FAIRWAY WATERING

Features of Typical Hose and Hoseless Systems Given

By WENDELL P. MILLER

IRRIGATION of the entire playing area of golf courses and polo fields is a comparatively new development except in California. The two irrigation plans shown here are intended therefore to illustrate the fundamental differences between the modern California system of hoseless fairway, green and tee watering and the present eastern method of piping the water along the edges of the fairways for use with hose and portable sprinklers.

Eastern courses which are subject to damage from drought or which desire a uniform length of course throughout the playing season are giving serious thought to the hoseless system of irrigation which is almost universal in California where economy of labor and uniformity of water application are of prime importance.

The hoseless system of irrigation that is shown for illustration was the first to be installed east of the Rockies and has been in successful operation since September, 1926 at the Country Club of Detroit. The system was installed before the snap valve was introduced. The sprinkler outlets were therefore installed in batteries of 5 to 8 outlets, each battery supplied by a 3 inch pipe and controlled by one main line valve, located adjacent to the main in the rough. With the advent of the snap valve the batteries of outlets fed from one lead from the main will be reduced to 3 units and the lead from the main to a 2 inch pipe. With the snap valve the water is available at all times at each outlet independent of any other outlet, but nevertheless, a 2 inch gate valve should be installed in the lead from the main to each battery of outlets.

Hose System Plan.

The hose system of irrigation illustrated by the Westward Country Club plan is basically the main system of a complete California hoseless system, with the final distribution pipes in the fairway omitted. If it should at some future time become apparent to the Westwood officials that it would be more economical of labor and materials to install a partial or complete hoseless system it will only be necessary to take off the present valve serving as a hose outlet and continue out into the fairway with the distribution pipe.

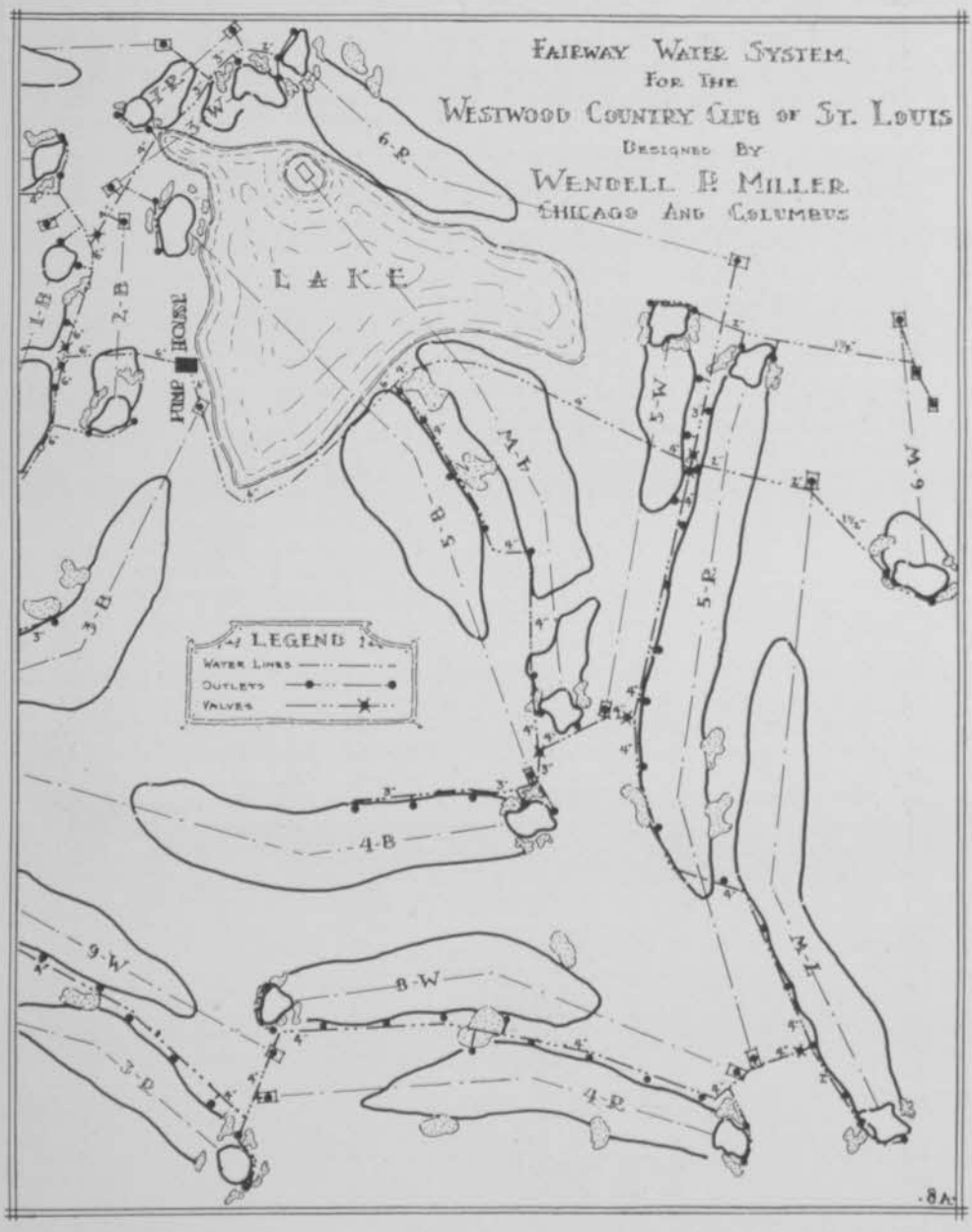
The Country Club of Detroit system provides for sprinkler outlets spaced 70 feet apart on a triangular layout. The first outlet is placed approximately 100 yards in front of the tee and all the fairway area from this point to the green is covered for a width of 150 feet. Allowance for the prevailing wind must be made in spotting the location of the outlets with reference to the center line of the hole.

In the Westwood system the hose outlet valves are placed 120 feet apart, on the edge of the fairway which will give an 80 foot center to center spacing of outlets should the permanent underground hoseless system be installed later.

The Country Club property is practically level so that a pump house pressure of 90 pounds and a minimum running pipe line pressure of 80 pounds insures complete coverage of all area served by the system. The Westwood property is more rolling and requires a pump house pressure of 110 pounds to maintain minimum running line pressure of 60 pounds on the highest points.

The Westwood pressure will be increased to 150 pounds at the pump house if the hoseless system is later installed, as the 80 foot spacing of underground outlets will require a running terminal pressure of 90 pounds to provide uniform and complete coverage under the wind conditions prevailing in St. Louis.

Running terminal pressures above 70 pounds are not practical on hose systems on account of hose fitting difficulties. The nearer the pressure approaches 70 pounds the more economical the labor of applying the water. A 20 ten foot increase from 80 to 100 feet in diameter of sprinkler coverage means an increase in area covered from 5,000 square feet to 7,800 square feet or over a 50 per cent increase in area. In



other words a sprinkler that only covers a diameter of 80 feet will require a minimum of 15 moves per acre for a hose type sprinkler whereas the sprinkler covering a diameter of 100 feet will only require a minimum of 9 moves to uniformly cover an acre. This is an increase of 75 per cent in the amount of labor required to operate the sprinklers covering only 80 foot diameters over that required for sprinklers covering 100 foot diameter.

The Country Club buys water from the city at 20 pounds pressure and boosts it to 90 pounds by an automatically controlled electric motor driven centrifugal pump. Westwood pumps its water from a lake by a four cylinder gasoline motor direct con-

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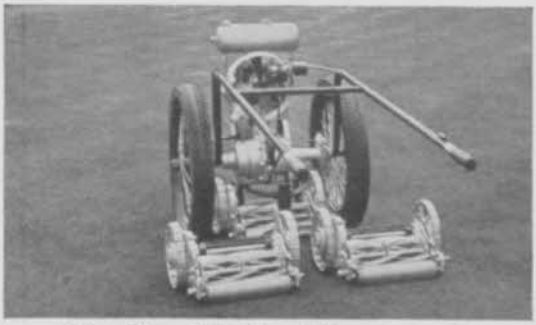
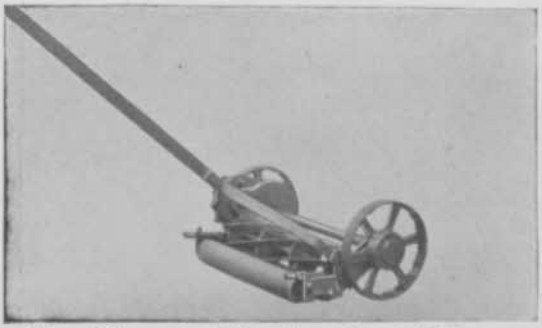


The Worthington "Overgreen"
(Furnished with or without Grass Catchers)

The "Overgreen" power putting green mower is making as great a revolution in the cutting of golf greens as the Worthington gang mower has made on the fairway. It will mow the eighteen greens of the average course in four hours and one-half. It is guaranteed to leave the putting surface, in respect to smoothness and freedom from any mark, in unexcelled condition. Unequalled in durability and freedom from derangement or delays.

The "Overlawn" is a power mower composed of a complete tractor drawing a Standard Worthington 30" fairway cutting unit. In this comparatively easy service it will last indefinitely.

The Worthington "Overlawn"



The "Shawnee" Putting Green Mower

The Shawnee 18-inch putting green hand mower is the peer of any hand mower in existence. Easiest to push and cuts a swath perfect in quality.

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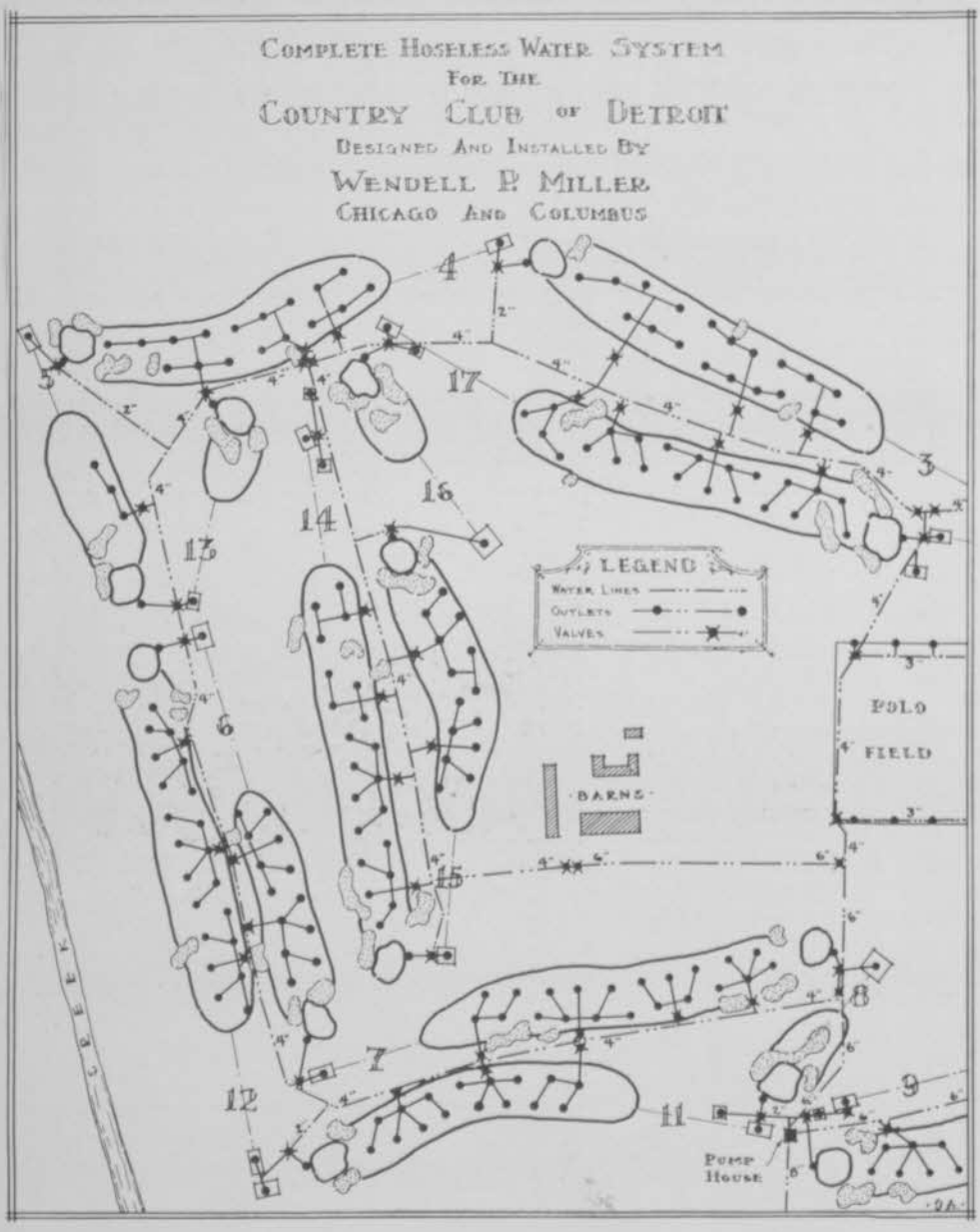

nected to a centrifugal pump. The country club plant delivers 450 gallons per minute and the Westwood plant now has one unit of 350 gallons per minute with a second 350 gallon unit planned for this year.

The main piping system of these two systems are identical in that they are both complete loops of 6 and 4 inch cast iron pipe with precalked lead joints. Both systems are valved at all main intersections to provide isolation laid in machine dug trenches about 2 feet deep and are graded to provide perfect gravity drainage of all lines during the winter.

Club house fire protection is provided through standard steamer hydrants located around the clubhouses and service buildings.

FERTILIZERS

Something About Their CHARACTER and USE

By O. J. NOER

THE intelligent use of fertilizers promotes the growth of good turf on greens and fairways. Successful turf culture also depends upon an ample supply of water and light, favorable soil conditions, selection of varieties of grasses adapted to local climatic conditions, and protection of the turf from injury. When these are favorable plant feeding becomes the prime factor in turf culture.

Ten different chemical elements are required by plants to make complete growth, and when any one or more is lacking, or deficient, normal growth is not attained. Turf culture is concerned with only three of the ten elements, namely nitrogen, phosphorus and potassium. These are often referred to as ammonia, phosphoric acid and potash. The other seven elements are generally sufficiently abundant to supply plant needs.

The solid substance of the soil is made up of minerals derived from the disintegration of rocks, and organic matter or humus, resulting from the decay of plant and animal residues. Most of the soil nitrogen is stored in the dark colored humus, hence dark colored soils usually contain more nitrogen than light colored soils. Humus also contains some phosphoric acid and potash but the main supply of these elements is derived from the mineral constituents of the soil. Phosphoric acid and potash are most abundant in the small soil particles, silt and clay.

In general, peat and muck soils are high in nitrogen but often low in phosphoric acid and particularly potash. Sands are often low in all three elements, especially nitrogen. Heavy soils, while they usually contain abundant supplies of potash, may be low in phosphoric acid and are usually deficient in nitrogen, especially when turf grasses are grown continuously.

Nitrogen is the most essential element in turf culture, due to its effect upon vegetative growth. Within certain limits the amount of growth is proportional to the amount of nitrogen available. The dark green color associated with rapidly growing foliage is largely the result of an abundance of nitrogen. Hence the need for nitrogen can be judged by the rate of growth and depth of color of foliage.

Phosphoric acid affects seed formation, which is of little interest in turf culture, but it also encourages root formation and development. The young grass seedling must get its food from the soil very early, because the young seed contains very little stored food, hence the presence of ample phosphoric acid is of primary importance in promoting establishment of young grass.

Potash aids in the formation of a class of substances called carbohydrates (sugar, starch, and cellulose). The first two are sources of energy, while cellulose is the substance which makes up the structural portion of the plant.

The growth of clover is stimulated by phosphoric acid and potash, so their use beyond the absolute requirements of the turf grasses is generally discouraged.

Nitrogen Occurrence

Nitrogen occurs in different forms which may be classified into the three following groups:

1. Organic nitrogen is derived from animal and plant residues. The principal sources are, manure, cottonseed meal, dried blood, animal tankage, fish scrap and milorganite. Most organic nitrogen is insoluble in water, and is not available to the plant until broken down into other forms.

2. Ammonia nitrogen is the form of nitrogen in ammonium sulphate and ammonium phosphate. Both are water soluble, and while many plants cannot assimilate ammonia as such, nitrogen in tnis form is readily available.

3. Nitrate nitrogen is the form of nitrogen in nitrate of soda. All nitrates are

water soluble, and nitrogen in this form in preferred by most plants.

While plants prefer nitrate nitrogen, other forms of nitrogen are converted to nitrates by the bacteria of the soil. During decay, organic nitrogen is first converted to ammonia, and the ammonia is then changed to nitrate nitrogen. Soil bacteria can and do convert the ammonia nitrogen of ammonium sulphate and phosphate into nitrate nitrogen. Since decay is necessary, organic nitrogen is usually more slowly available than either ammonia or nitrate nitrogen.

Soluble nitrogen is easily lost from the soil by leaching, and on greens the loss may be serious, due to frequent watering. Organic nitrogen is not so easily lost because the nitrogen must be converted into soluble forms, by soil bacteria, before leaching can take place. By making frequent light applications of soluble nitrogen fertilizers the danger of loss is reduced. A longer feeding of turf can be obtained by using a small amount of ammonium sulphate or phosphate together with an organic material. The immediate needs of the turf are satisfied by the ammonium sulphate or phosphate, and the later needs by a gradual conversion of the organic nitrogen into available form as needed by the plant.

Phosphoric Acid Sources

Bone meal, ammonium phosphate and acid phosphate are the principal sources of phosphoric acid, and of these, bone meal contains the least readily available phosphoric acid. The water soluble phosphoric acid of ammonium phosphate and acid phosphate is not lost from the soil by leaching, because insoluble compounds are formed in the soil.

In non-acid soils lime phosphate is formed but in acid soils iron phosphate is produced, because acid soils are deficient in lime. Iron phosphate is less readily available than lime phosphate, so acid soils often require applications of phosphoric acid. Greens, fertilized continuously with acid producing nitrogenous fertilizers, may eventually require limited applications of phosphoric acid.

Potash Sources

There are two sources of potash, muriate and sulphate of potash, each containing about 50 per cent potash. Both are water soluble and hence readily available for plant use. Potash does not leach from the soil, because any soluble potash applied in fertilizers is absorbed and retained by the finer constituents of the soil.

An understanding of the mechanism whereby plants obtain phosphoric acid and potash is important in the intelligent use of these materials. The insoluble phosphate and potash compounds formed when these materials are applied to the soil in fertilizers are not directly available to the plant. Plant roots can only absorb materials dissolved in the soil water. But there is always a little phosphoric acid and potash dissolved in the soil water, and as the turf removes these materials the supply is replenished by solution of some of the insoluble phosphate or potash. When the turf makes heavy demands, solution must take place rapidly, or the plant suffers. Thus the rate of solution determines whether the turf can satisfy its requirements.

Soluble phosphoric acid and potash, when applied to the soil are fixed in a condition which permits rapid solution whenever the plant makes heavy demands.

Since phosphate and potash fertilizers are quickly fixed in the soil, best results are usually obtained when they are worked down into the region of the soil where maximum root development occurs. Uniform distribution is also important because very little lateral movement of soil water takes place. Soils are so often low in phosphoric acid, that it is well to apply phosphates to new fairways prior to seeding. At this time the phosphate can be worked down into the soil by discing, and since there is no danger of loss by leaching, the added phosphoric acid provides for plant requirements over an extended period.

Soil Reaction

In addition to supplying plant food, fertilizers affect the soil reaction, and may tend to make the soil either more or less acid. Since an acid reaction discourages the growth of clover and weeds, fertilizers which promote acidity are preferred. Nitrogenous fertilizers affect the soil differently, nitrate of soda decreases soil acidity, ammonium sulphate and ammonium phosphate increase acidity, while dried blood and activated sludge have but little effect on the reaction.

When nitrate of soda is applied to the soil, the nitrogen is used by the plant and

Fred Kruger

Builder of Many Courses in the United States and Canada

Greenskeeper
Olympia Fields Country Club
Chicago

Largest Private Golf Club in America and Scene of 1928 National Open Championship

says of NU-GREEN:

"NU-GREEN was used last year regularly on Olympia Fields as a preventive of Brown-Patch and throughout the season the greens showed a healthy color. I recommend Nu-Green as a preventive of Brown-Patch and as a wonderful grass stimulant."

As builder of courses in many parts of the United States and Canada and as greenskeeper of the largest private golf club in America Mr. Kruger has had real opportunity to study greens conditions and test Brown-Patch treatments.

That Nu-Green has again been called upon to assist Mr. Kruger in keeping Olympia greens in perfect condition throughout the season, and in particular for the National open tournament, is an indication of his confidence in this new remarkable Brown-Patch treatment.

Dr. J. J. Monteith, Jr., in the December, 1927, issue of the Bulletin of the U. S. Golf Assn. Green Section, says of NU-GREEN:

"The areas treated with Nu-Green soon developed a luxuriant, dark, healthy green color, which stood out in sharp contrast to the untreated portion, where the turf retained the pale yellowish cast so common on many greens. In cases, these plots were so striking that they became a source of wonder and amazement to greenskeepers, professionals, club officials, and players."

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Note—New Prices

25 lb. size	$1.50 per lb.
50 lb. size	$1.45 per lb.
100 lb. size	$1.40 per lb.

NU-GREEN

Controls Brown-Patch

THE BAYER CO., Inc., Agricultural Dept., 117 Hudson St., N. Y. City

the soda is left in a form capable of neutralizing any acid already existing in the soil.

While the plant also uses the nitrogen of ammonium sulphate and phosphate the residue left in the soil is acid in character. Bone meal tends to decrease acidity because of the lime contained in the mineral portion. Acid phosphate also decreases the acidity of acid soils. In the formation of iron phosphate, previously referred to, the small amount of lime contained in the acid phosphate is released in a form capable of neutralizing the acid in the soil. Acid phosphate has less effect on soil reaction than bone meal, because it contains less lime. Potassium fertilizers increase soluble soil acidity. This is because the residue left, after potassium is taken up by the clay, has acid properties.

Acid producing fertilizers are now generally used on greens, but some factors connected with their use are often overlooked. Heavy soils in particular, possess a remarkable power of resistance to change of reaction and as a consequence repeated applications are necessary to produce the desired results. Sandy soils are more easily changed. The soil or sand used in top-dressing mixtures often contains sufficient lime carbonate to easily overcome the acid producing power of any fertilizer used. Manure contains considerable lime, and when used in large quantities in top-dressing mixtures, tends to decrease soil acidity.

Making Cotton Seed Hull Greens at Parris Island

By SETH WILLIAMS, Lt. Col. U.S.M.C.
President Parris Island Golf Club

CINDERS make the best foundation for cotton seed hull greens. They grip the cotton seed hulls and prevent the green from wrinkling when rolled. Greens can be contoured or stepped at a steeper angle than grass greens. Our greens are all elevated at least a foot in the rear to help hold a pitch; some are made with two steps, some with one and some plain. Those that have two steps are elevated eighteen inches. Where drainage is very good, the front of the green may merge into the fairway. Where the drainage is not good, it is better to make a four inch step so that all the green will be elevated. After a heavy rain our greens are ready for play within twenty-four hours. They are at their very best after a light rain or sprinkling. Greens may be made fast by constant rolling, or slowed by light sprinkling. Greens are usually made sixty feet in diameter, the front half consisting of a rectangle sixty feet wide and thirty feet deep, the rear half is a half-circle, thirty foot radius.

All cinders are screened through a quarter-inch screen. The cinders that will not pass the screen are used for the bottom layer. This foundation is laid true to the final shape of the green, then rolled with a two hundred pound roller, scattered and re-rolled. It must be packed hard. Next, place two by four inch lumber to make forms fifteen feet wide and two lengths of the green, in the same manner as forms would be laid for a four inch concrete floor. These forms are then filled with the fine cinders, raked and screened with a straight edge across the top of the forms. We leave about a two foot section between the forms and fill and level after the forms are removed. Steps are shaped by hand. This layer is then rolled with a fifty pound roller until footprints will hardly show. This rolling and packing of the cinder foundation is one of the secrets of a good finished green. The green is now ready for the cotton seed hulls.

Forms are again laid, using the two by fours flat. Hulls are distributed and raked and screened so as to make an even layer two inches thick. Forms are removed and the green rolled with a fifty pound roller. Small sections are rolled at a time, care being taken not to step on the unrolled hulls. Men should wear shoes without heels. The green is then sprinkled and re-rolled. This process is repeated again and again. We usually roll a green for three hours the first day, then for two hours a day for a week. Keep the green moist all the time, but not wet enough to pick up the hulls on the roller. The green can be played on after the first week, but needs about a month to reach its best condition. After the first week, use a roller weighing one hundred and fifty pounds until the green reaches good putting condition, then use the fifty pound roller for maintenance.

Greens made as above will hold a pitch shot as well as a good grass green. A pitch shot will take a divot from the green, but this can easily be replaced and firmed with the foot.