

Where tractors, instead of teams, can be employed for grading, the work is usually done much more economically. In construction, where tractors are used from the beginning of a job, and employed for clearing, plowing, and other fairway work, it is usually easy to make them pay for themselves and show a profit. If the architecture of the putting greens calls for large fills and extensive elevations, the job should be done with a steam shovel or gas excavator. In that case the shovel would probably be rented, although some golf course jobs have required enough shovel work to pay for one and then show thousands of dollars profit. If a steam shovel or gas excavator is used, either teams or tractors are required to pull the dump wagons. The tractors necessary on fill work are at the same time the best for plowing and other preliminary work, but are of little use on future maintenance work. The tractors most useful for golf course construction work with shovels are of the 2-ton caterpillar type. They pull dump wagons or carts and can work in soft ground, climb steep grades, and turn in small spaces.

A shovel and tractor job needs some planning, and the shrewdest planner will save the most money on construction.

CLEARING THE LAND

In commencing the construction of a golf course the first consideration will be that of the clearing, a subject discussed in detail in the article "Clearing Land for Golf Purposes," on page 56 of THE BULLETIN for March, 1928. This refers not only to heavy timber, woods, or scrub, but also to rock ledges, boulders, fences, buildings, and any other obstructions which will interfere with grading or with cultivation of the soil. Clearing and working of cleared land may well be carried on at the same time.

USING UNBROKEN SOD LAND

Sometimes pasture land on the golf course property is found to have an even surface and to possess a good tough sod which is entirely satisfactory for golf purposes without any treatment other than mowing or perhaps the removal of a few large stones. In other cases a little top-dressing to fill low areas will be sufficient to make old sod suitable for fairways. Wherever possible, such old turf should be preserved, for it takes much longer to grow tough turf than is ordinarily realized. In some portions that are slightly ridged or uneven it is possible to improve the old turf by cutting in various directions with a sharp disk harrow. The harrow should be set almost straight so that it will cut into the turf but will not turn it over. The turf should then be fertilized and rolled. On old Bermuda turf this treatment given in either the spring or fall growing season shows very noticeable results. In treating old turf on stiff clay soils an application of coarse sand in addition to this cutting will benefit the turf by opening or loosening the soil around its roots. Another condition frequently met with on light, sandy soil where it would not be advisable to plow, is that of very thin topsoils with poor subsoil. If such land were plowed the small amount of humus con-

tained in the surface soil would be buried and to a large extent lost to the grass. Such land would, of course, be benefited by applications of loam or compost; but this is usually too expensive a treatment for large areas. A cheaper method is to apply barnyard manure at the rate of from 20 to 30 tons per acre. By setting the disks in such cases at an angle the manure can be well incorporated into the soil.

BREAKING THE LAND

When the land is cleared of obstructions, whether it has been in cultivated crops, grain, pasture, or waste, it should be plowed and disked as soon as possible. Plowing should be as deep as practical, but not deep enough to bring up too much subsoil. Continuous cultivation for several weeks before planting greatly improves the physical condition of the soil, increases bacterial action and decomposition of organic material, conserves soil moisture, helps to eliminate weeds, and aids in the final leveling work. If there is sufficient time it will be well worth while to plant some green-manure crop to be turned under before planting. If there is no time for growing a green-



Digging a wide, open ditch with a wheel scraper on the side of a low fairway in Florida. The fill is being used to raise the fairway and to build the green and tee.

manure crop, and if manure is available, it is well to disk in a liberal top-dressing of manure (20 to 50 tons per acre) several weeks before seeding to allow time for decomposition and mixing with the soil.

GRADING

On land which has been cleared of timber there are bound to be holes of various sizes left where stumps have been removed. These should be filled, or otherwise they may be flooded and make further work difficult. These holes may often be used to advantage as places to bury stones.

On most courses the chief problems of grading will be around the greens, for it is there that the most extreme filling and excavating will be done. This part of the work usually raises the serious question as to where soil for the elevated portions can be obtained and where suitable topsoil may be secured. If there is likely to be any scarcity of topsoil, the best method is to stake out the full extent of all cuts and fills and then remove all topsoil from these areas. When the topsoil has been removed the cuts can be made for the traps, and