# CLAY BARS WATER SEEPAGE

By ARTHUR LANGDON

IT IS quite possible that one oil field practice may be of aid to the greenkeeper who has streams, dams, dikes, lakes, ditches, or water courses of any kind to maintain. This practice is in the use of a ground clay known as bentonite to prevent seepage of water into the ground and away from its prescribed basin.

In drilling oil wells by the rotary method, mud (clay mixed with water) is forced down the hollow rotating drill pipe from which it emerges through the "eyes" of the bit, picks up the cuttings, and brings them back up to the surface of the ground. Here the cuttings are allowed to settle out and the fluid is recirculated. This drilling mud has several very important duties to perform besides that of cooling the bit and picking up the cuttings. It walls up the freshly opened hole, prevents caving, consolidates loose formations, and checks egress of water from the fluid into the surrounding formations.

### Won't Settle Out of Water

As has been demonstrated in oil fields throughout the world, the best clay for this purpose is bentonite. This is due to its many peculiar properties which are chiefly dependent upon its particles being of collodial size and having the ability to stay in suspension in water indefinitely and form gels. As a consequence it will not settle out nor will it allow cuttings to settle out rapidly. Furthermore, and this is of importance in its application on the golf course, it forms a thin, comparatively impervious seal on the walls of the well and most effectively checks the infiltration of water into the formation.

The process may be compared to that which takes place in the filter bed of a city water system. The sand filter, because of its screening action, retains particles suspended in the water with the result that eventually a filter cake is built up on top of the sand of all the solids strained from the water. As the cake increases in thickness the passage of water into the sand is diminished until the time comes when the cake is practically impermeable and must be washed away by reversing the flow of water.

If, instead of ordinary solids, the water contained sufficient concentration of bentonite colloids, the filter bed would be sealed off so rapidly as to seem almost instantaneous, and only a thin cake—possibly less than a quarter of an inch in thickness—would be deposited. It has been demonstrated in the laboratory that this thin cake will withstand a hydrostatic pressure of many thousands of pounds per square inch without allowing more than a mere trickle of seepage to pass through it. On the other hand, only a comparatively slightly higher differential back pressure, perhaps less than 50 pounds, is required to wash it off.

Bentonite receives its name from the Fort Benton formation of the Upper Cretaceous of Wyoming. Presumably it is a volcanic ash. It is widely distributed throughout the United States and is found largely in Wyoming, New Mexico, South Carolina and California. Absorbing several times its own weight in water it will form a jellylike mass. As it is a clay with a pH value slightly on the alkaline side, there is no danger of it harming grass or other plants.

### Valuable as Sealing Agent

Bentonite, when ground to collodial fineness, or so that about 90% will pass through a 200-mesh screen, is an excellent sealing medium; and herein lies its possible value to the golf course which is concerned with the problem of retaining water in dams, reservoirs or lakes, or in disposing of it in streams or ditches. Practice has demonstrated that to seal, for instance, a lake or earthen reservoir or dam which may be drained temporarily, a thin layer of the powdered bentonite should be spread over the water-bearing surface. The more loosely consolidated or fractured the surface is, the more bentonite will be required. Generally speaking, the merest covering, or dusting, of the powder will suffice. It is quite pos-

sible that for purposes of spreading the clay various types of top-dressing machines could be utilized, particularly the kind which are adjustable so as to spread a very thin layer of finely pulverized dressing.

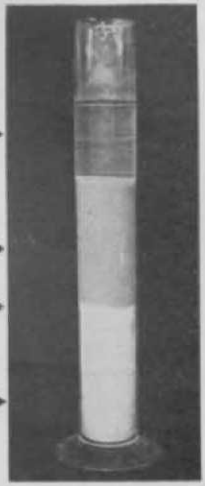
For ditches or stream beds the same procedure may be followed, except that a little more bentonite will be required, particularly where the water is most turbulent.

Where it is impractical to drain the reservoir bed of its contents, the seal may be applied by making a slurry of 2 parts of bentonite to 100 parts of water by volume and pumping this via hose or pipes to the bottom and sides of the water-bearing structure. Being a corrosion resistant and a lubricant, it will not have a harmful effect upon any metal with which it comes in contact. In mixing the bentonite and water there must be no lumps, else much of the effectiveness of the clay will be lost. The more completely dispersed is the clay, the better will be the slurry. If the slurry is left quiescent and is allowed to hydrate for several hours it will set into a gel. This does not render it unfit for use, however, since agitation will restore its fluid properties.

For sealing running streams the bentonite should be scattered along their length. If the stream is very rapid or turbulent, the powder should be distributed mostly at the head of the stream so that the current will carry and spread the clay. Close check upon the bed of the stream should be made so as to determine the effectiveness of the current as a distributor.

### Amount to Use Varies

The question of how much of the dry powder to use for the purpose of sealing is a difficult one to answer. Insufficient work has been done with bentonite along these lines to make very definite statements other than that the amount depends entirely upon the condition of the water-bearing formation. The more creviced or unconsolidated it is, the more bentonite will be required. An effective seal can be established in a leaky concrete or wooden reservoir with only a fraction of the bentonite required to check the water loss in a loosely compacted earthen basin. Furthermore, the operator must not expect to obtain an absolutely perfect seal; at all times there




will be a slight amount of seepage. But the leak after treatment will be only a small percentage of what it was before treatment. Even in a bad case which might require the application of 20 tons of bentonite to one acre of water bed, the cost would be only a fraction of that required to put in concrete. All of which makes bentonite worth considering when it will reduce seepage by as much as 95%.

Where to obtain ground bentonite may be a problem in those areas not containing deposits. Usually it is handled by talc companies or those concerns dealing in non-ferous minerals. In or near oil fields various oil well supply houses can supply either the bentonite or information as to where it may be obtained. It may be of help to know that this clay also is known as wilkinite, taylorite, and armonite, as well as a number of trademark names. The price may vary between $11 and $30 a ton.

Greenkeepers may also be interested to know that it is this same bentonite which does remarkable things to cement when used as an admixture. Two per cent added in the dry state to the dry cement will increase the water-cement ratio, eliminate the shrinkage of set cement, increase the tensile strength, add to the bonding strength, render the cement waterproof, and will hold the various aggregates evenly in suspension. Unlike the use of bentonite for preventing seepage, however, this use is patented and is licensed only to those who purchase the bentonite from the various divisions and departments of the National Lead Co.