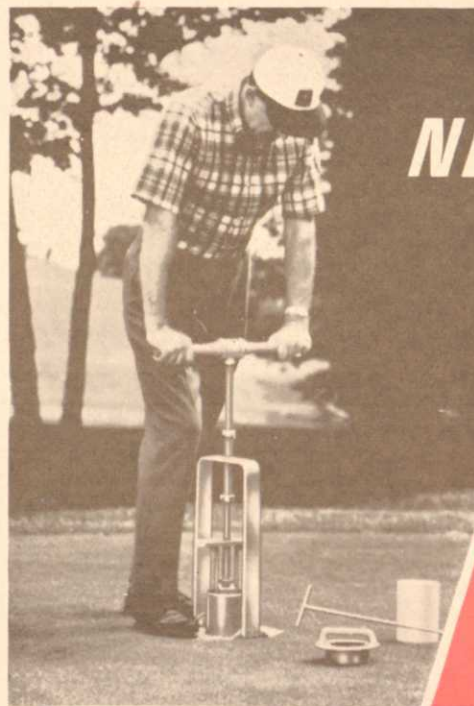
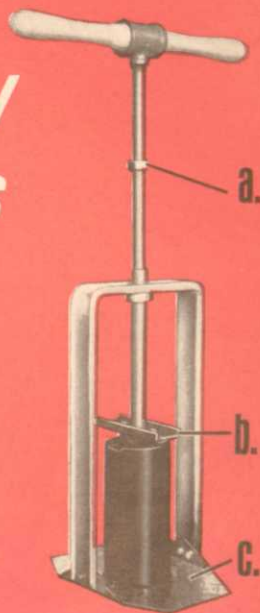


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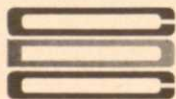
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## USGA GREEN

*continued from page 26*

The USGA Green Section Specifications for a Putting Surface, shown in Griffin's slides, were reviewed for the gathering by Dr. Ferguson. (The specifications are available upon request from the United States Golf Association, 40 East 38th Street, New York, N. Y. 10016.) Here are the seven steps in this construction procedure:

**Subgrade**—The contour of the subgrade should conform to those of the proposed finished grade, with a tolerance of plus or minus 1". The subgrade should be constructed at an elevation 14 inches below the proposed finished grade. It should be compacted sufficiently to prevent future settling which might create waterholding depressions in the subgrade surface and corresponding depressions in the putting surface. The use of rollers to compact soil is not satisfactory. Use a method called "footing" (old fashioned term) or modified "sheep foot" roller.

The materials above the subgrade consist of 4 inches of gravel, 1½ to 2 inches of coarse sand, and 12 inches of topsoil. Thus the total depth will be 17½ to 18 inches. However, this fill material will settle appreciably, and experience indicates that 14 inches will be the approximate depth of these combined materials after settling.

**Drainage**—Tile lines of at least 4-inch diameter should be so spaced that water will not have to travel more than 10 feet to reach a tile drain. Any suitable pattern or tile line arrangement may be used, but the herringbone or the grid-iron arrangements will fit most situations. Tile should be laid on a firm bed of ½" to 1" of gravel to reduce possible wash of subgrade soil up into tile line by fast water flow.

If the bottom mixture is not permeable, or if the green is long and hilly, surface water will quickly move to the subgrade soil and bubble up.

**Gravel and sand base**—The entire subgrade should be covered with a course

*continued on page 98*

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Robert Porter (l.), club president, discusses installation with Hal Dance, past president. Note copper mill in background.

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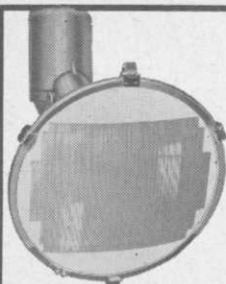
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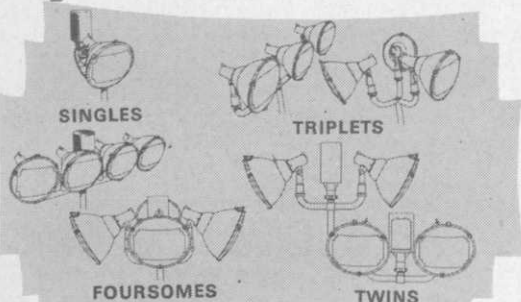
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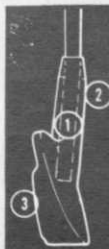
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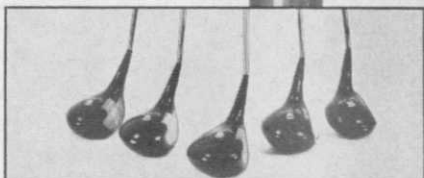
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**USGA GREEN**

*continued from page 92*

of clean washed gravel or crushed stone placed to a minimum thickness of 4 inches. The preferred material is washed pea gravel of about 1/4" diameter particle size. Larger gravel or stone may be used, but it is important that changes in size between this course of material and the succeeding one overlying it not be too great. Otherwise, smaller particles from overlying material will wash into the gravel, clog the pores or drainage ways and thereby reduce the effectiveness of the gravel.

In the sports vernacular, the successive layers would be say, basketballs, baseballs, golf balls and marbles. Then a top layer of BB shot will not go through.

When the gravel is in place, assuming that pea gravel has been used, a 1 1/2" layer of coarse washed sand (commercial concrete sand is satisfactory) should be placed to a uniform thickness over it.

"Ringing" the green—When the courses of gravel and sand are in place and outlets have been established for subsurface water, through tile lines, the green should be "ringed" with the soil which is to be used for aprons and collars. Any contours established should blend into the putting surface. The next step is to fill the depression, which represents the putting surface, with the prepared topsoil mixture next described.

**Soil mixture**—A covering of topsoil mixture at least 12 inches in thickness should be placed over the sand and gravel layers. It should meet certain physical requirements: Permeability — after compaction at a moisture content as described by Ferguson, Howard and Bloodworth, (USGA Journal, Sept. 1960), a core of the soil mixture should permit the passage of not less than 1/2" of water per hour nor more than 1 1/2" per hour when subjected to a hydraulic head of .25 inches; Porosity—*After compaction*, a sample of the soil mixture should have a minimum total pore space of 33 per cent.

*continued on page 100*

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## USGA GREEN

continued from page 98

To evaluate further the potential behavior of a putting green soil, information with respect to bulk density, moisture retention capacity, mechanical analysis, and degree of aggregation in the hands of a soil physicist would help.

Few natural soils meet these requirements. It is necessary to use mixtures of sand, soil and organic matter.

**Soil covering, placement, smoothing and firming**—When the soil that has been mixed off-site has been spread uniformly over the surface of the putting green, it should be compacted or firmed thoroughly and uniformly. Whenever possible after construction, saturation of the soil by extensive irrigation is suggested. Water is useful in settling and firming the surface. This practice will also reveal any water-holding depressions interfering with surface drainage.

Sterilization of soil and establish-

ment of turf—These steps may be accomplished by following well-known conventional procedures.

Dr. Ferguson concluded that some clubs have been deterred from building putting greens according to the USGA Green Section method because they have thought the construction costs would be excessive. It is not possible to ascertain costs in any given area because of variations in cost of materials and labor, but the following quantities of materials are required per 1,000 square feet of putting surface: Gravel, 4 inch depth — 12.3 cubic yards; Sand, 1½ inch depth—4.6 cubic yards; Soil mixture, 12 inch depth —37.0 cubic yards and Tile—approximately 100 lineal feet.

James L. Holmes, Agronomist, USGA Green Section, capped the morning session with the reminder that the Green Section specifications for building a putting green offer the greatest assurances of working without the hokus focus that accompanies some of the other methods.

continued on page 102

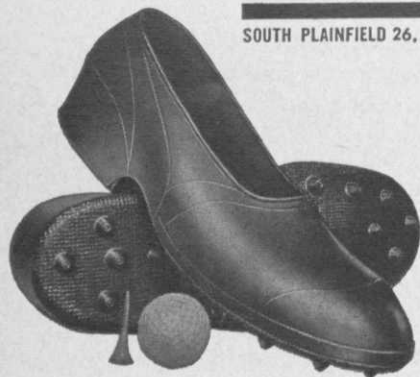
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