tion. Fertilization temporarily increases the need for water because of the action of osmotic pressures on the plant when the soil solution becomes more concentrated with solutes. Since osmotic pressures seek to equalize the concentration of solutions on both sides of a semi-permeable membrane, which is in this case the cell walls of the roots, and the movement of water is from the lower concentration to the higher one, then the addition of fertilizer may initially decrease the plant's absorption of water. It does this by increasing the concentration of solutes in the soil solution to a point greater than the concentration of solutes in the plant fluids or cell sap.

Provided the rate of fertilizer application is not too high, the plant usually adjusts to this situation very quickly and no permanent detrimental effects take place. Because of the process just explained, we should always water-in applications of fertilizer to help make it available to the plant as well as to make sure the soil solution does not become too concentrated.

Although I have just explained how fertilizer increases the need for water in plants, this effect is temporary. In the long run, proper fertilization will greatly aid the plant in its use of water. Experimental work has proven that plants which are properly supplied with nutrients actually require less water for growth and development. The mistaken belief that water can be substituted for fertilizer is altogether too common.

I have touched on the subject of watering and water use only lightly, but I hope that these facts will help to stimulate ideas, give a better idea of the principals involved and help someone to better answer the question: "How much water does the turf need?"

Automatic Irrigation

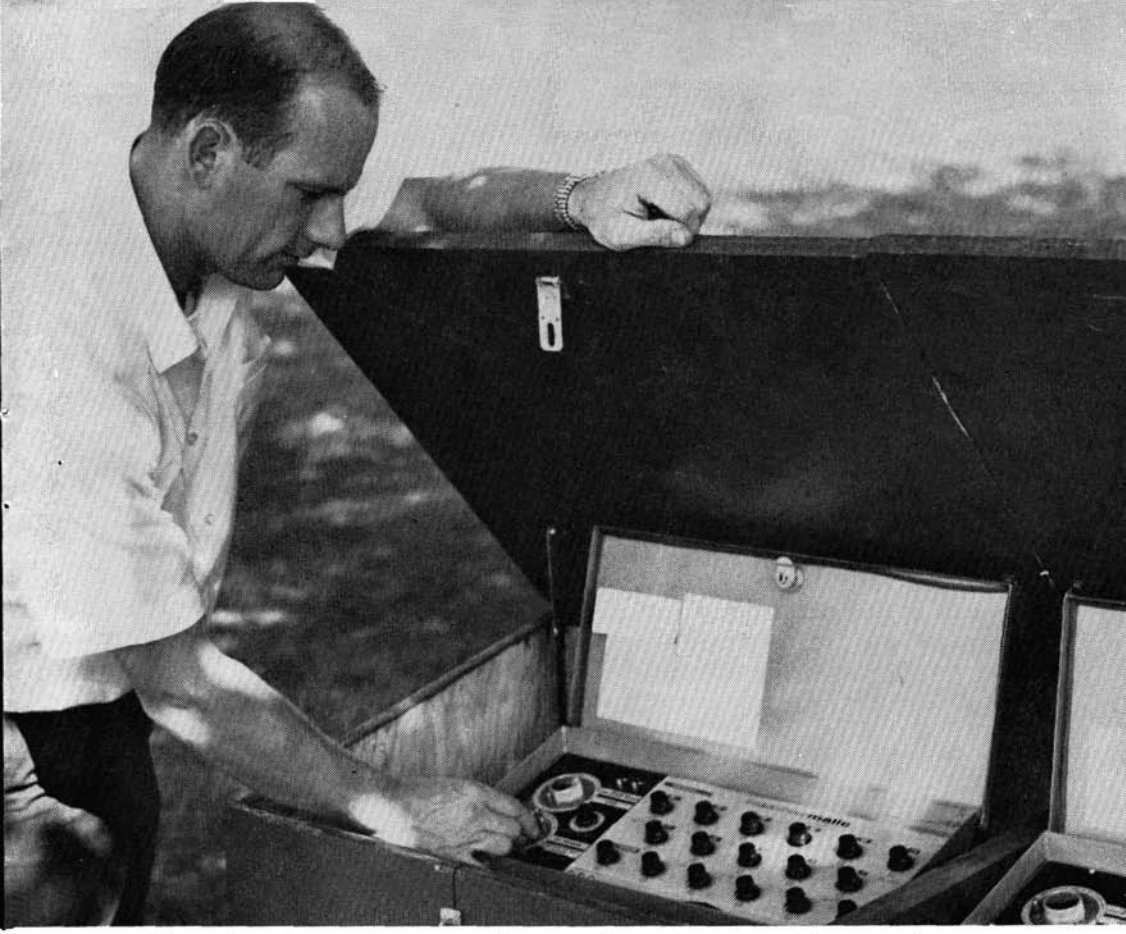
By **Robert R. DePencier**, Golf Course Superintendent, Sunningdale C.C., Scarsdale, N.Y.

Our Sunningdale Country Club now boasts of a completely automatic irrigation system. This is the Superintendent's "dream system," and I feel this way even though the quick coupler system that we used prior to conversion was extremely good. The old system had a capacity discharge of 3000 gpm at 85 psi. The logical question is: "why convert when you have such a good system?"

Our reasons were: To have greater accuracy and variable control of moisture so that we can water when we need to and where we need to; to use less water and so reduce our water bill; to reduce our labor costs which annually amount to $4,500, and now there should be little or no labor involved; and most important is the fact that there is less chance for human error.

In our conversion we re-piped eight fairways, using transite. On other fairways we used the original galvanized iron pipe which was installed in 1955. We have an 8-inch main which runs about 1,000 feet then breaks off to a 6-inch line which runs about 5,000 feet to all fairways. This then breaks off to 4-inch, 3-inch, and 2-inch pipe in fairways. On tees we have galvanized pipe, 1¼-inch and 1½-inch in size, and around greens we have 1½-inch and 2-inch PVC pipe.

In converting we used approximately 300,000 feet of No. 12 and No. 14 underground wire. We installed



The author, Supt. DePencier, makes an adjustment at one of his control points.

190 fairway heads, each valved individually using a direct burial valve. Each green and tee was valved separately. Greens have a perimeter system of three to five heads depending on the size of the green. Valves are placed down the center of the tees, and heads were selected separately for each tee. We have 14 gate valves so that any section could be shut-off when future repairs are needed. The cost for conversion was $56,000 and this included heads.

System Control

We have four points on the course from which I can see all heads in operation. We have finger tip control over the amount of water used by each station, and each can be set from zero to 60 minutes. We have 12 controllers each with 17 to 23 stations. Each controller can be set up for a water program of 14 days. The number of controllers must be tailored to the availability of your water supply. The number of sprinkler sections programmed to operate at the same time is altered according to available water supply. The volume must be adequate to allow the watering cycle to complete itself within the shortest allowable time.

Water Supply

Like every course in the Northeast, we try to be self-sufficient in water supply and so have developed a storage capacity for 5,000,000 gallons of water on the course property. We

did this by constructing two ponds, one across No. 17 fairway which runs into the larger one constructed in a natural valley on the fourth hole. The smaller pond is about 5,000 square feet in surface area and is 12 to 14 feet deep. The larger pond covers an acre and is 20 to 25 feet deep. 15,000 cubic yards of soil were removed and all this soil was used to improve our practice fairway, which is located in a low area of poor drainage, and to enlarge the tee. This soil enabled us to raise the practice area about three feet. The cost of pond construction was $25,000.

We now collect all water that runs-off from 26 acres of natural drainage and direct flow into the ponds; also, the run-off from the parking area and entrance road is directed into the drainage pattern into the ponds; also, we have a well that pumps 55 gpm for 15 hours daily and so produces ½ million gallons per week; and finally, there are natural springs within the pond area that produce 15 gpm. The pond spills over at 10 gpm and follows a natural brook which winds through the property adjoining the club.

We had to do some re-piping in order to bypass the seven city meters and to connect the system to the main line. It also was necessary to re-pipe all drinking fountains, to relocate a few, and to put in a few new ones—all connected to the city line. Together with the new pump house, this cost came to $20,000.

Trenching

The contractor was responsible for lifting and replacing all sod, trenching, and clean-up. Two Davis trenchers were used, one on tracks, and one on rubber. The latter was for short radius runs, around greens and tees, while the former was used to cut the line down the center of fairways. The pipe was installed to a depth of 18 to 24 inches, and all wire at least 12 inches. Before back-filling, I inspected all work to insure that it was done to my satisfaction, stone removal, grade, depth, etc. All work was done by the contractor, our crew was not involved. To firm the soil before replacing sod over lines, a powered vibrating tamper was used.

Coverage

I believe our system was well designed and carefully installed. We now have 1,000 gpm at 125 psi and can water tees, greens, and fairways with approximately one inch of water in less than one week with no interference to play. Our schedule for irrigation is from 9 P.M. through 6 A.M. We use impact type sprinklers and our pattern covers at least 15 feet into the rough on both sides of each fairway. We feel we have taken a step forward with full automation.

Watering the front tee on the 3rd hole at Sunningdale.