,000 square feet and the cubage 900,000. More than usual study was given to the questions of light, ventilation, and internal circulation of members and servants with respect to service under varying conditions of use.

Thoroughness Is keynote

From the swimming pool to the dining-room for chauffeurs, the clubhouse is a brilliant example of thoroughness in clubhouse architecture. The family service idea is carried to the nth degree, with the separate facilities provided for children and young, unmarried women. Starting with the locker facilities for the swimming pool we find 20 lockers for women guests in a nicely equipped light room off of the tunnel leading from the clubhouse to the pool. Showers are spotted near the

(Continued on page 80)

Interior of Westwood kitchen

Saving Your TREES *from Damage by the* BUGS

By *J. G. SANDERS*
Entomologist for Sun Oil Company

ALMOST any individual with ordinary eyesight can see caterpillars and "worms" chewing the foliage of trees and shrubs, and can observe the extent of injury, but there is another group of "bugs" that seriously harm trees and shrubs without waving a flag before us. Of these tiny pests, known as "scale insects," I wish to write and "kodak." With the illustrations at hand, identification of the common species should be easy.

Fortunately in the United States we have only a few of the more than 2,000 species known in the world, but these few are sufficient to cause much damage, trouble and expense to golf courses, park departments, orchardists, and ornamental growers.

Scale insects are usually very small and inconspicuous, although some are quite noticeable when occurring in numbers. There are both hard and soft scales. Some kinds attack only one kind of tree; some of them can feed with equal relish on a hundred kinds.

The young "scales" hatch in the late spring, first appearing like tiny mites, crawl about a few hours and then attach themselves to leaves, twigs, trunk or fruit. When they once have "set," they begin to secrete their "armor" and generally become fixed permanently to the plant, continually drawing upon the plant juices through their long tube-like mouth parts.

Scale insects have one or more generations a year, depending on the species involved and the latitude. Certain species like San Jose Scale may vary from one generation in the extreme north of the United States to three and four generations in the south, thereby constituting a graver menace in the latter region. Do not allow these scales to gain a foothold, but make it a rule to apply one dormant spray each year. Young, newly planted trees are often most seriously attacked by scales.

Injury by scale insects is in indirect proportion to their size and direct proportion to their numbers.

Chewing and Sucking Insects

While chewing insects can be controlled generally by sprays of arsenate of lead, paris green or arsenate of lime (stomach poisons); only by "contact" sprays which surround their bodies with a corrosive or smothering chemical can scales be killed, because they live only on the plant juices sucked from beneath the surface.

"Contact" insecticides include such materials as miscible oils, lime-sulphur solution, nicotine and strong soap compounds. Miscible oils diluted with water in varying proportions are chiefly used now in place of lime-sulphur, formerly the accepted control. Lime-sulphur has a most disagreeable odor, is very corrosive on the operator and his clothing; also it blackens paint on buildings, fences, and trellises wherever it touches.

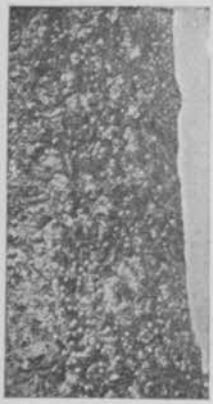
Miscible Oils Best Scale Killers

Miscible oils of good quality are easy and pleasant to handle and apply; cover the bark surfaces and crevices more completely, and are perfectly safe while the trees are in dormant condition. They can be applied any time in late autumn or early spring before the leaves appear.

Maple Leaf Woolly Scale

Many of the better known golf courses, large city park departments, orchardists and nurserymen are protecting their trees with good miscible oils, and secure excellent results with a minimum inconvenience to passing vehicles and pedestrains.

Some kinds of scale require stronger mixtures than others; hence the varying recommendations to be noted



San Jose Scale

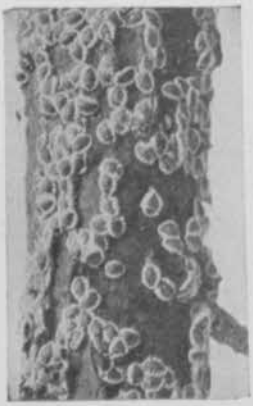
Oyster-Shell Scale

Apple Scurfy Scale

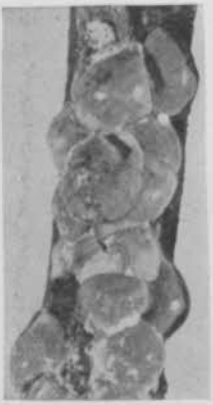
Dogwood Scurfy Scale

Rose Scale

Cottony Maple Scale



European Elm Scale



Tulip Scale

Pit-making Oak Scale

Oak Lecanium

Terrapin Scale

Euonymus Scale

Pine Leaf Scale

—Photographs Courtesy Sun Oil Research Laboratories

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below. (*See illustrations on page* 24.)

San Jose Scale. A small, round, dark grey or blackish, flat scale closely appressed to the bark of its host plant. It is a native of central China, having been accidentally introduced on trees from the orient and first brought to scientific and public attention at San José, California. The species is known to attack over 200 different kinds of trees and shrubs and is one of our most dangerous tree pests. A thorough application of 4 per cent miscible oil gives practically 100 per cent control.

Oyster-Shell Scale. This scale derived its name from its likeness in form to an elongated oyster shell. Its scale covering is dark brown, rather heavy and thick, affording excellent protection to the many tiny white eggs crowded beneath throughout the winter. Apple, lilac, poplar, willow, ash and ornamental dogwoods are especially favored hosts of oyster-shell scale. Use miscible oil one part to 15 parts of water as dormant spray. Apply thoroughly and abundantly; very hard to control.

Scurfy Scales. There are several species of these white elongated scales which attack apple, pear, currant, mountain ash, elm, dogwood, euonymus, etc., and often become injurious unless checked. Use miscible oil one to 15 or 20 parts of water.

Rose Scale. The white scaly growth on rose stems, particularly rugosa roses, is due to the rose scale. It also attacks raspberry, blackberry and dewberry canes, particularly those growing in shaded places. It is easily eradicated by a dormant application of miscible oil 5 to 6 per cent strength.

Cottony Maple Scale. A soft, white, fluffy scale. Entire towns in the Great Lakes region have lost their shade trees during the past 20 years through the attacks of this species. Soft maple and box elder are particularly damaged by this scale, although it occurs on many species of trees, shrubs and vines. A dormant application of a good miscible oil one to 15 to kill the over-wintering young is more effective than waiting until the trees are in foliage and in danger of injury by strong sprays.

European Elm Scale. Small, dark brown, sac-like insects surrounded with a white edge of wax unmistakably mark this imported pest of elm trees. It is harmful and when very abundant kills elm trees; also the honey-dew secreted is objectionable. Thorough spraying while dormant is necessary to control this increasingly serious pest which hibernates in the crevices of the rough bark. Use miscible oil one to 15.

Tulip and Magnolia Scales. These are very large, nearly hemispherical scales classed with the soft scales, but nevertheless with an effective waxy armor. They often cause much damage to tulip, poplar and magnolias. The tulip scale secretes an abundance of foul-odored honey-dew, attractive to bees and wasps. Use miscible oil one to 15 on trees when dormant.

Pit-making Oak Scale. The Pit-making scale is a serious pest in the northeastern states, especially on English species of oaks, which are frequently killed by it. Easily distinguished because of the little pit in which each scale rests and by the bright yellowish golden color of the scale's protective covering. Abundant from Massachusetts to Michigan, south to North Carolina and in California. Use miscible oil one to 15 parts of water.

Oak Lecanium Scale. The Oak Lecanium is a distinct pest on oaks in the southern states, frequently completely encrusting the branches and twigs. Use one to 15 miscible oil.

Terrapin Scale. A dreaded pest, as it hibernates on the branches in the half-grown stage, and is unaffected by lime-sulphur sprays. It seriously attacks plum, sycamore and maple, as well as peach. It is conquered by a one to 15 miscible oil spray without any injury to the trees, as extensive orchard and city spraying has proved. Very thorough applications necessary.

Euonymus Scale. Apply miscible oil one to 30 in dormant season and again in summer when young scales have hatched, using one to 50 dilution. Both applications are needed to clean up the bushes when badly infested.

Pine Leaf Scale. Narrow, snow-white scales are frequently so abundant on the leaves of pines and spruces that they give the tree a whitish appearance. Disfigured foliage and frequently seriously injured trees result. One thorough application of miscible oil diluted one part to 30 parts of water before growth starts, controls the pest.

Gloomy Scale. Maples from Maryland southward are subject to attack of gloomy scale, so severe that at times limbs or whole trees may be killed by it. In addition to the red and silver maples, this pest also attacks camperdown elm and

willow. It does not attack hard maple. Gloomy scale multiplies very rapidly. A dormant application of miscible oil one to 15 parts of water, applied thoroughly, prevents damage.

Maple Leaf Wooly Scale. White cottony patches in midsummer on the under side of maple leaves affords protection for the females of this pest. The males migrate to the trunks and when abundant give it a chalk appearance, over-wintering young in the crevices of the rough bark of the trunk and larger limbs. In addition to infesting maples it is sometimes found on hornbean, linden and horse chestnut. A dormant application of miscible oil one to 15 is efficient.

The species of scale insects discussed above are the more common ones which are likely to be found infesting shade and ornamental trees in this country. However, in the far west and in the extreme southern portion of the country several additional species may be encountered, but as a rule they are all amenable to the same type of control.

What Percentages in Your Maintenance Costs?

By GUY C. WEST
Supt., Fall River (Mass.) Country Club

HOW many times we hear it said that greens are the most important part of golf course maintenance, that good greens make a good course, and similar statements! To hear some golfers talk one could very easily get the impression that at least half of the money spent on golf courses was spent on greens. This may be true on some courses, but I have yet to hear where they are!

How many of us do know how much we do spend on the maintenance of greens as compared with the expenditures for other portions of the course? What *percentage* of our money expended for maintenance actually is expended on greens, and what percentage on the fairways, the tees, the rough, and the traps? How do these percentages compare from year to year?

To the greenkeeper who has a cost analysis of his course expenditures, percentages of expenditures for the various divisions of the course can be very easily figured.

The following figures, gathered by me at the Fall River Country club over the past six years may be of especial interest to the large number who have never seen such percentages. To all those who have cost figures for their own courses, these figures may be of interest as to how they compare. It must be remembered, however, that percentages, like unit costs, can only be compared rightly when all factors which enter in to the costs of maintenance are also examined. For example, two courses with the same total expenditures, and one with average size greens, and the other with very large greens, show a marked difference in the percentages for the item of greens.

Cost Percentages

As taken from my cost analysis figures for the past six years, the largest percentage, as might be expected, was for greens, and the percentages for greens were 33.1% in 1923; 35.8% in 1924, 33.1% in 1925, 30.3% in 1926, 26.7% in 1927, and 30.8% in 1928. It may thus be seen that the average would run a little under a third of the total cost.

Fairways ran 29.9% in 1923; 18.3% in 1924; 11.6% in 1925; 14.9% in 1926; 11.8% in 1927, and 11.6% in 1928. Tees showed for the same years, 9.4%, 12.4%, 12.5%, 8.5%, 9.3%, and 11.4%. Rough varied but little; 9.7%, 9.6%, 8.6%, 7.8%, 9.3%, 11.4%. Traps (including water hazards) showed a marked increase due to the building of new traps yearly; 5.5%, 6.7%, 14.3%, 17.8%, 17.6%, 16.9%.

Of the smaller items, the cost of preparing compost is perhaps of interest; for the same years, 3.0%, 5.5%, 2.4%, 4.3%, 5.9%, 3.8%. Turf nursery percentages, showing more use of nursery the past three years, were 1.1%, 0.5%, 1.8%, 2.6%, 5.2%, 3.6%.

Percentages can be studied for any course over a period of years in the same manner as unit costs. It must be remembered that if the standard of maintenance for any part of the course is raised, the cost per unit will be increased, and also the percentage cost will be greater, if the total expenditure is to remain the same.

Figure the percentage costs for your course, study them, compare them for your own amusement with others if you will, but compare and contrast them from year to year, item by item, and you will find much of interest.

FRONT VIEW OF TOOL HOUSE

A Maintenance Barn That *Cuts Work Costs*

By WENDELL P. MILLER

AT WESTWOOD Country club (St. Louis district) and Sunset Ridge Country club (Chicago district) considerable study was given to the matter of proper facilities for the storage of equipment and supplies, repair work quarters and headquarters for the greenkeeper. The result was two equipment sheds of similar character, there being only minor differences between the Sunset Ridge building which is illustrated here, and the Westwood job. Both buildings have been highly satisfactory.

The building was designed by first making a small templet of every piece of machinery which we knew would be used in the maintenance of the golf course. These templets were then divided into three groups, one representing the small tool division, which were grouped together in such a way as to get the area required for a workable small-tool room in which the tools of each kind could be placed in racks or on hangers.

The second group of tools included motive power and machinery which would be used every day during the playing season. These were then assembled to indicate the size of the wing necessary for housing this part of the maintenance equipment. The templet for the machinery, such as manure spreader, sraying machines, cultivation machinery and other items which would have but infrequent use on the golf course, were then assembled to indicate the space requirement for another wing of the building. Floor space estimates were then prepared to allow for the storage of two carloads of fertilizer materials.

A machine shop was then laid out, which would be large enough to drive in a full tractor fairway mower unit leaving space for easy working around the tool benches and forge.

A good sized office room was then laid out in the center of the building in such a way that the greenkeeper, while sitting at his desk, could see most of the activities going on in the work shop and main wing of the building. With the space requirements thus computed we designed the "U" shaped building with the court yard in the hollow of the "U."

A second floor was put in over the floor portion of the building for storage of pipe, seeds, hose, and other miscellaneous items of equipment, which have to be put under cover during the winter months.

No Lost Space

The really outstanding thing about the tool house at Westwood and that made at Sunset Ridge is that there is really room for every piece of equipment and yet no loss of space. At the same time each piece of equipment can be gotten out of the barn without necessity of moving several other pieces first. The storing of the machinery in the building is greatly facilitated by the fact that doors on the buildings permit the driving of tractors or trucks directly through the building in each of the three wings.

The building at Westwood was not designed without the idea of keeping the compost in the building as we did at Sunset Ridge because of the fact that we had a better location for the compost yards on