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DENSITY MOISTURE METER USING A RADIOACTIVE
SOURCE AND DETECTOR
Filed Nov. 1, 1966

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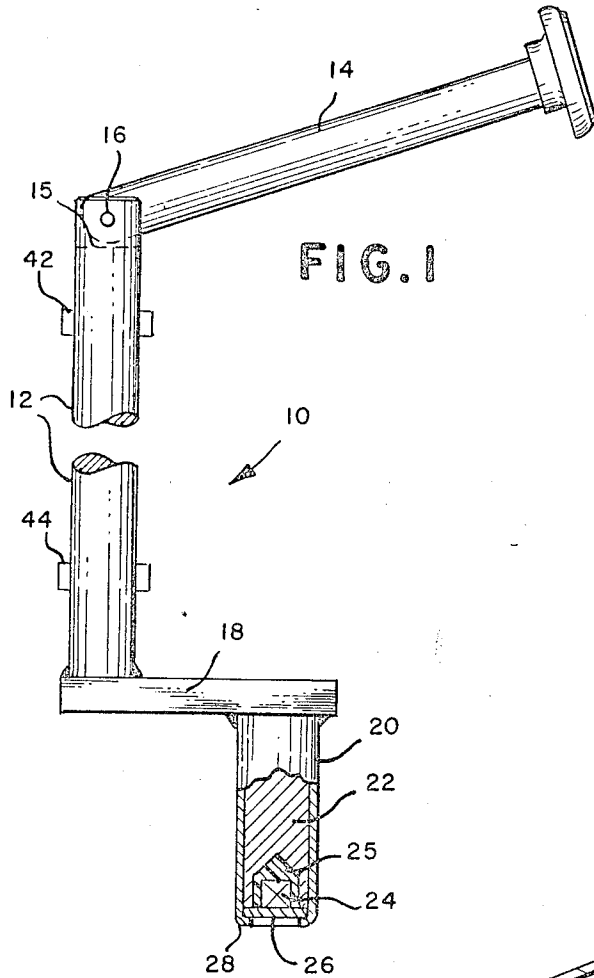


FIG. 1

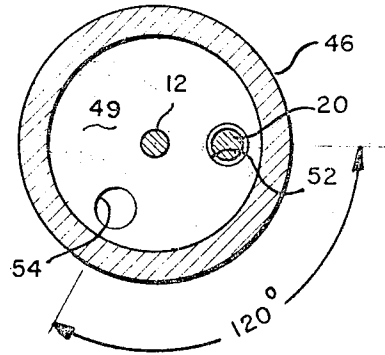


FIG. 3

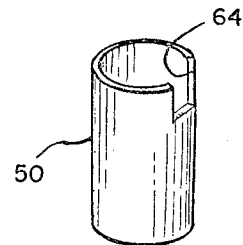


FIG. 4

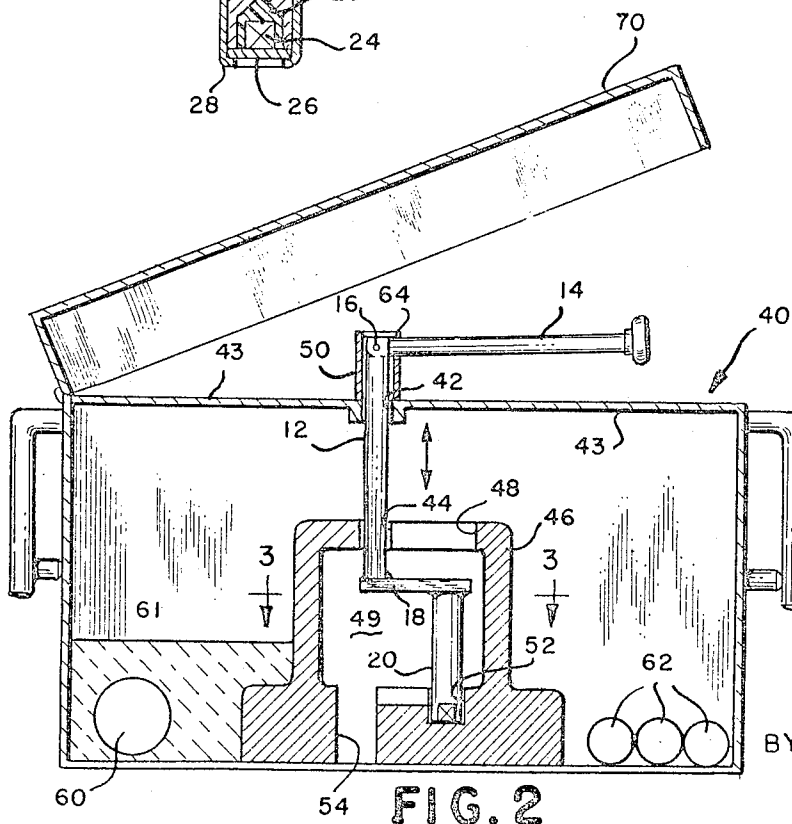


FIG. 2

INVENTOR
DONALD J. SEAMAN

BY
RONALD E. BARRY
Attorney

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DENSITY MOISTURE METER USING A RADIO-ACTIVE SOURCE AND DETECTOR

Donald J. Seaman, 6983 N. Range Line Road,
Glendale, Wis. 53209

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4 Claims

ABSTRACT OF THE DISCLOSURE

A meter, including a radioactive source, shielding means for the source, a housing surrounding the source and shielding means and having a top wall and a cover pivotable from an open position to a closed position relative to the top wall, shaft means extending through the top wall and supporting the source at its lower end and within the shielding means, handle means pivotally coupled to the upper end of the shaft and being pivotable from a first position located inwardly of the closed position of the cover to a second position disposed in an interfering relation relative to pivotal movement of the cover from its open to its closed position, the shaft and the radioactive source being movable from an inoperative, shielded position to an operative position when the handle is in its second position, and means for preventing movement of the handle out of its second position to its first position when the shaft and source are in their operative position, and for preventing movement of the shaft and source out of their inoperative shielded position when the handle is in its first position.

This invention relates to portable density-moisture meters and more particularly to an improvement in the construction and operation of the source control rod assembly which is used to carry the radioactive material.

Portable density moisture meters are being used extensively in the construction industry as a means of saving in estimating the cost of the job. The meters use a radioactive material as a source of gamma rays which are directed into the soil. After a predetermined period of time the gamma radiation is stopped and the back scatter from the reflected radiation is recorded on a meter. This reading provides a sufficiently accurate indication of the soil density in pounds per cubic foot of soil which can be used to estimate the type of equipment and cost of working the soil. This type of meter, because of the use of a radioactive source material, must be used with caution to safeguard the operator from gamma radiation and to prolong the life of the equipment.

The primary object of the present invention is to provide a density moisture meter that cannot be transported until the source material has been properly placed in a storage position within the meter housing.

Another object of the present invention is to provide an improved source control rod assembly that can be used with little instruction and provides a safety feature not presently available in competitive devices.

These objects are accomplished by mounting the radioactive source material within a control rod assembly that must be rotated to a storage position in order to provide sufficient clearance to close the cover. When used, the source control rod assembly is raised to lift the source material from the storage position and rotated to position the source material over an operating position at the bottom of the meter housing. The upper section of the handle must be pivoted to a vertical position in order for the control rod assembly to be lowered to the bottom of the housing. As long as the upper section of the control rod is in the vertical position the cover cannot be

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closed. When the control rod assembly is again raised and rotated to the storage position the upper section is pivoted out of the path of the cover and the cover can then be closed for transportation or storage. The control rod assembly will, therefore, provide both a means for handling the source material as well as an indication of the condition of the meter, i.e., operative or inoperative.

Other objects and advantages will become more readily apparent from the following detailed description when read in connection with the accompanying drawings in which

FIG. 1 is a side view of the source control rod assembly with a portion broken away to show the source material.

FIG. 2 is a side view in section of the density meter with the source control rod in the storage position.

FIG. 3 is a view taken on line 3-3 of FIG. 2 showing the operating and storage positions for the source control rod assembly.

FIG. 4 is an enlarged view of the pivot cylinder for the source control rod assembly.

Referring more particularly to the drawings, the source control rod assembly 10 includes a main shaft 12 having a handle 14 positioned in a groove 15 and pivotally connected by a pin 16 to the upper end of the main shaft. An offset bracket 18 is secured to the lower end of the shaft and has a source material cylinder 20 secured to and depending from the lower outer surface of the bracket. The axis of the cylinder will be offset from and parallel to the axis of the main shaft 12. A lead shield 22 is used to fill the major portion of the cylinder with the radioactive source material 24 embedded within an epoxy resin housing 25 that is embedded in the lead shield material. A stainless steel disc 26 is positioned across the bottom of the cylinder with the lower edge 28 of the cylinder rolled inward to hold the disc in position.

The control rod assembly is mounted in the density meter housing 40 with the main shaft 12 axially aligned in aperture 42 in the top wall 43 of the housing and aperture 44 in lead shield housing 46 located in the bottom of the housing. The lead shield housing has a groove 48 in its upper surface which is large enough to allow the source material cylinder and bracket 18 to be inserted into the cavity 49 in the lead shield housing. The upper end of the shaft 12 projects through a pivot cylinder 50 secured on the top wall of the housing 40 in axial alignment with aperture 42.

The handle 14 is pivotable from a horizontal to a vertical position about pin 16. When the handle is in the horizontal position it will fit in slot 64 in the pivot cylinder with the source control rod assembly seated in storage slot 52 in the housing 46. The handle while in the horizontal position is raised to clear the source control cylinder from aperture 52 and then rotated approximately 120° until cylinder 20 is aligned with opening 54 in the bottom of housing 46. The handle must be raised to a vertical position before the control rod assembly can be dropped to the operating position with cylinder 20 in opening 54. It should be apparent that the cover 70 cannot be closed when the handle is in the vertical position. When the radioactive source material is in the operative position the gamma radiation produced by the source material is directed into the ground. A neutron counter 60 is positioned within a polyethylene housing 61 in the front of the housing and used to record the moisture content of the test material. Gamma counters 62 indicate the density of the test material. The instruments used to make the test are well known and do not form a part of this invention, and therefore, no further explanation is necessary.

When the test is completed the handle 14 is again raised to bring the lower end of cylinder 20 out of aperture

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54. The handle can be pivoted to the horizontal position or left in the vertical position when the source cylinder 20 is rotated back to the storage position. Handle 14 will be again aligned with groove 52 in the pivot cylinder and can be dropped into the groove with cylinder 20 seated in the storage position. The source material is then safe and cannot harm the operator.

The pivot cylinder 40 is made with a height approximately equal to the distance between the surface of the top wall of the housing and the inside surface of the cover. It is only when the handle is in the horizontal position and seated in groove 64 that the cover 70 on the housing 40 can be closed and locked. When in this position there is no danger of exposure to radiation by the operator.

Although only one embodiment of the present invention has been shown and described it should be apparent that various changes and modifications can be made herein without departing from the scope of the appended claims.

What is claimed is:

1. A meter including a housing having a top wall and a cover pivotal from an open to a closed position relative to said top wall, a radioactive source, shielding means for said source and disposed within said housing, shaft means extending through said top wall and supporting said source at its lower end within said housing, handle means pivotally connected to the outer, upper end of said shaft means and pivotable from a first position located inwardly of the closed position of said cover to a second position disposed in an interfering relation relative to pivotal movement of said cover from its open to its closed position, said shaft means and said radioactive source being movable between an inoperative shielded position and an operative position when said handle means is in its second position, and means for preventing movement of said handle means out of its second position

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tion when said shaft means and radioactive source are in their operative position and for preventing movement of said shaft means and said radioactive source out of said inoperative position when said handle means is in first position.

2. The combination according to claim 1 including a pivot cylinder mounted on the top wall of said housing and having a height equal to the distance from the top wall of the housing to the inside surface of the cover,

said cylinder having a groove indicating the inoperative position of the source material, said handle being pivotal into said groove when the source material is in the inoperative position.

3. The meter set forth in claim 1 wherein said handle means extends vertically and above the closed position of said cover when it is in its first position and horizontally and below the closed position of said cover when in its second position.

4. The meter set forth in claim 3, wherein the shielding means includes a cavity for receiving said source at the lower end of said shaft means to comprise the inoperative position thereof, said source and said shaft means being movable vertically out of said cavity and being rotatable to their operative position when said handle means is in its second position.

References Cited

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ARCHIE R. BORCHELT, Primary Examiner

U.S. Cl. X.R.

250—83.6, 108

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,511,997

May 12, 1970

Donald J. Seaman

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, line 4, after "in" insert -- its --; line 16, "its" should read -- in --.

Signed and sealed this 29th day of December 1970.

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

WILLIAM E. SCHUYLER, JR.

Commissioner of Patents