THE
GOLF COURSE

A MONTHLY BULLETIN DEVOTED TO THE DISCUSSION OF MODERN METHODS AS APPLIED TO GOLF COURSE CONSTRUCTION AND UPKEEP

The Cost of Golf Course Construction

I

INTRODUCTION

IT is unfortunate that there is such a dearth of accurate figures from which it would be possible to predict in advance the approximate cost of constructing a golf course. Although millions have been spent in constructing new courses in the past few years, there has been no attempt to make the cost figures available for the guidance of new enterprises. In fact, the very nature of the work being carried out has militated against this. Golf courses are for the most part private enterprises conducted principally for the pleasure or benefit derived from the game. In most cases, where there has been a limit on the expenditure of money, it has been of no special concern to officials where the money went just so long as inspection of the accounts did not disclose any waste and so long as the total did not exceed the amount of money available. The money available being the only matter to keep in mind, the necessity for a careful analysis of the costs did not appear very strong, even though in nearly all manufacturing plants this is necessary in order to keep the total cost down to the lowest possible point. It has usually not been thought of, or if it was, the accurate keeping of unit cost seemed to be too much trouble, or as perhaps more often the case, was beyond the abilities of those in charge.

It is not the intention to convey the impression that it would be possible to take the figures obtained by any one club, or those from any group of clubs, and immediately sit down and figure the exact cost of a new golf course. While this would be a very desirable thing to be able to do, the conditions which obtain in each locality would make a figure found in this manner very inaccurate. There are so many things which affect the cost of construction that it is doubtful if there will ever be any figures which can be used in this way. Such factors as the supply, quality and cost of labor, the soil, the weather, the particular seed used, the amount and kinds of fertilizers and soil-building agents such as humus and manure, the length of the course, the amount of clearing to be done, these and many others will always play a most important part in the cost of any course. In fact, about the only costs which can be accurately figured in advance are the services of the architect, and the seed and fertilizers necessary.

However, the experience of a large number of clubs will enable the construction of tables showing the standard

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WINTER is upon us and in most sections of the country the Golfer has been forced to lay aside his clubs until Spring unless, perchance, he anticipates the pleasure of a visit to the sunny South.

We cannot doubt that the true Golf enthusiast appreciates the significance of the past season and looks back with considerable pride upon the wonderful progress the game has made in this comparatively short period. One can hardly claim that there has been any marked improvement in the play of the better class of Golfers, except in the case of the women, who have truly done themselves proud this year and taken a decided step forward. Consider, however, the almost unbelievable number of new courses which have been built or are now in the state of construction and the improvement of the old ones to meet present day requirements. This is the noticeable progress and the good resulting is bound to be permanent.

Who can deny that golf in America is even now in its infancy? Every new club means more golfers and the type of Golf Course demanded by club members today means better golf. The mediocre Golf Course will no longer do, and it naturally follows that the best talent obtainable is being sought to carry out the work which confronts a new club or an established one where an improved course is required.

A poor Golf Architect means a poor layout; inexperienced supervision of construction work means many unnecessary mistakes which often cost thousands of dollars to correct; grass seed and fertilizer of unknown quality mean an initial saving at the cost of poor turf which is a Green Committee's most trying and expensive problem; and finally, when a course is completed, lack of intelligent maintenance may spoil all the good work which has been done.

No one recognizes these facts more fully than most club officials, and from everywhere comes the same cry "We want the best of everything, we are willing to pay for the best, but we must be sure we are getting it."

PROFESSIONALS and greenkeepers frequently request us to advise them where they can secure situations. We shall be glad to furnish the names of competent men.

The Modern Construction of Putting Greens In the Middle West and Southern Hot Clay Soil District

By Leonard Macomber

CLAY soils are perhaps the most difficult class of soils to deal with, especially where climatic conditions are severe, and one must always bear in mind that to produce and maintain putting greens of the finest quality, it is necessary to make a marked improvement in the mechanical condition of all heavy soils.

If you have a heavy sticky close grained, compact soil, it must be made more fertile, porous, and warmer. The drainage must be well taken care of and sufficient sand and humus incorporated in the soil to make it porous and firm and supply the necessary plant food.

It is easy to form an opinion of a putting green by just walking over it. One can tell by the feel of the turf whether its firmness is due to over rolling or to the employment of more correct methods.

In many districts, it is impossible to play on putting greens situated on the natural clay soil very early in the Spring, because they remain wet and sticky so long and then with the arrival of the hot dry weather, clay soils have an unfortunate characteristic of caking, packing, and cracking badly.

The soil gets so hard it is impossible to play a "pitch" shot onto the greens and "hold" the ball. One month the greens are soft and "slow" and the next, they are hard and "fast."

So progressive ideas on putting green construction have resorted to elaborate methods to overcome all the difficulties of producing and maintaining first class greens in hot, clay soil districts.

We find one club, the Scioto Country Club, of Columbus, Ohio, spending as much as a thousand dollars in the construction of each of their eighteen putting greens. The system they worked on in general is as follows:

They built large irregular shaped undulating greens, first of all plowing the areas and scooping off all the good top soil into one deposit and then scooping down into the sub-soil to the depth of about twenty-four inches, piling up the poor soil separately—using it as a filler in some cases or for the foundation of mounds.

The general contours of the surfaces of the greens were formed in the subsoil and after laying drain tile in herring bone formation, they placed a six to eight-inch layer of cinders to take care of the drainage effectively. Of course in localities where cinders are not obtainable cheap, any other porous material, such as broken rock, gravel, or loose sand will answer the purpose.

On top of the drainage layer was placed a fifteen-inch composition layer made up of fifty percent soil (using the top-soil removed from the greens if of good quality), about twenty-five percent sharp sand, and about twenty-five percent stable or barn-yard manure; the soil having been previously sweetened with ground limestone.

The materials were all mixed in a cement mixing machine right at each green, and sufficient time allowed for the composition soil to settle before going on with the work.

Then was placed another layer about three or four inches thick—a mixture made up of the best sifted loam obtainable—representing about fifty percent. —thirty to forty percent. of sharp sand, and ten to twenty percent. of well rotted stable manure. This material was made lighter with less manure, and in the preparation of the seed bed, a complete artificial fertilizer was used and the seed covered with a quarter-inch layer of pure humus.

With the surface drainage properly taken care of, there was no difficulty in producing and maintaining an excellent turf on the greens. At the same time, it is necessary to weed, renovate, reseed, topdress, and sand the greens systematically and occasionally sweeten the soil with pulverized charcoal.

During severe hot dry weather, the greens are "dusted" with sifted compost and watered freely two or three times a week, and if the turf is kept healthy, thick, and strong,—there is not much room for weeds, and the annual crab grass.

The advantages of building greens as above are many. They play better; worms are less in evidence; the greens are open for play much earlier and later in the season; they behave properly in bad weather—that is, they drain freely in wet periods; the surfaces keep in good condition; and in dry hot weather, the soil does not bake, pack down hard, and crack. As the make-up and up-keep of the greens are artificial, it is not necessary or desirable to choose grasses that are natural to, or thrive best, in a certain district under natural conditions, but rather to choose those that are best suited for putting greens.

The nature of the soil in many districts is generally responsible for the failures to produce and maintain really good greens. If the soil conditions can be improved and changed, there is no reason at all, with artificial systematic treatment, why good greens cannot be produced and maintained. In some of the Southern States, for instance, on heavy clay soil in North Carolina and Georgia, putting greens are being constructed on more or less the above system and during June, July, and August, it is proposed to cover the greens with cheese cloth (about three to four feet above the ground) as a protection from the hot sun — and play temporary greens. It is the same arrangement as covering tobacco, but the greens should be watered systematically and uncovered occasionaly to benefit from the natural rains and allowed some early morning or late afternoon sun.

The Use of Lime

By R. Vander Beken

GREENKEEPERS are nowadays fully alive to the importance of maintaining a supply of lime in the soil that it may seem unnecessary to write at length on the subject, but as examples are so often cropping up where otherwise good soils are deficient in lime, it seems an opportune time to point out how to determine whether or not the soil contains a sufficiency of lime.

As is well known, one main use of lime is to neutralize the acidity of the soil, set up by the decomposition of organic matter. For a shortage of lime a good indirect indication can be determined by testing the acidity of the soil.

Methods of testing for acidity with litmus paper.

The usual test for acidity or sourness in a soil is blue litmus paper; if this is turned red, it may be concluded that the soil is sour and that it will greatly benefit by liming or an application of marl or ground limestone.

There are several tests, but three of the simplest are:

(1) Take a handful of soil in a somewhat moist condition, place a slip of blue litmus paper in the soil, which is then kneaded gently for a minute or two so as to bring the particles of the soil in close contact with the litmus paper. If the soil is acid the colour of the litmus paper will change in the course of 5 to 10 minutes to red.

(2) Take a little of the surface soil from, say, half a dozen places on the area to be examined and mix well. Take a few ounces of this mixed soil and, putting it in a clean cup or tumbler, pour on a little boiled water and stir until it becomes a thick paste. Into this insert a piece of blue litmus paper by means of a small stick or the back of a knife. After fifteen minutes carefully draw out the paper and if that part of the litmus paper which has been in contact with the "mud" has turned

red, it is to be inferred that the soil is acid.

(3) Place a strip of blue litmus paper in the bottom of a clean tumbler and over it place a round filter paper, or a piece of clean white blotting paper cut to fit the bottom of the glass. On this place a few ounces of the soil to be tested: pour on sufficient boiled water to wet the earth thoroughly throughout its mass, but no more, then set aside for about a half hour. View the litmus paper by turning the tumbler up-side-down. Here again if the paper has turned red we can conclude the soil is sour.

It should be remembered that it is well not to handle the soil, rather taking an implement, such as a trowel, to take up and mix the soil.

The above tests only tell if the soil is sour or not, so if it is desired the direct test for lime may be employed. This may be done by adding to half a teacupful of soil enough spirits of wine (made by adding to the commercial article an equal quantity of water) to thoroughly moisten and just cover the soil. If lime be present in quantities a lively effervescence takes place; on the other hand if the effervescence is only very slight it is to be inferred that lime is deficient in the soil.

Another test is, place two teaspoonfuls of soil in a glass, cover with water, pour on a teaspoonful of spirits of salt (hydrochloric acid). A gentle bubbling and a frothy head will appear if lime is present; if not the soil requires liming.

Lime in whatever form it is applied acts as a corrective of acidity, but further, it is an aid to the absorptive and retentive properties of the soil.

Ways and means of applying lime.

Quicklime is distributed in small heaps at the rate of ½ ton to the acre. Water is added at the rate of one-third the weight of the heap, and the latter is covered with about an inch of soil. When the heap is slaked it may be spread with a shovel. It is important that the slaked lime does not come in direct contact with organic manure. If carbonate of lime is applied it should be in a finely pulverized state and at the rate of 1 to 2 tons per acre. Its action is less rapid than that of slaked lime, and its use on light soils is recommended because lime itself appears to hasten the oxidation of organic matter —a process which goes on fast enough in well aërated light soils. On the other hand; peaty soils benefit more quickly by the use of lime, for it increases the plant food in the soil by directly attacking the complex insoluble compounds and breaking them down. A further important effect of lime, either as the hydrate or the carbonate on clay soils is the well known "opening" which it induces.

Finally lime and its compounds may perform many functions: in correcting acidity, in improving tilth, in promoting nitrification; all the same they are not fertilizers, and cannot be used as substitutes for manures, for drainage or for tillage.

Autumn is probably the best season for application, spreading on the ploughed land and harrowing it in. The tendency for all lime compounds is to sink, to be washed down by the rain, and therefore it should never be ploughed under. Never apply in excessive amounts, better apply too little than too much, as an overdose will cause a too rapid dissipation of its humus—certainly one of its most valuable constituents—the nitrogen.

It is well to substitute charcoal for lime on the greens and pieces of fairway where no clovers are to be encouraged, as the action of lime has a tendency to decompose the insoluble potash compounds, thus the lime compounds may act as indirect potassic fertilizers. The effect is most noticeable on clays and will be more apparent on clovers, which more particularly respond to potassic fertilizers.

In preference, on all soils, always use pulverized limestone rather than caustic or burnt lime, because in using the latter there is considerable loss in the liberation of Nitrogen and in the burning of the Humus in the soil.

The Cost of Golf Course Construction

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costs of unit operations. For example, it is not likely that there will be much variation in the cost of excavating a cubic yard of soil in constructing a bunker, nor will there be much variation in the cost of hauling this yard of soil for say half a mile over average roads. Also, the cost of seeding an acre should be approximately constant all over the country, and so on down through the large number of separate operations which compose the complete work. If it were not for some such basis as this it would certainly not be possible for a concern to contract to build a cellar, for example, at a given price and still be sure of some profit. Contractors learn by experience just what it will cost to do work of this sort, and while the construction of a golf course is much more complicated, it is easy to see that if we used standardized figures, properly corrected for the labor rate prevailing in the vicinity, and the total cost figured by this way adjusted very carefully for the probable effects of local conditions (soil, weather, etc.) we would have an estimate which would have some foundation in fact and which would not be a haphazard guess as is the case with the vast majority of estimates for golf courses.

II

After this preliminary survey of the subject, we are prepared to dig into the details a little more deeply. Obviously, after a decision is reached to go ahead with a new golf course, the first necessity is the land. The first consideration is an inspection of the available sites, and while accessibility is most important, it is also necessary to consider the configuration of the ground. Here is the first place where the services of a competent and experienced golf architect are absolutely essential. To pass upon the qualifications of a tract of land for a golf course is seldom possible for one who does not make it a business. The architect should be the very best and even though his services are very expensive it is poor economy to use any other. It will not do to engage a man who has made a success in laying out one course in a locality where he may have been for years and where he has had the advantage of the utmost familiarity with local conditions. In the new place where conditions are altogether different only luck will save the amateur from adding thousands of dollars to the expense of building the course. His inspection and report, which will take into account many factors which cause expense, such as soil conditions, distance from freight stations from which the materials required will have to be hauled, etc., will enable the new club to select the most suitable site. After this question has been decided the architect will sometimes spend several days going over the property and fixing each of its features in his mind. Then the course will be laid out in such a manner as to obtain the best possible balance between the lay-out and the money necessary to construct it. Often a change of a few yards one way or the other will save thousands of dollars to the club, and for this reason, if for no other, an experienced man is required.

The cost of having a competent golf architect pass on the land and see the job through from start to finish will seldom run under $1,000 and will frequently go to $1,500 or more, depending partly on the length of time when his personal supervision is required. These figures may seem excessive to some but they are by no means the top prices which have been paid on isolated occasions, but are fees which are paid day in and day out and the men who earn these amounts are always swamped with work. It is a lucky club which can obtain their services for even a few days without waiting their turn for weeks.

The cost of the architect's services is of course an overhead expense which should not be at once charged against the cost of the course but which should be allowed to rest until the work is finished. It is also a charge which

should not affect the unit costs which are to be obtained as the work goes on.

The next item is that of general supervision. A man should be secured who is competent to manage the entire work. He should have charge of purchasing the materials which are required, paying the labor, keeping the costs, etc., and it is not absolutely essential that previous experience in golf course construction be had. A first class engineer or superintendent will usually give entire satisfaction, providing he is willing to carry out his instructions to the letter without interfering in parts of the work about which he knows nothing. He should be the type of man who will call in expert assistance when necessary, especially in connection with the actual production of the turf, and who will place the responsibility for these special portions of the work absolutely upon a man who has had long experience. Of course, once in a while a club may run across a manager who can take charge of everything, but it is probably better when one man does not have to take the responsibility of every little detail.

As a rule, the first thing necessary to do is to clear portions of the land from trees, etc. Here co-operation is necessary between the architect and an expert in clearing. By working along together it may often be deemed best to slightly alter the plans in order to get around some special difficulty and thereby save considerable money to the club without interfering in the least with the quality of the lay-out. The architect may be depended upon to take these facts into consideration but in any case a thorough understanding with the man who will take charge of the clearing will help considerably.

The cost of clearing the land will of course not be constant at all points. Some portions will perhaps be densely wooded, while others will contain merely undergrowth or nothing at all. However, with labor at about $2.00 per day, the cost of clearing an acre of ground will run from $50 to $175 or $200, or more in isolated instances. As a rule, clearing may be figured at about $150 without danger of going far wrong. In many cases, where the timber is worth anything at all, a local man will take the contract to clear the desired portions of the course and take his pay in the wood removed. If the club wishes to do the clearing itself, some of the wood can nearly always be disposed of in one way or another. Even the small saplings can usually be sold and thus be made to bring back a part of the cost of removing them. A careful investigation by the manager will always disclose some means of selling the wood, and much money can be saved in this way. The railroads are usually in the market for certain classes of wood for mine-props, ties, etc.; excelsior and barrel factories will use their share, and so on. In rare instances a club might be able to make an actual profit on their clearing.

The next operation is the drainage. This should be turned over to experts whose recommendations should be followed absolutely. If properly done in the first place, even at great expense, the club will save a large amount of money in future years and will also save the annoyance of putting the course out of play while the ravages of some heavy storm is repaired. Correct drainage is essential if good turf is to be had and the putting greens will require special attention. As an example of what follows when abnormal weather conditions overtax the drainage system, the experience of the Scioto Country Club may be studied with profit. During the summer when this course was under construction, the weather was wetter than for many years past. In addition to the natural inconvenience resulting from this state of affairs, great trouble was experienced from excessively heavy downpours. These resulted in washing out to a greater or less extent all the putting greens and fairways, and in certain cases the damage was so great that it was only repaired at enormous expense, due to hauling in large quantities of earth to fill the washed out places and to the extensive enlargements of the drainage system, which were made nec-

essary in order to avoid a repetition of the trouble in the future. It is estimated that the cost of constructing the course was increased by at least $15,000. It was necessary to put in drains of extra size, and in one fairway a 24 inch storm sewer was built to handle the water.

This is of course in many ways an extreme instance and the club can hardly be blamed for not foreseeing the extraordinary weather condition which would have to be faced. Nevertheless, the lesson which is taught by this experience is an important one and one which should be taken carefully into consideration in order to reduce the risk of a similar occurrence elsewhere.

(*To be continued*).

Grass Diseases

(*Continued from the October Issue*)

Epichloe Typhina, known as *reed mace, red muff,* etc., is a parasitic fungus found in summer growing on the base or stalks of many grasses growing in damp places. I have found specimens of *cocksfoot, Timothy,* and especially *tall oat grass* with this characteristic parasite in various eastern counties, but have not seen it growing on *agrostis,* which is said by authorities to be its commonest host plant. It grows in the form of a muff surrounding the stem usually above the node or joint, and is white at first, then turns orange or purple, when it is in the *conidia* or spore-bearing stage. Although it is practically harmless, it is as well to cut the grass before the fungus turns orange-colored.

IV.—Fungus Growths

The second division consists of those diseases set up by poisonous conditions of the soil, the commonest example being the fairy ring. These are caused by various fungi, the commonest being *Marasmius oreades,* but *Lycoperdon perlatum* and *Stropharia squamosa* are two other species often observed. The *mycelium* of these fungi feed to a certain extent on the roots of the grass, and the *mycelium* sets up a kind of fermentation in the soil, rotting the roots so that the grass dies off in patches or is at least considerably weakened. As it is difficult to dig out the rings, it is best to apply a solution of sulphate of iron (one pound to one and a half gallons of water) starting from the outside of the green ring. A second solution at half strength may be applied fourteen days later, three applications generally being sufficient. The ground should first of all be pricked over with a fork before watering, and it is best to do it in the evening if the weather is hot or dry. The other fungi, *Tricholoma* and *Lycoperdon,* are more troublesome on light soils where the *mycelium* spreads out in an irregular net work, causing the turf to look very unsightly. It is generally due to decaying roots of trees or hedges that have been cut down on the site of the lawn or green.

I must class in this division the Clover Mildew, *Peronosporum trifoliorum.* This is not a grass disease, as it only attacks clovers and other leguminous plants; but when it does, it sets up a decay which spreads to the grasses, and for this reason it should be checked where noticed. It can be distinguished by the under surface of the clover leaves becoming covered with a dense dingy and lilac-colored mildew. The leaves turn yellow and then rot off. The disease spreads rapidly outwards in rings if the weather is warm and moist, but a spell of frost or dry bright weather will generally check it. A particularly bad case came under my notice at Cobham, where one of the most beautiful lawns I have seen was made unsightly a few years ago by the clover being attacked by this mildew. It was checked, however, by mowing the turf very closely and applying a weak solution of liver of sulphur followed by muriate of potash. Besides clover mildew, there are other mildews which attack plants in turf, such as *Peronosporum calotheca,* which is common on *Spurrey, Sheradia, Serastium,* etc. None of these diseases actually attack grass, but they make the turf unsightly and

weaken it, hence my making reference to them here.

Spumaria Alba.—Although not actually a parasitic grass fungus as it lives in the soil, yet it may be considered as an enemy of the greenkeeper, as the *plasmodium* creeps up the blades of grasses, especially on a calcareous soil, and forms a dense mass of hard sponge-like crust which effectually chokes the grass. It is also said to kill horses if they eat this crusted grass, so it is advisable to mow it as closely as possible when noticed and the grass forced by sulphate of ammonia or a quick-acting manure. I might also refer to the poisonous drips of trees which kill grass, that from sycamores, beech, and horse chestnut being particularly poisonous. Where it is necessary to make grass grow strongly under trees it must be helped along with good dressings of lime and manure.

Slimy Morrell (*Leotica lubrica*).—This is troublesome in wet lawns under trees, as it causes large black masses of fungus which rot the grass. It often originates from the use of sawdust or peat moss manure; and if troublesome a dressing of basic slag or powdered lime may be given.

Peltidia Canina Refulgens.—This is a small black lichenous growth often found in mossy turf. It may be destroyed or checked by a five-per-cent. solution of sulphate of iron, the turf afterwards being dressed with potassic manures.

The Elf or Fairy Cup (*Peziza aurantia*) is a troublesome fungus on loamy soils overlying chalk, but as it is so readily removed by being cut bodily out with a knife no further reference need be made to it.

Slime Fungus (*Myxomycetes*).—Under this name may be classed the various slimes, green or black, that cover a soil in shady or confined situations where it is not covered by grass. They usually prove most troublesome on a damp soil or after a spell of continuous warm wet weather. A two-per-cent. solution of sulphate of iron may be used if the grass is very thin, but half this quantity if the turf is of fine quality.

Where the blacker olive-colored *algae Nostoc commune* makes its appearance, it is as well to apply a dusting of dry lime. This pest spreads rapidly over the ground towards the end of summer in damp situations, especially when situated near slow-running streams or pools. As the *Nostoc* has the power of movement and travels over the ground, in all probability it originates from adjoining pools, and it is therefore advisable to apply a dusting of dry lime around the banks of the pool if it proves troublesome at all.

V.—Third Division

The third division consists of those plant parasites that live more or less on grasses, and I will briefly refer to a few of the commonest plants that are parasitic on grass.

The Yellow Rattle (*Rhinanthus cristagalli*) is a pretty yellow-flowered plant found in meadows that are badly drained. Spring grazing with sheep and an application of six cwt. of salt or basic slag is a good preventive and will tend to check or destroy the plants.

Red Rattle (*Pedicularis palustris*) is another parasitic plant found on grasses, especially cocksfoot and tall oat grass when growing in peaty or damp soils.

Bartsia Odontites is a red flowered parasitic plant found on poor soils by the roadsides or in gravel pits, and, whilst not invariably parasitic on grass, several of its roots will be found attached to grass roots by means of little suckers.

Melanpyrum Pratense, the *Cow Wheat,* is also semi-parasitic on grass, but as a rule only when growing strongly on the edge of a plantation will it become parasitic.

Euphrasia Officinalis, the common *Eyebright,* is more often than not parasitic on grass. The *Bastard Toad Flax* (*Thesium linophyllum*) is another semi-parasitic plant, found more especially on chalk pastures in the southern counties.

Bastard Toad Flax.—All the above parasites attach themselves to the grass roots by means of *haustoria* or suckers, and rob it of the food material that it manufactures for itself.

Dodder on Gorse.—The well-known *Dodder* of clover is not parasitic on grass, but there is a species, *Cuscuta epithymum,* that is said to be parasitic on grass; but whilst I have found it growing on many other plants, I have only once come across it, and even then it was doubtful whether the *Dodder* was living on a piece of heather or the grass that surrounded it.

Remedies

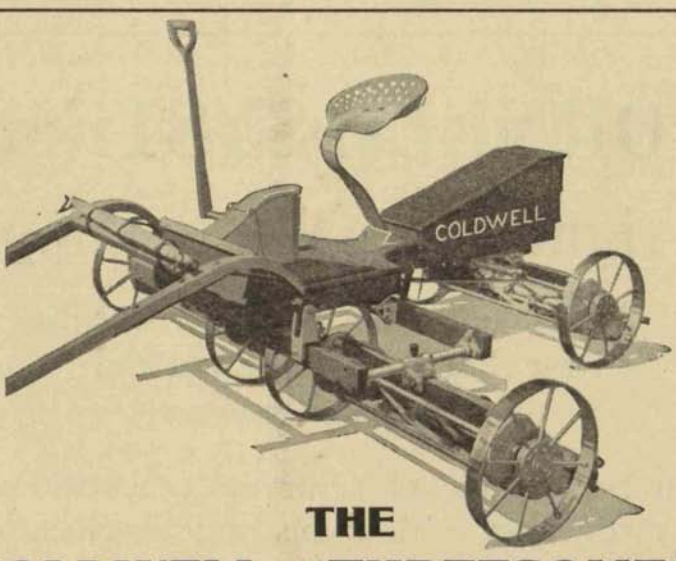
Having described the more common grass diseases, I must say something about the remedies. First and foremost the best treatment in all cases where grass is attacked by disease is to mow the turf as closely as possible and then to encourage a strong growth of grass by quick-acting manures, so as to enable the grass to grow away from the disease. In soft shady turf, and on those golf courses that lie on river flats where fungoid diseases spread very quickly, drastic treatment may be rendered necessary. In this case, spraying with sulphide of potassium (one ounce to ten gallons of water) may be done. Permanganate of potash diluted to a clear rose color also makes a useful preventive, and applications of flowers of sulphur applied when the grass is wet may also be recommended for bad outbreaks of the red mould, etc. Excepting in cases where soil is sour, solutions of Kainit (one ounce per gallon) are useful in helping the grass to resist mild attacks of rust, etc. Dry lime is particularly useful in most cases, excepting that it is always well to avoid using lime as much as possible, as it encourages clover.

All dressings are best applied in the evening, as it is during the night that mildew spreads most rapidly. On soils liable to repeated attacks of various grass mildews, the excessive use of nitrogenous and crude acid manures should be avoided, and where it is necessary to hasten the growth without unduly forcing the grass, phosphatic dressings should be used. Bone meal must be blamed for causing a large amount of fungoid growth as well as encouraging clover; whilst leaf mould, especially that from ash and sycamore leaves, also sets up mildews, though the advantages of the leaf mould may possibly outweigh the disadvantages.

Most of the diseases referred to are noticeable when they are in the form of white, gray or orange-colored moulds, this generally being the spore-bearing stage. It is then that precautions to prevent the disease from spreading should be taken. Rough grasses in hedgerows, reeds, and rushes are nearly always infected with rust and other diseases, so these should be kept cut down as much as possible. Cigarette ends and bits of rag lying in the turf are frequently the starting place of the white grass mildew. Leaving cut rye grass on the turf is also particularly bad, as a poisonous ferment is set up by the rye grass leaves that rots the finer grasses.

There is, however, a brighter side to this gloomy lecture, for parasitic fungi are not always injurious to the plants on which they live, and in some cases plants when infested with a particular parasite often grow more robust and vigorous than the non-infested plants. This condition, known as *symbiosis,* is noticeable in the case of rye grass. Even if grasses have their parasitic enemies, all plants are affected in the same manner, and, like "the fleas that have lesser fleas upon their backs to bite 'em," so these different mildews and fungi have other moulds that live upon them, which keeps the balance of Nature and prevents every blade of grass in the country from being destroyed. The *Yellow Rattle* is also punished for its greedy disposition of living on the grass roots by suffering in its turn from a parasitic fungus that causes gouty swellings on its roots.

THE END



THE COLDWELL "THREESOME"

We call your particular attention to the features mentioned hereafter, as they are absolutely essential to a perfect machine of this type and are *found only in the Coldwell "Threesome."*

1—All gears and axles of drive wheels are run in dust proof grease cases, which only need filling once in four or five months. This means easy draft, long life to the machine and a great saving of time.

2—The **Back Rollers** are made in three sections, which insures against tearing the lawn when turning circles. These rollers are each provided with bronze bearings, turning on a hollow grease-filled shaft. This shaft, once filled, needs no further attention for months.

3—The **Drive Wheels** have malleable hubs, steel spokes, wrought-iron rims and are made fast to shafts which turn on ball bearings inside the grease case. (All wear easily taken up from inside of case.)

4—**No springs are necessary** to keep the back roller from jumping up, as the Lawn Mowers are swung from the main frame by large friction surface hangers, which hold it down.

5—A single lever at the operator's right enables him to lift all three cutting knives free from the ground at once. It also permits him to throw out of gear all three revolving cutters without leaving his seat.

6—The weight of the super-structure and operator is evenly divided over the three Lawn Mowers. The combination of the carrying frame and a very simple draw rod mechanism makes one of the most desirable features of this machine, and it is this combination that makes absolutely positive the accurate position of the rear machine relative to the two front machines, insuring at all times, and under all conditions, the proper overlapping of the cuts. This valuable feature is found only in this machine.

This style of machine is designed for cutting wide swaths on grounds that are settled and dry, also where rolling and fine cutting are not the first consideration. On fine lawns where the turf is right and where pride is taken in having fine cutting and a beautiful velvety surface, free from horse marking, streaks, etc., there is only one type to use, that is the motor-driven Lawn Mower, which rolls the lawn every time it is cut. We make several varieties of this type, including both the "Walk" and "Ride" types, circulars of which we will be pleased to furnish on application.

COLDWELL LAWN MOWER CO. NEWBURGH, N.Y.