Design Details of 9-Hole Course Watering Demand Care

(Concluded from November)

By WENDELL P. MILLER

IT IS customary to start from the source of supply with (usually) a three-inch main running in a straight line for the farthest corner of the course, taking off branches and laterals as needed, and reducing the pipe size at each branching. In this behalf one must have full knowledge of the water pressure and volume available (residual or operating pressure, and not still or static pressure). From the tables are calculated the capacity of the pipes. The sprinkler and pipe manufacturers provide tables showing the discharge and diameter covered, of the sprinklers at various pressures. With all of the information and tables mentioned it is a simple calculation to determine the sizes of pipe necessary to deliver the water necessary.

Design without regard to future use is, of course, poor engineering but designs without complete calculations and certainty of results is no engineering at all. Still you will find that most initial tee and green systems show not the slightest trace of even rudimentary engineering knowledge or skill.

Figuring Results

Before completing the design it is necessary to determine the number of sprinkler settings for each green for the sprinkler chosen—the discharge—the number of hours required to irrigate each green—the amount of labor required. Failure to figure these things and to figure friction losses in the piping, and to determine all the facts of the water supply, have resulted in corresponding failures of irrigating systems of such haphazard arrangement.

Correct Design

A correct design for the tee and green system can be secured only by anticipating the future extension of the course into 18 holes (if land is retained or available for this purpose) and planning a complete hose irrigation system, with the projected extensions into a complete hoseless system. After complete irrigation is planned, it is easily possible to select from the complete plan such portions of the ultimate system as are presently needed to reach the tees and greens, using, however, occasional long laterals (2″ size) to reach tees and greens which otherwise, and as part of the final system, could be reached only by long runs of larger piping. In other words, considerable judgment is required to balance present and future requirements against future abandonments and present capital outlay.

Design Plans (Maps)

Topographical maps are valuable in irrigation design, but not necessary. A complete layout map of the course showing every piece of pipe and tile and every valve and fitting, is absolutely essential. Further, extreme care should be taken to preserve several copies of the map and pass it from one administration to the next. The originals should be kept by the club's engineer, if there be one—if not, the club's secretaries should be charged by the board with keeping track of the map. Where the club has a policy of long term green-chairmen the club can entrust the original maps (tracings) to the chairman. We consider negligent of his duties any greenkeeper who does not maintain a complete up-to-date layout, water, and drainage map of his course. Failure to preserve their maps has caused much extra expense, much grief, time, and lost motion to clubs when the time for improvements has arrived.

Winter Drainage

It is necessary to lay the mains and laterals to grade, though not below frost line. Whenever possible, the laterals should be laid to drain backwards into the mains. The mains should be laid to a definite gentle grade so far as possible with the fewest possible number of low points and "pockets." At each low point or pocket in both laterals and mains it is necessary to install drainage outlets (if the course is located in the freezing latitudes). The simplest good form of drainage is an

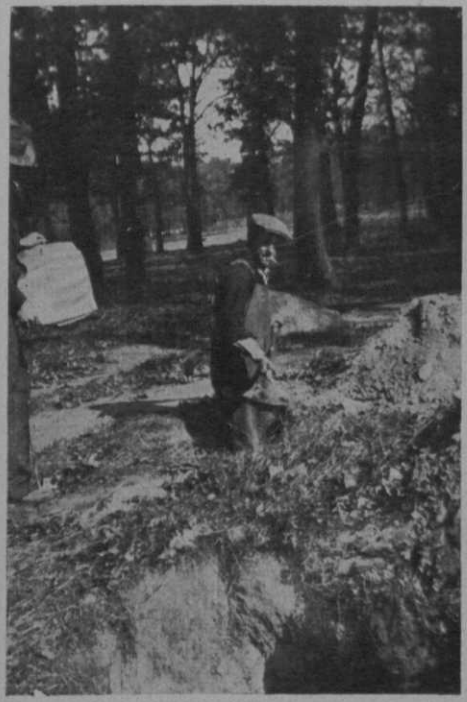
Greens watering system must take approach watering into consideration. Proper arrangement of outlets for this work demands thorough study.

outlet taken from the bottom of the main at the low points (or end of lateral, or low point in lateral) and terminating in a hand valve which is surrounded with a 12″ tile set on end and reaching to the surface where it is covered with a heavy wooden disk which fits tightly in the bell end of the tile. At the bottom of the tile and below the valve there should be a pocket of gravel or cut stone (except in sandy or gravelly soil). The drain valves are opened in the fall and closed in the spring.

A cheaper form of water pipe drainage, one that is quite commonly used in sandy soil, consists of merely a tee and plug in the line, or at the end of the line. When fall comes it is necessary to dig down to the plug, remove it, drain the system, and replace the plug. This method can be improved by using a tile and cover to eliminate the digging.

If proper attention is paid to drainage by constructor, damage by freezing of water in the pipes is eliminated.

Every drainage outlet should be faithfully detailed on the plans of the course.



Hunting for pipe connections. This expensive work shows value of accurate map.

Blow Off Chambers: Blow Off Valves

These represent an unnecessary capital outlay and are to be found only in irrigation systems designed by people who have had no prior contact with turfed area irrigation.

Outlets: Location

The outlets should be located so that not over 100 feet of hose are needed for any tee, green, or combination. There should be one outlet for every green, located on the *lower* or near side so that the approach can be watered from the green outlet. The green outlets are preferably located within a few feet of one of the lower corners of the greens.

Watering Approaches

This is usually not provided for. If the outlets are located on the approach side (corner) of the green, and suitable pressure is provided, the greens may be watered in one setting of a few hours, and the approaches or green aprons in one or two more settings.

Tees

Some of the tees will be served from the green outlets—and in most cases the tees will be irrigated during the early morning hours. The water requirements of the tees are considerably less than the greens.

FRICTION OF WATER IN PIPES

(From "Standards of the Hydraulic Society")

Loss of Pressure in Pounds per 100 Feet of 15-Year-Old Smooth Pipe.

No. of Sprinklers Served	Gallons per Minute	¾"	1"	1¼"	1½"	2"	2½"	3"	4"
1	20	58.9	18.2	4.8	2.3	0.8	.3	0.1	...
2	40	....	65.8	17.3	8.1	2.9	1.0	0.4	.1
3	75	....	....	....	26.0	9.0	3.1	1.3	.3
5	100	....	....	....	44.2	15.5	5.2	2.1	.5
8	150	....	....	....	....	32.9	11.0	4.5	1.1
10	200	....	....	....	....	55.9	18.7	7.7	1.9

Outlets: Size and Kind

The proper size outlet for hose is one inch. The friction loss in ¾" hose is astonishing, it is sufficient to render impotent an otherwise satisfactory water system. On the other hand, hose larger than one inch is hard to handle. Further, one inch hose will carry, without undue friction loss, all the water any of the best sprinklers on the market can handle.

Street washer outlets (lawn boxes) and also all types of valves for threaded hose connections are almost obsolete on golf courses. Threaded outlets are now being installed only by club committees and others who have no knowledge of golf course operations. There are quite a number of satisfactory "quick coupling" valves on the market, and there is no more reason for not using these than there would be to return to the blind typewriters of the nineties.

Hose

The hose should be in 100-foot lengths and not in shorter lengths connected with couplings. Ninety degree swivels should be used at the outlets to prevent breaking the hose.

Risers

The risers should be of the same size as the pipes which feed them. From the standpoint of future changes, no riser should be less than one and one-quarter inch.

Pipe Sizes

The smallest pipe suitable to feed a single outlet is one and one-quarter inch. Pipe this size carrying 15 gallons per minute loses nearly three pounds pressure per 100 feet. If 20 gallons are forced through it the loss becomes five pounds per hundred feet. Pipe so small as 1¼" should not be used unless pressure pumping is installed or adequate pressure otherwise provided—in which event one and one-quarter inch pipe should be limited to terminal runs of not over 150 feet and even not then unless absolute shortage of funds compels.

One and one-half inch terminals of short length can be used to feed two outlets provided there is plenty of pressure. A

Comparative Carload Prices of Pipe Per Hundred Feet

F. O. B. Chicago—October 10, 1930
Prices supplied by Jas. B. Clow & Sons

Size of Pipe, Inches, Internal Diam.	Black Steel Threaded & Coupled	Galvanized Steel Threaded & Coupled	Standard Black Wrought Threaded & Coupled	(*) Class 150 Cast Iron DeLavaud Bell & Spigot	(*) Class B Cast Iron Bell & Spigot	(‡) (*) Class 150 Cast Iron Precalked or Screwed Joints
1¼".....	$ 8.19	$ 10.59	$ 15.85	.....	.....	$ 20.60
1½".....	9.79	12.67	17.91	.....	.....	.....
2 ".....	13.18	17.04	24.10	..... (†)	$ 25.00	23.40
2½".....	20.84	26.95	42.00	.....	.....	.....
3 ".....	27.25	35.24	54.92	.....	48.50	41.55
4 ".....	41.93	53.32	76.19	$48.00	57.00	50.18
6 ".....	73.87	93.92	134.20	68.50	81.50	72.10
8 ".....	103.31	131.81	204.04	97.25	116.00	101.86

(*) Prices include lead and jute for hot poured lead joints.
(‡) Prices supplied by McWane Cast Iron Pipe Company.
(†) Six foot lengths.

glance at the table shows the situation clearly.

Better to use a minimum size of two-inch pipe for all terminals, laterals, and risers. Two-inch pipe will carry 35 gallons per minute with a loss of only two pounds per hundred feet — hence two-inch pipe can be used for two outlets in runs up to 500 feet, or even more, under booster pumping.

Mains

The minimum size acceptable for the principal main is three-inch and the four-inch size is much better. Four-inch pipe will carry 150 gallons per minute with a friction loss of only one pound per 100 feet of pipe, whereas with three-inch pipe the loss is nearly five pounds per 100 feet. Where the principal main branches, the branch lines should be two and one-half inches in size. If readers will examine the following table carefully, they will readily understand the question of pipe sizes.

Friction in Pipes

Friction caused by the passage of water through pipes is little understood by both laymen and designers who are not engineers. Pipe friction is an insidious enemy which works unseen and unappreciated, something considered to be a mysterious technicality raised to complicate an otherwise simple matter. Yet there is nothing more certain and definite than friction in water pipes in connection with the carrying capacity.

We ask each reader to look at the above table, and notice the sharp increase in friction loss in the smaller sizes of pipe as the flow is increased from 20 gallons (one sprinkler) to 40 gallons (two sprinklers), and to 75 gallons (three sprinklers). With the foregoing table in mind, it is easy to understand how the friction losses in long runs of small pipe nullify the initial pressure, and handicap the greenkeeper.

Friction Tables

Exhaustive investigation of friction losses in the last few years have resulted in a revision of the old tables of friction losses. Designers are advised to be certain that the tables they are using correspond to the foregoing table, which is taken from the standards of the Hydraulic Society and converted into pounds by the following: (1 foot of elevation = .433 pounds pressure). The new tables are much higher than the old tables. Some of the sprinkler manufacturers are still distributing the old tables which are now known to be very misleading.

Pipe

There are three ordinary classes of pipe —steel, wrought iron, and cast iron. *Wrought iron and cast iron* pipe have a life of 75 to 100 years, or more. Steel pipe is made in plain (black) and galvanized finishes. Black steel pipe lasts from eight to 15, or even 20 years; galvanized steel pipe lasts longer than the black pipe. Clubs installing steel pipe do so in the certain knowledge of replacements within eight years to 20 years, according to water and soil conditions.

In the 3″ size and larger, cast iron pipe is cheaper than wrought iron, both are equally satisfactory. In the 4″ size and larger, steel pipe is more costly than cast iron, and awkward to handle. The following table illustrates the difference in the cost of different kinds and sizes of pipe:

Chickweed and Plantain Control in New England

QUES.—What method other than iron sulfate is effective in controlling chickweed and plantain? What strength?

Ans.—Enough iron sulfate to kill chickweed and plantain will kill the grass.

Spraying with arsenate of lead will do a good job on plantain. This is not so successful on plantain as on dandelion. Use about four pounds per 1,000 square feet.

Sulfate is not satisfactory because it kills everything. The chickweed came back.

On pearlwort, three pounds of sulfate per gallon applied with a paint brush gave good results in hot weather.

Arsenate of lead put on dry and washed in killed chickweed and not grass. This is due to the fact that the chickweed leaves being wider, hold the arsenate of lead while the grass doesn't. This was on the U. S. D. A. plots. Also used dry—dusted on the chickweed—gave good results.

Loosening the soil drives our plantain sometimes.

Plantain may be driven out by applications of poultry manure or by other fertilizer.—*N. E. Newsletter.*

Here's some indication of American ingenuity. George Klewer, a Chicago golfer, has a collection of 447 different golf tees, many of them being picked up at a Chicago public course.