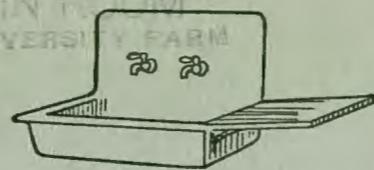
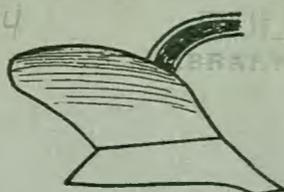
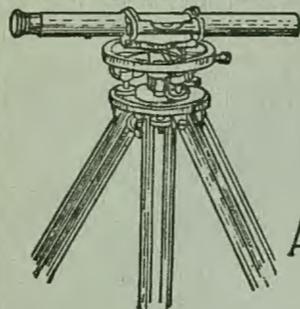


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Use of the Level on the Farm

H. B. ROE

FOREWORD

In modern farm operation and management, there is frequent call for the performance, by the farmer or his help, of work and the possession and use of equipment that fifty years ago were not considered as part of either the work or the equipment of the farm. The level and leveling fall within this class.

Often, on a farm, it is either necessary or convenient to know the approximate difference in height between two or more points. Except in cases involving much figuring and complicated plans affecting a comparatively large area, the means and method of determining differences in level or of setting out a level line or level surface are easily within the reach of the farmer with but a slight cash outlay for relatively permanent equipment not particularly subject to repair and maintenance cost.

Complete discussion of the theory and practice of leveling is beyond the scope and purpose of this News Letter. For such the reader is referred to standard surveying manuals available at bookstores and in libraries; but, for leveling ordinarily required on the farm, University of Minnesota Agricultural Extension Circular 36 entitled "A Simple Inexpensive Farm Level and How to Use It" will be a sufficient guide. In Special Extension Bulletin 160 there is a rather complete discussion on laying out terraces, that will also be helpful.

TYPES OF FARM LEVELS

Types of levels satisfactory for farm use vary from the simple home-made level described in Circular 32 to the architect's level equipped with a compass and a graduated circle for approximate measurement of bearings and angles. The price range is approximately between \$7.00 for the home-made device and \$75.00 for the architect's level with compass and graduated circle. The type of instrument quite widely recommended for general farm use is the drainage level pictured on this letterhead. This instrument with tripod and cheap rod can be obtained for about \$25.00. Such a level requires the minimum of adjustment for accurate use if reasonable care is used in handling it.

THE LEVEL ROD

Most cheap, commercial rods are not very easily read. Hence we recommend to the farmer, handy with carpenter's tools, that he make his own rod. Use a strip of clear white pine board dressed to a uni-

form width of 2 1/4 inches and either 10 feet 3 inches or 12 feet 3 inches in length with ends sawed square. Using a carpenter's pencil and a zigzag rule graduated in feet and 10ths and 100ths of feet mark off the strip, for its entire length, in feet and 10ths of feet. Using a square, draw the foot marks heavily clear across the rod, half foot marks a little over half way across and 10ths marks only about one-fourth across. Beginning with the first full foot at one end and running the full length of the rod, mark each foot in consecutive order, 1, 2, 3, 4, — etc., with a heavy-lined figure about two inches high extending half way each way above and below the foot mark. The half feet and 10ths need not be numbered as one will soon grow accustomed to counting them and small numbers are not easily read at a distance.

TYPE JOBS

Frequent among the farm jobs that require a level are the following: (1) Leveling the foundation of a building, (2) Setting a septic tank at proper depth relative to the basement, (3) running strip farming contours on slopes subject to erosion, (4) Determining possibilities of drainage outlet for a field, (5) Running a grade for a single line of tile drains, or for a sanitary drain or small ditch such as may be dug with the regular farm help, equipment, and power, (6) Running and checking terrace lines for soil erosion control.

The following discussion is offered merely to show the simplicity of the process and to encourage the use of a level by the farmer himself. Many farmers in the south and southwest now do so advantageously.

ILLUSTRATIVE JOBS

Leveling jobs of this kind naturally fall into two classes. The first three items just listed are in one class; the last three are in the other.

Case 1. In the first group no figuring whatever is required; only careful manipulation of the instrument and as careful reading of the rod. The instrument must first be set up firmly on its tripod and carefully leveled up. Let us assume that it is a foundation that is to be leveled up and that the proper height of the top of the wall has already been determined and marked at one corner. Suppose the rod reading, on this point to be 3.72. Then, at each of the other corners, the proper height for the top of the forms for a concrete wall, or for the guide line

in case of a masonry wall, will be that point where the reading is also exactly 3.72.

If a contour line is desired to plow or to plant by, after deciding just where, at one edge of a field, one wishes to start such a line the first step is to set up the instrument at a point from which one may see, on the approximate level, as nearly across the given field as possible without having the sight intercepted by the rolling ground surface of intervening knolls. Then the rod should be read when held at the starting point already decided on at the edge of the field. Suppose this reading is 4.80. Then for that given contour all that needs to be done is for the rodman to walk on across the field as nearly on the level as he can judge and, at each point where a stake seems necessary for the guidance of the plowman, permit the levelman to read the rod. If the reading at such a point is 5.10 the point is below the contour and the rodman must move up hill at right angles to the line along which he has walked and try again until the point is found where the reading is 4.80. If the test reading is 4.60 then the point is above the contour and the rodman must move down hill and try again until the point is found where the reading is 4.80.

Case 2. The second class of job listed requires more detail in handling the readings and an understanding of rates of grade, usually expressed as a given amount of rise or fall in 100 feet of horizontal distance, that is, as a per cent of the horizontal distance. To illustrate, assume that a terrace is being laid out on a predetermined rate of grade. For the method of locating terraces the reader is again referred to Special Bulletin 160. The location of the terrace having been decided the field procedure is the same as that for laying out contours, as already described, but the required rod reading will vary with each new position along the terrace line. For example, if the portion of the terrace being run out is to have a 0.2 per cent fall, assuming that the rod reading at one end of the given gradient is 4.50, fifty feet from that point along the terrace line the proper rod reading will be 4.40 or 4.60, according as one is running up or down grade in staking the terrace; at one hundred feet the corresponding rod readings will be 4.30 or 4.70; and so on until the rate of grade changes. Even then the same method holds but the changes in rod readings must conform to the new rate of grade.