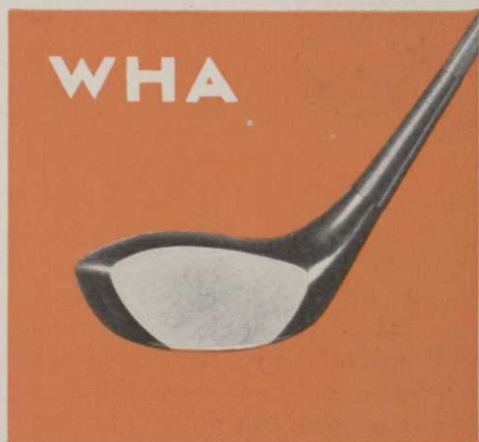


# Hagen Wood Clubs



**W H F** is a club with power—real power. The details of design and structure have been carefully developed with the requirements of the new ball foremost in mind. WHF woods are to be the running mates for Hagen "International" irons. The heads are large—sufficiently large to present a deep face. The illustration shows another new insert face. This extra protection has been placed on the lower part of the face—at the point where the greatest wear appears on most clubs. The face inserts are vari-colored in the three woods to more readily distinguish them. The sole plates are scroll type of heavy gauge aluminum. Only Walter Hagen Steel Shafts are used. These are protected with mahogany finished Duraloid to match the steel shafts of the "International" irons. The WHF has been made to retail at \$12.00 a club and is, of course, made in matched and registered sets of Driver, Brassie and Spoon. Here's a real wood club for every golfer who hits a long ball—and wants to hit 'em longer.

**W H A** This new Hagen wood club is similar in general appearance and construction to the WHF model. The only difference being the absence of the insert on the face. WHA will also prove an excellent companion club for Hagen "International" irons. It is made only with Hagen steel shafts, covered with mahogany finished Duraloid. Drivers, Brassies and Spoons in matched and registered sets to retail at \$12.00 a club.

**AMERICAN RYDER CUP** teams have always carried the finest bags obtainable. The 1930 Ryder Cup model illustrated is a fair example of the fine quality found in our golf bags. These bags are not merely a promiscuous assembly of parts more or less related in standard. On the contrary, every element in their construction represents a distinct achievement, a practical advance in the interests of better golfing luggage. Concentrate on the best—sell Hagen bags. (No. 7510—7-inch, illustrated, retails for \$47.50.)





# POSSIBILITIES

## for NEXT YEAR

**T**HIS year has been a good year for pro business. Pro shop profits haven't fallen off as some had pessimistically predicted. If anything, they've increased. We know they're showing a nice increase in the shops where pros are featuring the Hagen line. And it's not over yet—this season—not by a long shot. There's still a lot of profit to be made by that intelligent group who are concentrating their sales effort on Walter Hagen golf equipment. When this season does draw to a close, the Hagen merchandisers are going to sit back and admit—it has been a good year.

Now for 1931. There are even greater possibilities for next year. Golf is undoubtedly going to receive more interest than ever before. Golfers are going to show more interest in the proper equipment. Start planning now. It's not a bit too early. The Hagen line of golf equipment, with its advanced features of design and construction, offers you the most logical merchandise for your concentration in 1931.

Your ideas and ours are the same. Our ultimate objective, in building every unit in the Hagen line, is to make only the finest—to make it properly, and so attractive that your sales effort is reduced to a minimum and, probably most important of all, to see that Hagen equipment is sold in a legitimate manner. Remember, you have not cut-price competition on the Hagen line. Competition—of course—there wouldn't be any business without it. But you are assured that Hagen merchandise will be sold always at one price—your price.

It's not surprising that the leading pro merchandisers in all parts of the country have put their sales effort behind the Hagen line. Concentrate on Hagen equipment in 1931. Next season is going to show you a very pleasing increase in your pro shop sales. Decide now to get all of your share—feature the Ultra Line—Walter Hagen golf equipment.

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**THE L. A. YOUNG COMPANY, DETROIT, MICH.**  
*Makers of Walter Hagen Golf Equipment*  
Also Sales Offices at: NEW YORK, 1270 Broadway CHICAGO, 14 E. Jackson Boulevard  
SAN FRANCISCO, 153 Kearny LOS ANGELES, 730 S. Grand Ave. SEATTLE, 919 Second Ave.

# Seed Mixture Impurities Show Wisdom of Buying Right

As Told by

PROF. A. L. STONE

Wisconsin University College of Agriculture

to

H. HANKINSON

“UNLESS you are willing to have something ‘put over on you,’ don’t buy cheap mixtures of grass seeds.”

This is the suggestion of A. L. Stone, of the agronomy department of Wisconsin’s College of Agriculture. Prof. Stone has made extensive studies of impurities found in grass seeds. He warns greenkeepers to select for golf courses only pure seeds sold by companies known to be reliable.

“Some companies,” he says, “make no secret of the fact that they include in their grass seeds a certain percentage of other materials, including chaff, when they make up mixtures for a cheap market. The public think they are getting more for their money when they receive a bulky package for a small sum. Therefore, it is easy to sell such seed.

From actual analyses and counts made by Prof. Stone some of the mixtures have been found to contain, besides a small amount of good grass seed, more than fifty percent of other materials. These include timothy, redtop chaff, Italian rye grass, meadow foxtail, and a greater or lesser amount of weed seed.

“Since timothy grows quickly,” explains Prof. Stone, “it may be an advantage at times to use it as a protective covering when more desirable grass seed cannot be sown early. Or it may be added to other grass seeds for the purpose of getting a quick green stand. When the other grasses come on, the timothy will die out of its own accord. In either case, pure timothy seed alone should be purchased. Timothy is not a permanent grass, however, and should never be regarded as such. The first season, a lawn sowed with it looks fairly well, but the second season it is hard to mow, has a bunchy appearance, and is a decidedly inferior piece of

turf. The third season, if nothing has been done about it, the timothy will probably have been crowded out by weeds. Meadow foxtail is never a satisfactory addition to a grass mixture, and Italian rye grass is also among the cheaper grass seeds. Perennial Italian rye is found in almost every mixture. It is used in Great Britain, but it is not hardy in this country.”

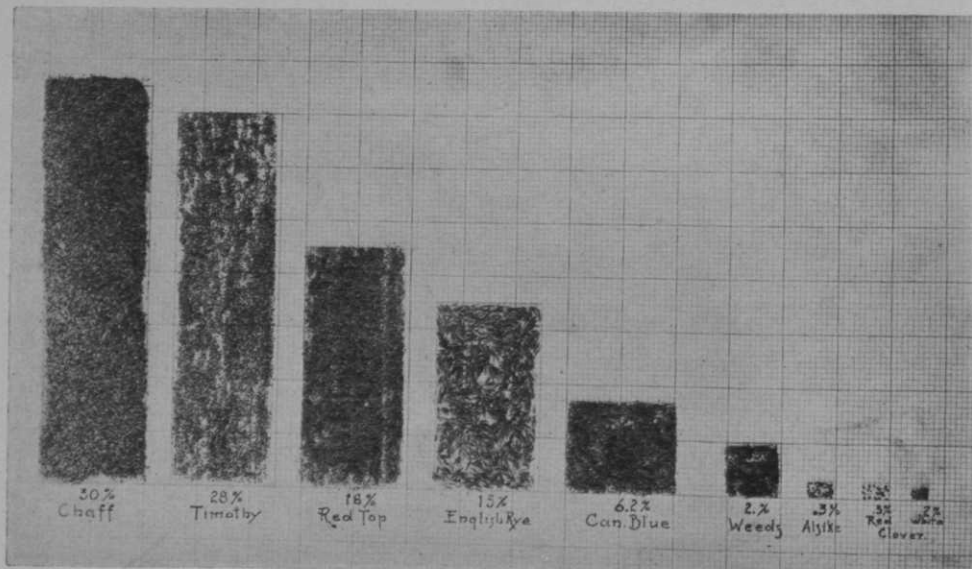
## Guarding Against Adulterants.

In examining cheap mixtures of grass seeds, there have been found, besides timothy and other grasses of a temporary or unsatisfactory nature, many seeds of light weight. They can easily be detected by blowing into a handful of a cheap grass seed mixture, for they will scatter almost like chaff. In fact, some of it is nothing more than dried husks—the sweepings from the floor of the seed house, or the light weight seeds which have passed through the cleaning mill. Light weight seeds are no better than chaff, either, for they will never germinate. If seeds are old, the percentage of their growing power is usually small, too. This can be determined only by planting some of the seed to find out how much of it will start.

Since it is of great importance that the greens on golf courses be kept free from weeds, Prof. Stone considers it of great importance that greenkeepers have some acquaintance with the weeds that infest grasses and with the weed seeds that are commonly found in cheap grass seed mixtures.

Weed seeds that infest grasses are different from those that commonly appear in grains, he points out. Out of 75 kinds of weed seeds there were found to be only a half-dozen or so that are common to both kinds of plants.

Some of the weeds most common and



A cheap package of grass seed splits up, by weight, about as shown above. About 25 per cent (the redtop, Canada blue and the clovers) are what can be called first-class grass seed; the rest is waste.

most troublesome to grass lands are quack grass, witch grass, and crab grass. Quack grass probably needs no description; it is well known as one of the worst pests. Witch grass breaks off just below the head, and the wind carries the seed along. It is not so troublesome where grass has become established, but on new land it is a menace. Crab grass is almost as bad as quack grass in being hard to fight. Along in August it makes its appearance as purple spots in putting greens and fairways. If a joint touches the ground, it attaches itself and forms roots. Cutting with the mower does not destroy this weed, for it is impossible to get all portions, and it cannot be kept from going to seed.

Stink grass is of a gray-green color, forming mats and spots in greens. It produces multitudinous seeds, and fully fifty percent of the mixed grass seeds contain some of this pest.

Certain triangular seeds that look almost like those of buckwheat are commonly found in mixtures. These are the seeds of sheep sorrel, or yellow dock. This weed has arrow-shaped leaves, and it is a bad pest on grass lands. Especially if a soil is acid, is this weed quite sure to be found in a flourishing condition. It makes reddish-brown patches in a field. Even when the acidity of the soil has been

corrected with lime, this weed will thrive. It propagates on an underground stem, almost like quack grass.

Common chickweed and mouse ear chickweed, like quack grass, are troublesome although they are annuals, for they lie close to the ground. Through a long season they continue to bloom and mature seed, and both are very difficult to get rid of when once they are started.

One of the most easily recognized weed seeds in a mixture is that of peppergrass. This weed has a small flat reddish or orange colored seed.

The seeds of the common rough cinquefoil are very likely to be found in timothy seed and in grass seeds that have not been cleaned. This weed is an annual, and the seeds develop in any kind of sod. Cinquefoil is not so difficult as some to keep from seeding, but it goes to seed at the same time as grass, and because of that the seeds become mixed with the grass seed.

### Plantain Pests.

The plantains that are common in grass lands are of two kinds. Black seed plantain with its broad leaves, purple colored near the base, is a large seed variety; common plantain has grayish green leaves, white near the base, and its seeds are small.

An exceedingly troublesome perennial in lawns is buckhorn. This weed has seeds that will live in the soil a long time. Neither do they decay when too wet, as most seeds do. Then, whenever conditions are right, they begin to grow. The seeds of buckhorn are of about the same size and weight as those of red clover, and for a long time they could not be detected among grass seeds. Finally, someone discovered that buckhorn seeds could be separated from clover seed by moistening all the seeds and mixing them with sawdust. The buckhorn seed has a mucilagenous covering which the clover does not have, so that, when damp, the weed seed sticks to the sawdust and can be sieved out of the other seeds.

Heal-all, the seed of which is found to some extent in mixtures, is a weed that reaches a height of one or one and one-half feet when grown. It is likely to form solid patches, for it spreads underground, and it is a perennial.

A greenkeeper should know what the sow thistle looks like, for greens are almost sure to be infested with this weed at some time. It maintains itself in pastures, where it is seldom eaten by animals, and the seeds are carried for miles by the winds. It is a bristly, leafy-stemmed, coarse weed, bearing yellow flowers in summer.

Seeds of the Canada thistle are also conveyed by the wind and may prove a

nuisance. This weed cannot maintain itself in grass land as well as in a field, but it sometimes gets started somehow.

In England, keepers of estates sometimes include yarrow in a seeding of grass. But in this country it is a bad grass land weed. It should be dug up wherever found and never allowed to go to seed.

Many grass seed mixtures contain ox-eye daisy seed, and in some places this becomes a pest. Yellow trefoil seeds are common, too; they look so much like alfalfa seeds, it is almost impossible to tell them apart. Although an annual, yellow trefoil is a persistent weed, and it has the same mean habit as crab grass and chickweed of lying close to the ground. The seeds of white cockle resemble those of white clover. This weed spreads entirely by its seeds. It is biennial, that is, it requires two years to produce seed.

A persistent little vine with a purplish blue blossom, called Creeping Charlie, trails along the ground. Its seeds are seldom seen, but it gets into the greens in some way, and it will run out the grass in those areas where it appears unless it is controlled.

"Since so many impurities are likely to exist in seeds that are mixed commercially, it is usually better for greenkeepers to buy grass seeds separately and mix them themselves when a mixture is needed," is Prof. Stone's belief.

# California Greens Problems Cover Wide Range

By ARTHUR LANGTON

**A** WORK on California greenkeeping if done properly would present a symposium of all the problems which harass greenkeepers in all parts of the world. Added to this there would be included a goodly number peculiar to the Golden State which it has acquired in the course of time. This in spite of the fact that the region is one notorious for its equable climate. What is given here is merely a survey of conditions as they are and as they have developed.

In the old days, about ten years ago, the state was an ideal place for the greenkeeper. He could throw down some grass seed, almost any kind, and await developments. If he was located in the south he added as much water as he could obtain conveniently. Usually the seed came up without any more attention, thus justifying the somewhat extravagant statement fostered by enthusiastic chambers of commerce that "anything will grow in California." Almost anything will grow in

California, and well, too; unfortunately, this applies as forcefully in regard to weeds, rodents, diseases, and other pests of the fairway and green. It is true that the state has no extremely cold weather to combat, but it is also true that the grass never gets a rest and that the pests mentioned above have twelve months in the year in which to promote their depredations.

But all these things did not matter in the old days. Golfers, largely tourists from the east, were so delighted with the idea of playing the royal and ancient game while a blanket of snow covered their home course in Kokomo that they were wont to overlook such details as Bermuda greens and fairways, dried out grasses, perpetual winter rules, and the like. It was golf and they were thankful for it.

### Players Get Fussy

There came a time, however, when the blandishments of California real estate agents, state publicity bureaus, and native sons prevailed upon easterners to close or transfer their businesses and move to the west coast where they could have twelve months of uninterrupted golf. As residents with more time on their hands these men began to take more detailed notice of western courses and found them wanting in many respects when compared to their eastern counterparts. Especially were faults found during the late summer months. Therefore, because golf tops all earthly things, it behooved the newcomers to make investigations, to hire experts, and to spend money in order to make California's courses come up to the eastern standard.

With this more lavish outlay, the state's greenkeepers began to show results. Greens became smoother and stayed that way for a greater length of time. Fairways were improved to such an extent that one could be reasonably sure of getting a playable lie on them. The war against Bermuda grass began with the introduction of finer grasses which made for better playing turf, but which wilted under unceasing weeks of play and hot sun. This inability to stand up necessitated the introduction of powerful artificial stimulants, which created an abnormal, unbalanced condition in the soil, making it a parade ground for brown patch and other insidious grass ailments.

### Need Different Method

But out of this innovated confusion of agrostis, ammonium sulphate, hoseless ir-

rigation, and power greens mowers, one thing early became apparent: eastern greenkeeping practices were not and could not be those of California. Conditions in the state were too varied and different. California is not solely a desert waste, a tropical jungle, a mountainous ridge, a pastoral plain, or a rolling plateau; it is an interesting combination of each with some interesting features of its own thrown in for good measure. There are courses in the state which incorporate several of these features and, incidentally, all the accruing problems of course maintenance.

An attempt to make a blanket description of greenkeeping in California therefore would be futile in view of what has been told. The state, which ranks fourth in the nation, has its approximately 250 courses distributed among seven distinct geographic or physiographic provinces: the Southern California coastal plain, the coastal mountain region, the Great Valley, the Klamath-Siskiyou region, the volcanic plateau, the Sierra Nevada, and the Great Basin. A few facts about these provinces will enable one to have some idea of the variety which is California.

### Surveys California Sectors

Taking them in no particular order, the Southern California coastal plain shall be considered first. This is the southwest corner of the state and is the only plain not separated from the ocean by a range of mountains. For this reason it is kept comparatively cool in the summer months. The region centers about Los Angeles and is the scene of the famous midwinter tournaments. It is here that most of the money has been spent on golf courses with the result that many fine clubs are being maintained in spite of the paucity of rainfall. It has been said by an Eastern authority that at least one course near Los Angeles has the finest greens in the world. However, Easterners will call this statement pure propaganda.

Then to be considered is the coastal mountain region starting at Santa Barbara in the south and proceeding north along the coast to a point above San Francisco Bay. In the populous and fertile region of this province are many fine courses of championship caliber laid out so as to take advantage of the cooling ocean winds, rains, and fogs. In this region is located Del Monte with its famous Pebble Beach course, venue of the 1929 U. S. Amateur. This is one club which incorporates the

Pacific ocean in its layout, a truly brilliant course; not to neglect mention of Cypress Point nearby.

### More Than 500 Soils

The Great Valley, which occupies the major central portion of the state, has a legion of more than 500 distinct varieties of soil washed down from the mountains which surround it on all sides. There are many golf courses in this great farming territory, many of which are of the sand green variety, although summer heat precludes year round enjoyment of the game.

The Klamath-Siskiyou region in the northwest corner of California is comparatively unimportant from a golfing standpoint. This is a rugged lava-strewn region which receives plenty of moisture, but the nature of the land forbids many golf courses. This is essentially a mining area.

In the northeast corner of the state is a huge volcanic plateau, the rockiness of which forbids any tilling of the soil. It is almost devoid of golf courses.

The Sierra Nevada mountains are a diastrophic block which constitutes the greatest single mountain range in the United States. In it there are 30 peaks with altitudes exceeding 13,000 ft. One of these is Mount Whitney, the highest point in the nation. Some of the mountain resorts here have their own golf courses, but they are necessarily short for the most part.

The Great Basin located in the southwestern states has a portion of its edge in the southeastern part of California and contains such picturesque but very dry features as Death Valley, the lowest and hottest point in the United States, the Mohave Desert, and the Colorado River basin. Not a territory conducive to golf but one containing a surprising number of nine-hole courses with sand greens which have their earnest adherents as does the most verdant club although they may not have a blade of grass upon them.

### Force Feed Is Schedule

It may be seen that greenkeeping in California has a range as great as that of the state itself with hundreds of new problems demanding a solution every day. The vaunted climate is really an enemy of the greensman as has been hinted already. While Eastern courses are recuperating from summer wear beneath a foot or two of snow, the California clubs are pounding along on the same old force-feed schedule. A few of the private courses are able to shift play to temporary greens for a short period during the year; others quite con-



P. & A. Photo

"You must avoid fatigue," the doctor told Curtis W. Willock of Pasadena, Cal., so Mr. Willock bought this electric car and thus continues to golf and at the same time obeys the doc's command.

sciously allow the grass to become dormant and disregard the complaints of the players. But the problem of the public course is a harder one. Usually it has no room to spare for temporary greens and must remain open at all times. If it allows the turf to deteriorate in any way players refuse to come and the precarious existence of the course is undermined further.

It is a hard state for the greenkeeper. The public is now demanding fine grasses not indigenous to the region in which the courses are situated. Wages are comparatively low to the Eastern standard. There has been a scarcity of experimental stations of any kind and such bulletins as are obtainable nearly always apply to Eastern conditions. Consequently greenkeepers have had to feel their way in obscurity using a trial and error mode of procedure. In Southern California many of the greenkeepers get together on one of the courses once a month to discuss ways and means of confronting the various enemies of turf culture. They also have a monthly magazine published for the same purpose. The one thing which this group has found to dominate all others is that fixed treatments are prescribed for one set of conditions which have only a remote chance of obtaining locally.

# What Cost Water System?

By WENDELL P. MILLER

*(Continuing a series of articles on the important subject of golf course watering systems. See our June and July issues for the two preceeding instalments.)*

## Fixed Sprinklers (Concealed or Pop-up)

This type of system has not been used on golf courses because the makers have never been able to convince the golf clubs that these systems are practicable. Hence it is the specialized makers of golf course sprinkling equipment who are the first to develop concealed-fixed position sprinklers for golf courses. At this writing, "Billy" Bell is installing eleven hundred concealed sprinklers on the grounds of the Agua Caliente golf course. Greenkeepers are quick to accept this equipment for tees. The illustration shows a typical double-tee installation at Midlothian Country club. Other tee installations have been successfully accomplished at Pomonok Country club, Flushing, Long Island; Cascade Hills Country club, Grand Rapids, Mich. and University of Michigan golf course, Ann Arbor, Mich.

The concealed sprinkler is a revolving sprinkler, usually throwing two streams, and when not in use, is concealed underground, only the top (3 inches in diameter) being visible. When the water is turned on the sprinklers rise out of their shells and operate in the same manner as the portable sprinklers. A typical sprinkler secures a uniform coverage over a diameter of 100 ft., at 85 pounds residual pressure. A smaller type (tee size) covers a diameter of 80 ft. at 60 to 70 pounds.

These sprinklers, called pop-ups, are practical, cost not over 10% more than the portable sprinkler systems (for the entire installation).

The outstanding advantage of this type of sprinkler is the saving in labor cost. There are no sprinklers to handle, and only occasional adjustments required. The night engineer or night watchman can operate an entire system, in addition to his regular duties. The next step is the application of time-clock controlled solenoid automatic valves which will eliminate all operating labor. The automatic systems, once set, will start and stop each battery

of sprinklers according to water requirements. The year 1931 should see this system in actual operation on one or more courses.

## Fixed Above Ground Sprinklers

Fixed above ground sprinklers are not readily accepted by golfers hence initial installations of this type are limited to tees and greens. Country Club of Detroit has used fixed tee sprinklers for several years. They piped to convenient locations, put a valve in each tee line and attached lawn sprinklers.

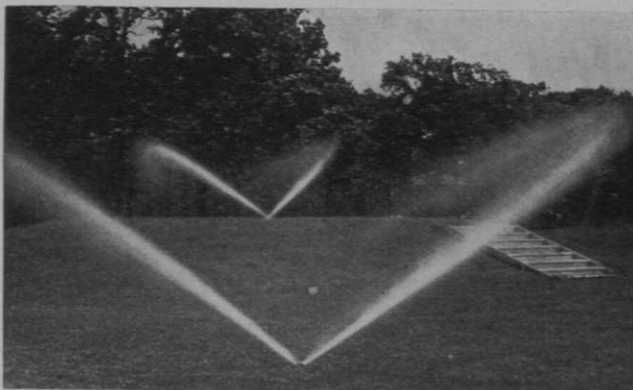
Hoseless greens, using fixed outlets and portable sprinklers have been in use for some time on greens not surrounded by sand traps. Recently we have extended this idea by using "half circle" sprinklers, two to four located in the long grass on the edge of the green and out of the line of play. These sprinklers are permanently attached to their riser pipes and each sprinkler is adjusted to its required arc, more or less than a half circle as required. The radius covered is 50 ft. at 60 to 80 pounds residual pressure. One valve controls each green.

The eighteen greens of the Cascade Hills Country club, have recently been equipped in this manner. No water enters the traps. The over-lapping on the greens is not a serious factor and is minimized by prevailing winds. The writer cannot predict the acceptance of this system by golfers as the ever-present sprinklers occasionally present a mental hazard rather than a stymie and there may be some objection which, however, we believe will be overcome when the advantages of this system are known.

## Portable Half-Circle Sprinklers

Recently we adopted a different procedure for several sample greens at Pomonok Country Club (Long Island). Here we used fixed outlets and portable "half-circle" sprinklers. Each sprinkler is permanently adjusted to the arc proper for its position and is numbered to correspond to

Pop-up type sprinklers in operation on one of the tees at the Midlothian C. C., Chicago.



the number of the outlet. At each watering each sprinkler is placed in its correct outlet and position. The objection, if any, to this method is the requirement of about 60 numbered sprinklers for the eighteen greens. Perhaps this is offset by the advantage of fixed certain coverage and no waste of water.

We have described the essential features of the various types of systems. These systems are applicable to the nine-hole courses but before proceeding to the principles and details of the mechanics and hydraulics which will enable the smaller clubs to engineer their own systems, we propose to answer the question, "What does it all cost?"

### PART III.

**N**O TWO clubs can ever solve their irrigation problems in exactly the same way. Soils vary widely in their water-holding capacity, even between different areas on the same property, and still more widely between different properties—hence wide variations in actual water requirements. Surface and underground water supplies are never the same in two places. Topographic features, acreage and course layout are different in every case.

The clubs themselves differ widely in their manner of dealing with their problems. Men who are wizards in their own businesses sometimes lose their sense of proportion when sitting as club officials; again, the action of boards of directors of clubs is frequently a compromise between extreme ideas and contending factions.

Some clubs install cheap steel pipe of very short life, lay it on top of the ground perhaps, install pumps without automatic pressure control, and without adequate housing. Such installations soon become a total loss. Occasionally some club will

go to the other extreme and overdo the installation. One well known club recently spent over \$90,000 on its water system, and still has hose tees and snap-valve outlet greens and ordinary hoseless fairways. In a very few years this club will discover that the present rapid development of concealed sprinkling systems will necessitate further expenditures if they are to keep up-to-date (as they pride themselves on doing), and reduce their operating costs.

Another club went to the other extreme and, combining an inadequate appropriation with unsound advice, installed an irrigation system which operates at an unusually excessive cost for labor and power and their course is only superficially watered.

It is clear, therefore, that there can be no fair comparison of installation costs between clubs—existing figures can serve only as guides to the costs of other projects.

### Costs for Nine Hole Clubs.

Little information is available on the cost of installation of irrigation systems for nine-hole courses. Most nine-hole clubs can install their piping systems for less than half of the cost for 18 holes, for two reasons; first, the proportion of large sized pipe is less in a nine-hole system, and, second, most of the nine-hole clubs are located in the smaller towns where lower priced skilled labor prevails. The water supply will, however, usually cost a nine-hole club much more than half the cost of an 18-hole supply, unless the nine-hole club will forego the automatic class of 18-hole installations. Clubs located on lakes, rivers, ditches, having large ponds or cheap village water have a decided advantage as we will later demonstrate.

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The Club Managers' Association of America composed of managers of leading golf and town clubs throughout the United States offers its services without charge to clubs in the United States and Canada in the solution of club operation problems; construction, planning, equipping, installation of system and the procurement of skilled executives whose records are such as to guarantee satisfactory results.

The Club Managers' Association of America is a clearing house for the problems of club management bringing to club officers and managers alike the benefits of the combined knowledge and the exchange of ideas of the leaders in the profession.

If you are a manager interested in the work of the association and would care to learn of the eligibility rules for membership, or if you are a club officer with problems which might require expert advice, address your inquiries to

## CLUB MANAGERS ASSOCIATION OF AMERICA

Henry R. Dutton, National Secretary  
54 Pinckney St. BOSTON, MASS.

5th ANNUAL CONVENTION  
Pittsburgh, Penn.,  
February 24th-25th, 1931

### Some Typical Costs.

*Riverside Golf Club, Riverside, Illinois (Chicago District).* This club is located on the Des Plaines river from which the water supply is taken. An expensive submarine cable is required to connect the clubhouse and pumphouse. Also an expensive pipeline was laid across the river. The pumphouse is of brick with fancy tile shingles. Equipment consists of one new 400 gallon pressure pump, one (old) 200 gallon triplex pump, one air compressor, one 5 ft. x 20 ft. pressure tank (3,000 gallons) and one switchboard giving automatic control.

The fairway distribution system comprises 13,558 feet of pipe and 108 snap valve outlets. This new system is connected into the old tee and green system. Complete winter drainage is provided. Total cost, including 2,000 feet of best grade hose, 20 non-kinking hose swivels, 20 quick couplers, and 20 standard sprinklers and all engineering fees, was \$21,363.00 (18-hole poa annua greens course) divided as follows: piping system \$13,729.00; pumphouse structure, \$1,899.00; pumping plant \$3,587.00; submarine cable and re-wiring clubhouse terminals to get all service on one meter \$1,248.00; hose, sprinklers, etc., \$900.00. Only cast iron and standard wrought iron pipe was used. Working pressure at pumphouse, 70 and 90 pounds.

*Onwentsia Club (Lake Forest, Illinois).*

This club is fortunate in being able to utilize an existing well and well pump. A new concrete reservoir was placed under ground—capacity 250,000 gallons. A substantial pump-house structure and expensive power substation were provided.

The Onwentsia system is a hose system with 134 snap outlets for the tees and greens and along the fairways, also along the polo field and in the gardens and clubhouse area where liberal provision was made for watering the lawns, flowers and shrubs. With ample funds available liberal provision was made for the larger sizes of pipe, which of course tend to keep down the power cost.

The complete system includes 22,386 feet of 2 in., 4 in. and 6 in. cast iron pipe with a total cost for the piping system of \$28,281.00. Hose, sprinklers and couplers cost \$1,134.00. The pump-house structure cost \$4,210.00 and the pressure pumping plant, with automatic control, \$6,125.00. The cost of the reservoir was \$13,687.00 and the power substation, \$3,003.00. Owing to