Suggestions on Installation and Use of Fairway Sprinklers

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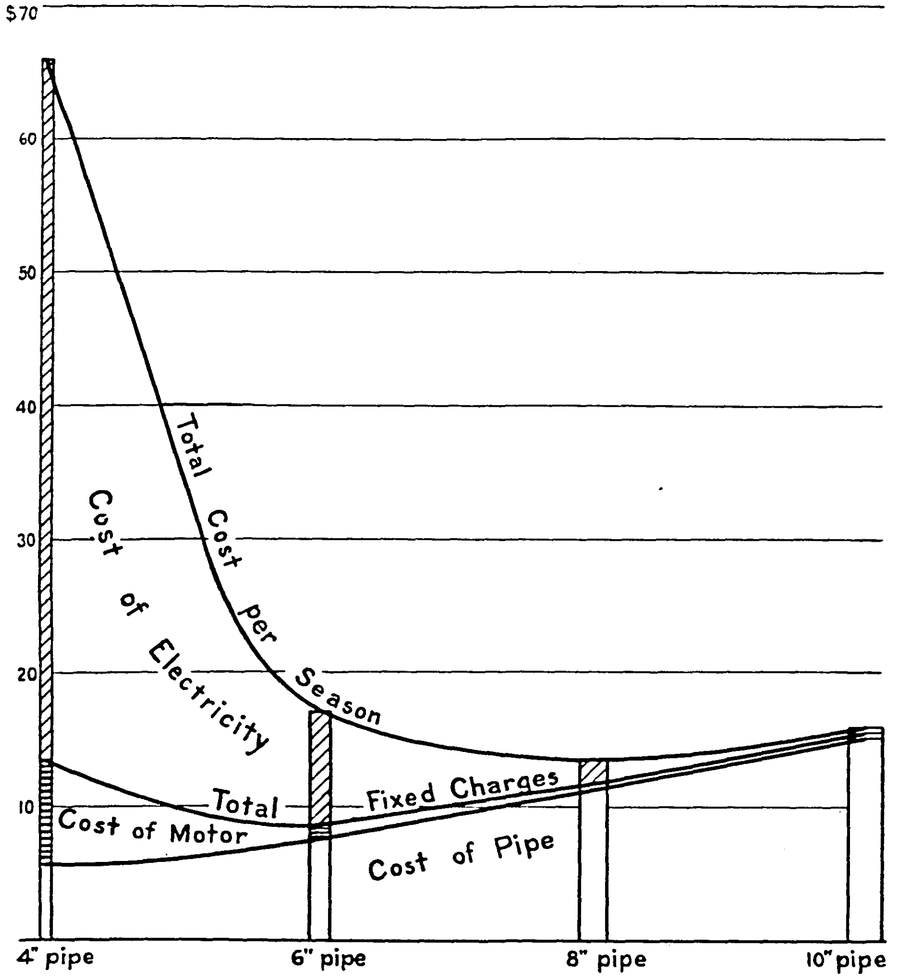
With the present marked tendency to irrigate the fairways as well as the putting greens and teeing areas, the expenses incident to watering become of considerable importance to most golf clubs. This is true of both the capital investment and the direct cost of water charge, whether the latter be the cost of pumping or the amount paid to a municipal supply system. It is possible to make the investment cost excessive and the pumping cost low, or vice versa, in any pumping system, but intelligent planning and good construction will produce a well-balanced outfit that will make for low cost in the end.

Although, as mentioned above, the cost of watering where the fairways are included will be an important item for many clubs, it does not mean that the installation of irrigation equipment may not be a very wise expenditure. It does mean that intelligent consideration should be given to the real need for watering in the region in which the golf course is located, as well as the needs of various parts of the individual property. Marked differences may be found where casual observation would lead one to believe conditions were the same. This is true even in the humid eastern states, say from the Atlantic Ocean to the far boundary of the states that border the Mississippi River on the west, which is the territory under consideration in the preparation of these notes. In the neighborhood of Philadelphia, for instance, watering is frequently needed, whereas at Johnstown, also in Pennsylvania, the need for watering can not be shown. The average annual rainfall of the two places is almost identical, but the rainfall around Philadelphia is noticeably erratic in the length of periods between rains and in the amount that falls in each rain, while at Johnstown it is remarkably and favorably consistent. Dry spells do occur at the latter place, but not with a frequency that would warrant the expense of providing for the watering of fairways in that locality. Again, each golf course presents a different irrigation problem, and seldom would it be wise to duplicate the facilities of a club 40 miles away.

All of the above affects the amount of water that must be provided, the storage facilities that will be needed, and the size of pipe, capacity of pumps, and the amount of power that will be required. But most of all it is important to grasp the idea that water is the main consideration; that fairways take a great deal of water, and that it is in the dryest time that the need for an ample water supply is most keenly felt.

As watering of golf grounds is unquestionably best accomplished by the spray system, the water must be delivered to the outlets in pipes under pressure. Under no circumstances should the pressure at any outlet be less than 25 pounds to the square inch while the watering is being done, and to operate successfully at that low pressure the pumping plant, pipe sizes, and type of nozzles used must be correctly selected and properly installed. Even for those conditions a suitably higher minimum pressure should be available when the system is new, and the pressure at the pump must be materially higher than at the nozzle even if at the same elevation. This is because of the friction in the pipes, which is present whenever water is flowing. Relatively few people realize the importance of the item of friction. To overcome this friction, power must be used; for a given quantity of water and a large pipe, perhaps only a little power; for the same quantity of water and a small pipe, it may be a great deal of power. Pipes cost money, therefore the tendency is to use small pipe; but power (commonly electricity) costs money, therefore a momentary impulse suggests using big pipe. But of course both can not be done for all sections of the same job; so the proper thing is to use the intermediate size of pipe on each section that will give the lowest annual cost when all cost components are added to-



Cost of electricity is an important item in total seasonal cost in the operation of a water system. Installation of 4-inch pipe, in the particular case for which this chart was prepared, was estimated to involve a total seasonal cost of nearly $70, while 10-inch pipe would represent a total seasonal cost of a little over $15 for each 100 feet of pipe. The use of 8-inch pipe appeared from the figures obtained to be the most economical gether. These will be the annual cost of the pipe (sinking fund, interest, taxes, and such), the annual cost of the installed motive power that will be required to force the water through the pipe, and the annual cost of power.

The accompanying chart shows graphically the annual cost of 100 feet of different possible sizes of pipe that were being considered for a main supply pipe for a certain spray-watering project. It shows that 8-inch was the cheapest size in the long run for this particular job, although 6-inch would not be bad. The economical size of pipe for any project under any set of conditions can be determined by preparing a similar chart from the conditions applying to that job. Every change in price of pipe or labor of installing it, in number of gallons a minute to be pumped, in hours a day of operation, in number of days that watering is anticipated during the season, in cost of electricity, or in interest rates or taxes, would change the chart. In every irrigation installation such a chart is a great help in determining what is real economy. The chart here given was applicable last November to an 18-hole course about 6,500 yards long on sandy, gravelly soil, it being assumed that the parts of the fairways to be watered had a total length of 4,700 yards and an average width of 55 yards. Electricity for driving the pump could be secured for 3¼ cents a kilowatt hour, and the chart was prepared with the idea that all irrigating was to be done between the hours of 8 p. m. and 8 a. m. Standby or service charges for the installed motive power, interest on the investment, taxes, and interest on the sinking fund installments were figured on the suitable basis for that job and are all included in the chart as it appears. It was estimated that 85 days of pumping were required during the watering season.

The elimination of all unnecessary items from the system also helps to keep down the cost and so make fairway irrigation possible for more clubs. One such elimination is the hydropneumatic pressure tank found on some installations. If the irrigation system is necessarily tied in with a water supply system for other purposes, such a tank is necessary, but it should be considered as a part of the other system entirely. For the irrigation system it is best to use a centrifugal pump and pump directly into the main pipe line. Properly chosen centrifugal pumps may be started at any time with all the valves on the system closed and no excessive pressure will be built up. They must be primed before starting to insure proper lubrication of water-lubricated bearings. Where an irrigation system and another water system are tied in together, it is good practice to start the irrigation pump by hand and to have the smaller pump that is used for year-around service arranged to operate automatically. In other words, it can not be considered good practice to start, bring up to speed, operate for 4 minutes, and stop a 300-gallon a minute pump every time a 3,000-gallon tank drops its pressure.

If, however, full automatic equipment is demanded in spite of a probably greater cost in the long run, it can be provided. If two pumps are installed, the smaller one for year-around service can be set to start when the pressure drops to a certain point and the larger pump at a lower one. Thus, whenever the demand is so great that the small pump is falling behind, the larger pump will come into action. Both pumps may then operate together, or arrangements can be made so that the starting of the large one will cut off the smaller one.

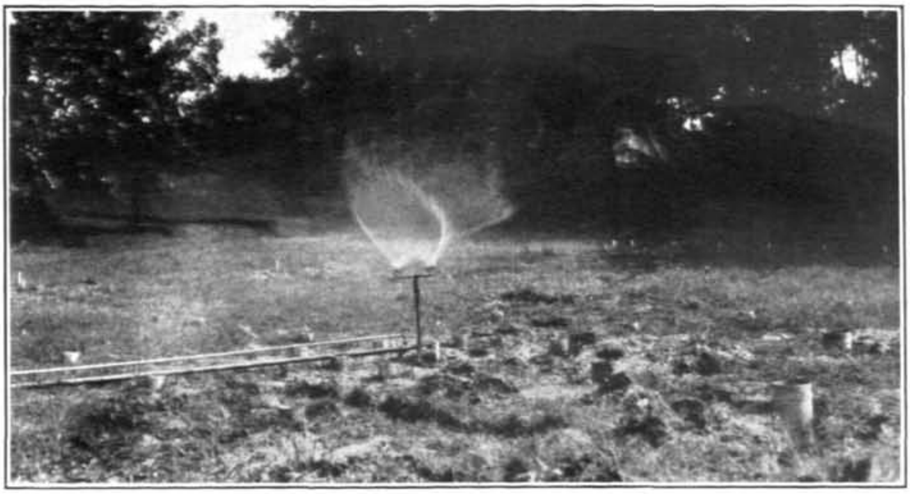
On the other hand, starting an electrically driven centrifugal pump is a simple matter, even including the priming. Many different arrangements for priming are possible, but for the size of equipment required for watering fairways priming may be done by means of a common pitcher pump. The entire starting process under such circumstances, with one possible arrangement of the equipment, is as follows: (1) close the gate valve in the main pipe line at the discharge side of the centrifugal pump; (2) pump by hand with the pitcher pump until it discharges water freely; (3) close the small valve between the pitcher pump and the centrifugal pump; (4) close the starting switch; (5) slowly open the gate valve in the main pipe line at the discharge side of the centrifugal pump (this is the same valve closed in the first step of the process).

If the management of the club feels that none of the help can be trusted with making the five steps of this simple process, all but one can be eliminated by placing the main pump under "flooded suction," as it is sometimes called, in which case it will be self-priming. This, in many cases, would add somewhat to the expense of watering; but a self-priming pump would be necessary for automatic operation. With a self-priming pump driven by a high-resistance rotor type of motor, it would only be necessary to close the electric line switch to bring the pump into action. If it is desired that the workmen do not enter the pump house, the electric starting box could be placed in a vestibule outside so that the pump could be controlled for ordinary operation without entering the building.

In any case, the pump and motor with accessories should be inspected frequently by a competent mechanic. The less the amount of automatic equipment to be cared for, the less will be the mechanical skill required to keep the outfit in satisfactory operating condition.

Where fairway irrigation is undertaken it is desirable that special labor be employed and the watering be so planned that when one spot gets watered it is thoroughly wetted. After that it should not be watered again for several days, as a general rule. A good watering about once a week should carry most turf through continuous drought in fine condition, except on the loosest of sandy soil or in the case of some special condition, such as a very thin soil directly over rock. Under such unfavorable conditions an irrigation once in three or four days is permissible; but whenever grass is being watered it should be given sufficient water to carry it to the next scheduled watering. The above rules may also be applied to the irrigation of putting greens and teeing grounds if begun on that basis in the spring of the year. It is quite possible, however, that the nature of the grasses usually used on putting greens and teeing areas may be a special watering problem. Because of their apparent inclination to a short root system, it may be necessary to shorten the period between applications to even less than three days, but every effort should be made to reduce the frequency of watering to a minimum, and to increase the quantity of water applied sufficiently to carry the growth to the next watering. Changing to the above method in the middle of the summer after training the grass roots to frequent scanty waterings is likely to be harmful.

Where the irrigation system, which is wanted only for a limited season, can be kept entirely independent of the water system that is needed for year-around operation, it is often economical to do so. In some instances it may be possible to combine an outdoor swimming pool with an irrigation system. Such a pool requires a large quantity of water but only for the warm season. If it is practicable to keep the water system that supplies the large-demand summer requirements independent of the year-around water system, it is generally possible to lay the pipes for the former shallower and thus reduce installation costs. It is, of course, necessary to drain such pipes in winter. It is also economical and good practice to lay the pipe line more or less according to the contour of the ground surface with a certain disregard for grade. Unless placed below the depth of freezing, it must be so laid that it can be entirely drained by opening valves at a few low pockets.

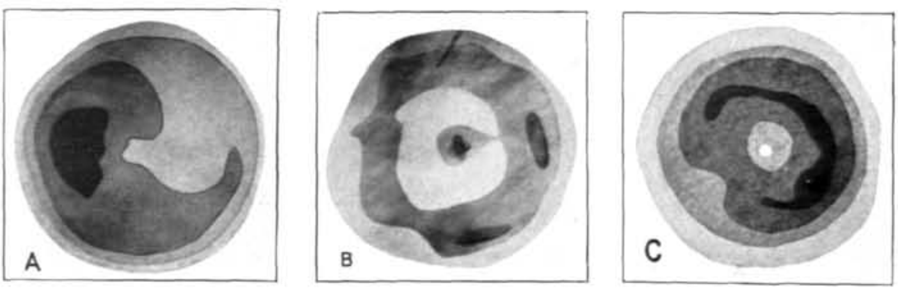


The uniformity of distribution of a sprinkler of this type can be tested by placing cans within the area sprinkled to catch the fall of water. In the test here illustrated, as the surface of the ground was uneven the tops of all the cans were brought to the same level. The small pipe just above the supply pipe leads to the pressure gauge, which should be outside of the area being sprinkled

If air entrapments that seriously affect the flow tend to collect at high points in the line, it is a simple and inexpensive matter to install efficient air relief valves at these points, but irrigation experience has shown that only a small percentage of installations requires such devices.

Where a system with fixed locations for sprinklers is to be installed, the matter of uniformity of distribution becomes important. Not only must the locations be carefully chosen so as to get a suitable amount of overlapping of the wetted areas, but sprinklers that give good distribution must be selected for the job. Wind movement will generally aid the distribution to some extent, but most sprinklers, no matter how pleasing their spray is to the eye, fail to give a uniform amount of water to the thirsty grass. The same grass that gets very little water in one irrigation tends to get very little in every irrigation, and the grass that is nearly drowned in one watering is treated nearly the same in every watering. It must further be realized that perfect distribution can not be secured from fixed locations for sprayers that wet a circular area. It should also be remembered that with frequent repetitions, marked lack of uniformity in the distribution may have a marked effect on the grass in the case of a prolonged drought.

Where portable nozzles at the end of hose connections are used, the likelihood of consistently overwatering and underwatering the same grass is much reduced because there will be variations in the setting of the sprinklers from one watering to another. Even for watering under such conditions, where sprinklers with a range of coverage of 60 to 80 feet or more in diameter are used, the matter of distribution is important although not so much so as in the case of fixed sprinkler locations.



Rotary sprinklers, at their best, seem unable to give a perfectly uniform distribution of water. These three diagrams show the variation in quantities of water distributed to various parts of a circular area in three tests of rotary sprinklers made by the Bureau of Agricultural Engineering. Increase in depth of shading represents increase in quantity of water delivered in the ratio of one unit for the lightest shading, two units for the next heavier, 3 for the next, and so on. In A a light wind resulted in one-half of the area sprinkled receiving an overabundance of water and the other half an insufficiency. In B the velocity of the wind was about two-thirds that in A. In C there was practically no wind, but still the distribution was not uniform

As indicated above, most sprinklers do not distribute water uniformly, and to such extent that, in fact, those which put only two or three times as much water in one part of their wetted area as they do in other parts may be classed as relatively very good. The accompanying drawings show pictorially the distribution under certain wide-range nozzles that are well-suited to watering systems equipped with portable sprinklers with hose connections. A uniformly-shaded area indicates uniform distribution.[1] The test for diagram A was made under an air movement that would be classed

[1] Further data concerning distribution under various nozzles are being published by the United States Department of Agriculture, Washington, D. C., in a circular on this particular subject.

by the United States Weather Bureau as a light wind, or less. The major lack of uniformity in distribution appears, however, to be due to the wind, although variations in frictional resistance as the nozzle revolves may be a factor. The velocity of air movement when the data for the distribution shown in diagram B were obtained was about 2/3 that occurring when the former test was made. The slight lack of uniformity here noticed is apparently due to the nozzle rather than to the wind. It was practically calm when the data for diagram C were obtained. The lack of uniformity in distribution must in this case be mechanical. It may be due directly to the nozzle, a slight roughness causing increased friction for a part of its revolution, or possibly to its being extremely sensitive to a truly vertical riser connection. In all tests the risers were set vertically in all directions as far as the eye could tell, but no elaborate measurements were made to guarantee a truly vertical setting.

If anyone desires to make a rough test of the distribution accomplished by a sprinkler he is using or thinks of using, it can readily be done. The test should be made on level ground and where water under pressure is easily obtainable. Mowed turf or land free from vegetation is to be preferred. Suitable containers to catch the spray from the sprinkler should be placed on the ground, either on radial lines leading out from the sprinkler as shown in the illustration on page 167, or in a checkerboard arrangement. They may well be spaced at 5-foot intervals. Ordinary open-top tin cans, if water-tight on the sides and bottom, are good for this purpose. They should be preferably of approximately the same size and of fairly large diameter. With the outfit set up, the sprinkler should be operated for a considerable time, say one hour, and at the end of this time the depth of water in each can may be measured with an ordinary ruler. The relative depths will show what uniformity of distribution is obtained. Perfect distribution would be indicated by the same depth of water in all cans within the area sprinkled.

Where fairway watering is to be undertaken with portable sprinklers on the end of hose lines (a simple, straightforward method that has much in its favor for enduring satisfaction) it may be desirable, as the sprinkling will preferably be done at night, that some system be devised whereby sprinkling will surely be done on the under-watered areas. As it is often difficult to detect these at night, it would be well for the workman to walk over the course by daylight, leaving suitable markers to be sure that these spots are not omitted in the night's sprinkling. A wagon or truck to carry the nozzles and hose lines back and forth from their normal storage is desirable.

It is the insect with the choicy appetite which, if evil-minded, does the most damage, and if well-minded does the most good. The potato beetle and the cotton boll-weevil will attack only the potato plant or the cotton plant, and occasion great losses. The cockroach, on the other hand, will eat almost anything it finds, and so we hear little of its depredations. Fortunate it is that many of the parasitic insects are choicy as to their food, for in this way we have flies which center their attacks on the destructive Japanese beetle and thus prove of real economic value.