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**GRAIN BIN TEST PROBE**

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4 Claims. (Cl. 73-425.2)

This invention relates to grain sampling devices, and more particularly to improvements in grain bin test probes for obtaining samples of grain below the surface in storage containers such as bins, elevators and the like.

Large quantities of grain have been stored in grain bins and other structures on farms and in elevators under Government loan programs. Grain stored in buildings with flat bottoms is called "flat storage." In the storage of grain, due to moisture content and the conditions of storage, the grain may heat or mold, or may become infested with insects or otherwise damaged, and if not properly treated or handled may become unfit for use as food or feed. It is desirable to obtain information periodically as to the condition of the stored grain at various levels and thereby determine if the condition is such that treatment should be performed to prevent damage or loss. Since the grain in flat storage cannot be turned for insect, moisture and temperature inspection, it must be probed and samples obtained on about 10-foot area spacings and at least 5-foot depth intervals to be assured that the grain is in a safe storage condition. The grain storage buildings may be metal grain bins or may be buildings as large as 140 feet wide by 540 feet long with 20-foot side walls and 45-foot peak at the ridge, and are usually filled to capacity, leaving only 4- to 5-foot head room.

Grain probes heretofore used require two or three men to push them into a maximum depth of 20 feet and can obtain only one sample at a probing whereby the testing is time consuming and expensive.

The principal objects of the present invention are to provide a sectional grain probe which can be operated by one man for penetration into the stored grain to any desired depth and remove samples at a plurality of levels in one probing; to provide such a probe structure which can be used in deep grain storage with relatively small head room; to provide such a probe structure with sections having hollow portions forming chambers for receiving samples with portions being relatively movable whereby entry ports for passage of grain into the chambers are closed during penetration of the probe into the grain and are opened for taking the samples on reversal of direction of movement of the probe; to provide such a probe with a point or first section having spiral ribs or screw portions thereon to form an auger which will move into the grain when rotated in one direction and move out of the grain when rotated in the opposite direction; to provide such a probe with a plurality of separable sections with mating joint sections pinned together for limited relative rotation with cooperative ports registrable in response to rotation in one direction to provide entry for grain into sample-receiving chambers; and to provide a grain test probe that is economical to manufacture, easily inserted into grain to any desired depth and efficient in operation to take samples at selected desired depths.

Other objects and advantages of this invention will become apparent from the following description taken in connection with the accompanying drawings wherein are set forth by way of illustration and example certain embodiments of this invention.

FIG. 1 is a vertical sectional view through a grain storage with a grain probe embodying the features of the present invention inserted into the grain.

FIG. 2 is an enlarged vertical sectional view through the grain test probe.

FIG. 3 is a further enlarged partial vertical sectional

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view through probe sections at a joint taken on the line 3-3, FIG. 2.

FIG. 4 is a transverse sectional view through the grain probe taken on the line 4-4, FIG. 3, with the sections in rotated position for opening the ports for entry of grain into chambers in the sections.

FIG. 5 is a transverse sectional view similar to FIG. 4 with the sections rotated to a position for augering the probe into the grain with the entry ports closed.

FIG. 6 is a transverse sectional view through the probe sections with the sections rotated to the position during insertion into the grain.

FIG. 7 is a transverse sectional view through the probe sections similar to FIG. 6 and taken on the line 7-7, FIG. 3, with the sections rotated for removing the probe from the grain.

FIG. 8 is a disassembled perspective view of the joint portions of adjacent sections.

Referring more in detail to the drawings:

1 designates a grain storage building or bin having a grain storage chamber 2 therein with a flat bottom 3 and a quantity of grain 4 in the storage chamber, the building or bin having side walls 5 and a top wall 6, and the top 7 of the grain being spaced from the top wall 6 to provide head room therebetween.

The numeral 8 generally designates a grain test probe having a plurality of sections including a point section 9, a handle section 10, and intermediate sections 11 adapted to be separably connected to provide a total length sufficient to penetrate to the depth desired in stored grain.

The point section 9 preferably has an elongate tubular member 12 with a wall 13 defining a bore 14, the lower end of the section having a point member 15 with a substantially conical end 16 terminating in a point 17. In the illustrated structure, the large end of the conical end 16 is preferably of the same diameter as the outside diameter of the tube 12 with a reduced extension 18 having a diameter corresponding to the diameter of the bore 14 of the tube whereby said extension 18 fits into the lower end thereof. The reduced portion or extension 18 forms a shoulder 19 at the large end of the conical portion 16 whereby said shoulder 19 engages the lower end of the tube 12, as illustrated in FIG. 2. The point member 15 is secured in the tube 12 by a suitable fastening means, as by a pin 20, extending through aligned transverse apertures 21 in the tubular member 12 and extension 18, whereby said extension 18 closes the lower end of the bore 14 and the portion of the bore above the end of the extension 18 defines a grain-receiving chamber, as later described. The point section 9 has an outwardly extending spiral rib 22 on the tube wall 13 whereby said lower section forms an auger, the spiral rib 22 being in the form of a helix which, in the illustrated structure, is right-handed whereby rotation of the point section in a clockwise direction, when viewed from the upper end thereof, causes said point section to auger downwardly into grain storage. The upper end portion of the tube 12 has transverse apertures 23 extending through the walls 13 in spaced relation to the upper end 24 of said tube for receiving a fastening means such as a pin 25, as later described. The chamber in the tubular member 12 has an inlet port 26 near the upper portion of the tube, and preferably spaced downwardly from the aperture 23, as illustrated in FIGS. 2, 3 and 8, said port being of suitable size for entry of grain as, for example, a suitable structure may consist of a thin walled aluminum tube 12 having an outside diameter of  $1\frac{1}{16}$  inches, with the port 26 an elongated slot of approximately  $\frac{1}{2}$  inch width and  $\frac{3}{4}$  inch length. The length of the point section 9 is preferably shorter than the length of the intermediate sections 11, it being necessary only to have sufficient length for the point member 15 and the spiral

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auger screw rib 22 to pull the probe into the grain when rotated whereby the port 26 may be moved sufficiently close to the bottom wall 3 that the sample of grain taken thereby will be adjacent to the bottom of the storage.

The intermediate sections 11 each have tubular members 27 with walls 28 defining bores 29 therethrough, the tubular members 27 being the same material and size in cross-section as the tube 12. The length of the intermediate section tubes 27 is preferably the same as the spacing of the depth intervals from which it is desired to take samples as, for example, the intermediate tubes 27 may be of a length of 39 inches to provide for taking samples at 39-inch spacings and also to facilitate the use of the probe in grain storage wherein the head room is small. The upper portions of each of the intermediate sections have transverse apertures 23 for receiving fastening pins 25 and also grain inlet ports 26 with the respective spacings of the apertures 23 and ports 26 from the upper ends 30 of the tubes 27 of the intermediate sections being the same as the spacing of the corresponding apertures and ports in the lowermost or point section 9, said apertures 23 and ports 26 all corresponding in sizes. The lower ends of the bores 29 of the intermediate sections 11 are closed whereby the portions of the bores above the closures form grain sample collecting chambers 31, it being preferable that the closures be formed by joint connectors 32 for connecting the probe section with the next lower section of the assembly. In the illustrated structure, the connector member 32 for each intermediate section is a cylindrical member of suitable diameter to fit into the bores of adjacent section tubes. The joint connector 32 has an end portion 33 which extends into the lower end 34 of the respective intermediate section tube 27 and said tube and portion 33 are secured together by suitable fastening devices such as pins 35 extending through aligned transverse apertures 36 and 37 in the tube wall and the end 33 of the connector member 32, the pins 35 and apertures 36 and 37 being such that the tube 27 and connector 32 are held against relative rotation, it being necessary to separate the connector member 32 and the lower end of the intermediate section tubes only when it may be desired to clean the structures. When the connector member 32 is secured in the lower portion of the tube member 27, the connector extends from the lower end 34 of said intermediate tube a distance slightly greater than the distance of the lower end 38 of the port 26 and the upper end 24 or 30 of the tubes 12 or 27 respectively, whereby when the adjacent sections are connected by sleeving the upper end of a tube over the connector 32 the adjacent ends of the tubes of the respective sections will abut as illustrated in FIG. 2, and a transverse slot 39 in the connector will register with the aperture 23 in the next lower tube whereby the connector pin 25 will extend through the apertures 23 and slot 39 to effect a separable connection between the probe sections. The lower end 40 of the connector 32 has a recess or notch 41 extending upwardly from the bottom thereof and adapted to register with the port 26 in response to relative rotation of the adjacent tube sections. The slotted aperture 39 is of such size and shape relative to the pins 25, as illustrated in FIGS. 4 and 5, whereby clockwise rotation on the upper of adjacent sections, when looking downwardly thereon, will move the respective pin 25 in the slot 39, as illustrated in FIG. 5, and when so positioned the notch 41 will be out of registry with the port 26, as illustrated in FIG. 6. When the upper of adjacent sections is rotated counter-clockwise to effect relative rotation of the adjacent sections, the pin 25 will move in the respective slot 39 to a relative position as illustrated in FIG. 4 whereby the relative rotation will move the recess 41 into registry with the respective port 26 to provide a passage for grain to enter into the respective sample collecting chamber, as illustrated in FIGS. 3 and 7.

The handle section 10 consists of an elongate bar 43

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secured to and extending transversely of a cylindrical member 44 having a reduced end portion 45 adapted to extend into the bore of the uppermost intermediate section 11, said reduced portion 45 having an aperture 46 registrable with the aperture 23 for receiving a pin 25 to connect said reduced portion of the handle member to the uppermost section 11.

In using a test probe constructed as described, the handle member 10 is arranged with the reduced portion 45 extending into the auger or lower point section 9 and is connected thereto by a pin 25. The operator then starts the point member 15 into the upper surface of the grain to be tested and rotates the section 9 in a clockwise direction whereby the point section is augered downwardly into the grain. Then, with the port 26 still above the surface of the grain, the pin 25 is removed and the handle section 10 separated from the point section 9. An intermediate section 11 is then aligned with the point section whereby the lower end of the respective connector member 32 is inserted into the upper end of the bore of the point section 9 until the slot 39 registers with the aperture 23, and then a pin 25 is inserted into the aperture 23 and slot 39 to make the connection. The handle member is then mounted on the upper end of said intermediate section and connected thereto by a pin 25, and the structure is rotated clockwise to cause the probe sections to auger downwardly into the grain, the pin and slots of the connectors being positioned as illustrated in FIG. 5 whereby the notch 41 and port 26 are out of registry. When the structure has penetrated downwardly until the port 26 at the upper end of said intermediate section is slightly above the upper surface of the grain, the handle member is again disconnected and another intermediate section applied and the handle member then attached to the upper end of said second intermediate section, and the process repeated. This arrangement for adding additional sections is continued until the lower end of the probe is at a desired depth, preferably at the bottom 3 of the storage. Then the handle member is turned counter-clockwise to move the pins and slots 39 to a relative position as illustrated in FIG. 4 which moves the notch 41 of each of the connectors into registry with the respective ports 26 whereby grain at the respective levels of the ports will flow into the ports 26 and through the notches 41 into the respective grain collecting chambers, thereby taking a test sample from each of the levels where the ports 26 are located. After sufficient time has elapsed for the grain to enter into the respective chambers, the handle member is then further rotated counter-clockwise to cause the probe to be augered upwardly and, then, as the respective ports 26 move above the surface of the grain the respective pins 25 are removed to disconnect the section extending upwardly above the grain, and the handle is then connected to the next lower section and the process repeated until the entire probe is removed from the grain storage. As each of the sections is removed, they are marked whereby the operator will know at what level the test sample was taken, and then the grain is poured from the respective chambers and the samples examined and tested to determine the condition of the grain at the various levels from which the samples were taken.

The same sectional probe structure may be provided with a plurality of apertures of such small size that grain will not pass therethrough with said apertures being spaced in the wall tube sections 12 and 27. Also, passages may be arranged to extend longitudinally through the connector members 32 for communication between the chambers in the tubular sections, said passages being closed when grain samples are to be taken. With such a sectional probe with the passages in the connector members opened the probe is inserted into the grain in the same manner as above described, and then when extending to the desired depth liquid fumigant is applied to the upper end of the uppermost tubular section and said upper end

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closed whereby the fumigant will pass through the apertures in the tube walls and into the grain.

It is to be understood that while I have illustrated and described one form of my invention it is not to be limited to the specific form or arrangement of parts herein described and shown except insofar as such limitations are included in the claims.

What I claim and desire to secure by Letters Patent is:

1. A grain test probe comprising, a plurality of elongate tubular sections each having a bore with one end closed, an extension on said closed end adapted to fit in the other end of the next lower section, said extension having a recess and said other end portion of the next lower section having a port registrable with said recess to form a flow passage communicating with the bore of said next lower section, and means connecting said extension with said other end of the next lower section for limited rotative movement whereby when rotated in one direction said port and recess are out of registry and when rotated in the opposite direction the port is brought into registry with the corresponding recess.

2. A grain test probe comprising, a plurality of elongate tubular sections, one of said sections having a closed pointed lower end, a spiral rib on said one section extending outwardly therefrom to form an auger for effecting movement into stored grain in response to rotation of said one section, means closing the lower end of each of the other sections to form a chamber therein and having an extension adapted to fit into the upper end of the next lower section to close same, said extension having a recess therein, said upper end portions of the next lower sections each having a port registrable with a corresponding recess to form a flow passage into the chamber of the respective section, and means separably connecting said extensions with said upper ends of the next lower sections for limited relative rotative movement whereby when rotated in one direction said ports and corresponding recesses are out of registry and when rotated in the opposite direction the individual ports are brought into registry with the corresponding recess, the spiral rib on said one section being of a direction relative to the apertures whereby rotative movement to effect penetration into grain to be tested moves the corresponding ports and recesses out of registry and rotative movement to retract the sections from the grain effects registry of said corresponding ports and recesses.

3. A grain test probe comprising, a plurality of separable sections including a point section, intermediate sections, and a handle section, each of said point section and intermediate sections having elongate grain receiving chambers extending downwardly therein from the upper ends of the respective sections, said point section having

a pointed lower end, a spiral rib on said point section forming an auger, each of said intermediate sections having lower portions arranged and shaped to cooperate with the upper portion of the next lower section whereby one is sleeved onto the other and closes the upper ends of the chambers in the next lower section, the upper portions of each said lower section having a port, said lower portions of the intermediate sections each having a recess which when moved to registry with the respective port forms an inlet passage to the respective chamber for flow of grain therein, and means separably connecting said sleeved portions of adjacent sections for limited relative movement whereby when moved in a direction relative to the auger portion for effecting augering movement of the sections into grain storage the respective ports and recesses are out of registry and when moved in the opposite direction for movement of the sections out of the grain storage the individual ports are brought into registry with a corresponding recess.

4. A grain test probe comprising, a plurality of separable sections including a point section, intermediate sections, and a handle section, each of said point section and intermediate sections having elongate grain receiving chambers extending downwardly therein from the upper ends of the respective sections, said point section having a pointed lower end, a spiral rib on said point section forming an auger, each of said intermediate sections having lower portions arranged and shaped to cooperate with the upper portion of the next lower section whereby one is sleeved onto the other and closes the upper ends of the chambers in the next lower section, the upper portions of each said lower section having a port, said lower portions of the intermediate sections each having a recess which when moved to registry with the respective port forms an inlet passage to the respective chamber for flow of grain therein, means separably connecting said sleeved portions of adjacent sections for limited relative rotative movement whereby when rotated in a direction relative to the auger portion for effecting augering movement of the sections into grain storage the respective ports and recesses are out of registry and when rotated in the opposite direction for movement of the sections out of the grain storage the individual ports are brought into registry with the corresponding recess, and means separably connecting the handle with the uppermost of said sections for effecting rotation of said sections.

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