Golf Course Water Supply

By Kenneth Welton

As a rule golf course water systems have proved inadequate. Experienced water supply and hydraulic engineers generally seem to consider such systems too simple a matter to be given much concern. Part blame for failures sometimes attaches to golf course construction committees, who do not always appreciate the demands put upon a water system during hot, dry weather, and as a consequence cut to the utmost the allotment for installation. No greenkeeper, however competent, can keep a course in the excellent condition now required, without adequate water facilities. A system of small pipes with low pressure and perhaps other deficiencies increases the cost of watering by a sum of money that could be used advantageously in other maintenance work.

The water requirements of a golf course may be estimated approximately from a study of the rainfall. The average monthly rainfall for 12 eastern and middle-western states for June, July, and August is roughly 3½ inches. For September and October the average is about 3 inches. In the West and South these figures do not apply. The above average rainfall is sufficient to keep pasture vegetation alive even though the rain may be very heavy and followed by long droughts. It does not, however, suffice to keep the turf in the continuous vigorously growing condition such as is demanded on golf courses, especially on greens. Close cropped grass does not have the deep root system found among the cultivated crops and therefore is more subject to water shortage since the surface layer of soil dries first. If nature does not provide 3½ inches of well-distributed rain per month during hot, dry weather, artificial irrigation is necessary. If 4 inches is taken as equivalent to the rainfall for a month somewhat above the average, we find that the average daily rainfall should amount to about ⅛ inch, or ¼ inch every two days. An average putting green of 6,000 square feet would therefore require approximately 500 gallons every day, or 1,000 gallons every two days. An acre (43,560 square feet) of fairway would require approximately 3,500 gallons every day, or 7,000 gallons every two days.

There are a number of nozzles and sprinklers on the market which, under 40 pounds pressure, discharge 15 to 20 gallons of water a minute. One-inch hose is usually regarded as the most satisfactory size for golf course sprinkling. Allowing 10 pounds loss of head for the friction in 100 feet of 1-inch hose, water delivered to the hose connections at a pressure of 50 pounds should therefore water an area of 6,000 square feet sufficiently in about one hour every other day. It is ordinarily not good practice to apply 1,000 gallons of water to a green of that size in less time. If more water is necessary, it is more desirable to increase the time for watering rather than the volume of water. To apply water too rapidly to some greens will expose the root crowns of the grass and also leach away fertilizers previously applied. All putting greens can not be treated alike. Sandy greens may absorb water very quickly if there is no interruption in their naturally good soil drainage; whereas greens that are built of heavier soil, or greens having poor soil structure, will not absorb water as fast. Of course, nature can not be controlled; but we can control artificial watering. A long, gentle rain always helps vegetation more than a short, hard rain. Frequently courses are

found that are over-irrigated, it being thought that the off color of the grass is due to lack of sufficient water, when often the real cause is lack of fertilizer.

Skilled engineers who specialize in golf course irrigation are few and often the expense of retaining such men is considered to be unjustified. In many cases an understanding of the principles of hydraulics, together with practical working information, will be sufficient for a construction committee, construction superintendent, or greenkeeper in the installation of a new water system or the improvement of an old one. In laying pipe it is sometimes possible to get men who have had some steam fitting or plumbing experience; and as the fitting of pipe on golf courses is comparatively simple, it will only be necessary to have a plan to work from and intelligent supervision. The use of a large number of fittings should be avoided where the correct connection can be made with a few. With threaded pipe all male ends should be painted with graphite or red lead before the connection is screwed up. Joints should not be made so tight as to split the fitting or strip the threads. No trenches should be refilled until the system is tested at the maximum pressure and all leaks are repaired.

Since 1-inch hose is desirable for use on putting greens of present-day size, it is good practice, even for a single hose connection, to use no pipe smaller than 1¼ inches. If the pipe is long, or used to supply two nozzles at one time, it should be larger than 1¼ inches. The waterway or area of the bore of pipe is proportional to the square of its diameter. The pipe sizes of a distribution system are usually proportioned approximately on that basis, although such procedure results in increased loss of pressure and flow in the laterals. On that basis a 2-inch main would feed two 1¼-inch laterals or a 1½-inch lateral and a 1¼-inch lateral. A 2½-inch main would feed a 2-inch lateral and a 1½-inch lateral. A 4-inch main would feed a 3-inch lateral, a 2-inch lateral, and a 1½-inch lateral. Too much emphasis can not be given to the importance of large pipes, because increased frictional resistance and diminished pressure and discharge always follow from increasing the length of a pipe line or reducing its size. Farmers' Bulletins 1426-F, "Farm Plumbing," and 1448-F, "Farmstead Water Supply," give further information on friction losses and pipe discharges, and will on request be mailed free by the United States Department of Agriculture.

Pipe that will not be used during the winter need not be laid below frost depth. Outlets must come to the surface, and in cold climates pipe lines must be drained. It is a simple matter to place blow-offs at low points on the system so that the greenkeeper can drain the whole water system before the severe frost sets in. In case of a leak the location usually shows quickly on the surface of the soil, and with a shallow laid pipe line repairs are easy to make as compared with similar work in a line four or more feet deep. Most of the lines of the smaller sized pipe can be laid at the bottom of a trench or furrow made by a plow. Since breaks may occur in pipes, it is advisable to lay most of the pipe line in the rough, and for the same reason it is not wise to lay pipe lines under greens, tees, or approaches.

Clubs lacking the services of a competent engineer should lay out the proposed pipe system on paper and plan how the lines should run in order to cover the course most effectively and at the least expense. By working back from the outlets, through the various lines, one should be able to determine the approximate size of the main, which

should never be smaller than the discharge outlet of the pump, and to the first lateral branch or branches is usually one or two sizes larger than such outlet. Differences in pressure due to elevation should also be taken into consideration. Pressure is usually stated in pounds per square inch. A head, or difference in level of 1 foot, equals .43 pounds pressure; a head of 10 feet equals 4.3 pounds pressure; a head of 100 feet equals 43 pounds pressure. If, for example, the highest green is about 100 feet above the pump, the pump must be capable of delivering the maximum quantity of water required at one time and maintain a pressure of at least 43 pounds, plus 50 pounds at the highest connection, plus the pipe friction loss in the main and laterals through which the flow occurs. If the pipe sizes and lengths are such as to give a friction loss of 10 pounds, the required pressure at the pump as indicated by a gage on the pump discharge would therefore be about 103 pounds. The suction lift, including friction loss in the suction pipe, should be included to make up the total head against which the pump must operate. This is usually less than 10 pounds. The supply of water to any green is readily regulated by throttling the gate or nozzle openings.

Clubs usually require also a certain quantity of water under pressure for the clubhouse and fire protection. A common practice is to install one or more hydropneumatic tanks into which water and air are forced by an electrically driven pump arranged to start when the pressure in the tank falls to about 30 pounds and to stop when the pressure reaches 50 or 60 pounds. For watering the course some clubs find it advisable to pump into an elevated tank or reservoir from which the delivery is by gravity flow. In other cases a centrifugal pump forces water directly into the distribution lines. Sometimes the source of supply is an artificial reservoir or a natural lake, pond, or stream. Sometimes one or more wells are necessary. In all cases the pumping equipment should be such as is adapted to the conditions and the requirements.

Provided little or no fairway watering will be done, a maximum demand in most instances of 15,000 gallons per hour, or 250 gallons per minute, suffices. If fairway watering is anticipated, larger pumping and storage capacity will probably be required to meet the demands. Assuming the supply is available or has been developed, a club may proceed to the purchase of pumping equipment guaranteed by the manufacturer as being capable of delivering a specified quantity of water against a given head.

Keep a plan of your water system.—Remember that the best water system devised is likely to require some additions or modifications in future years. If an accurate plan of the mains and laterals is preserved it may avoid much added expense and inconvenience in later years. Frequently it is decided to connect a new lateral, and unless plans are available much digging may be necessary before the nearest main is discovered. All this is expensive and disturbs play. The personnel of a golf club often changes, and if the water system plans are trusted to memory they may soon be lost. Be sure to have a carefully prepared diagram; then file it where it will be preserved and available at any time.