

March 31, 1942.

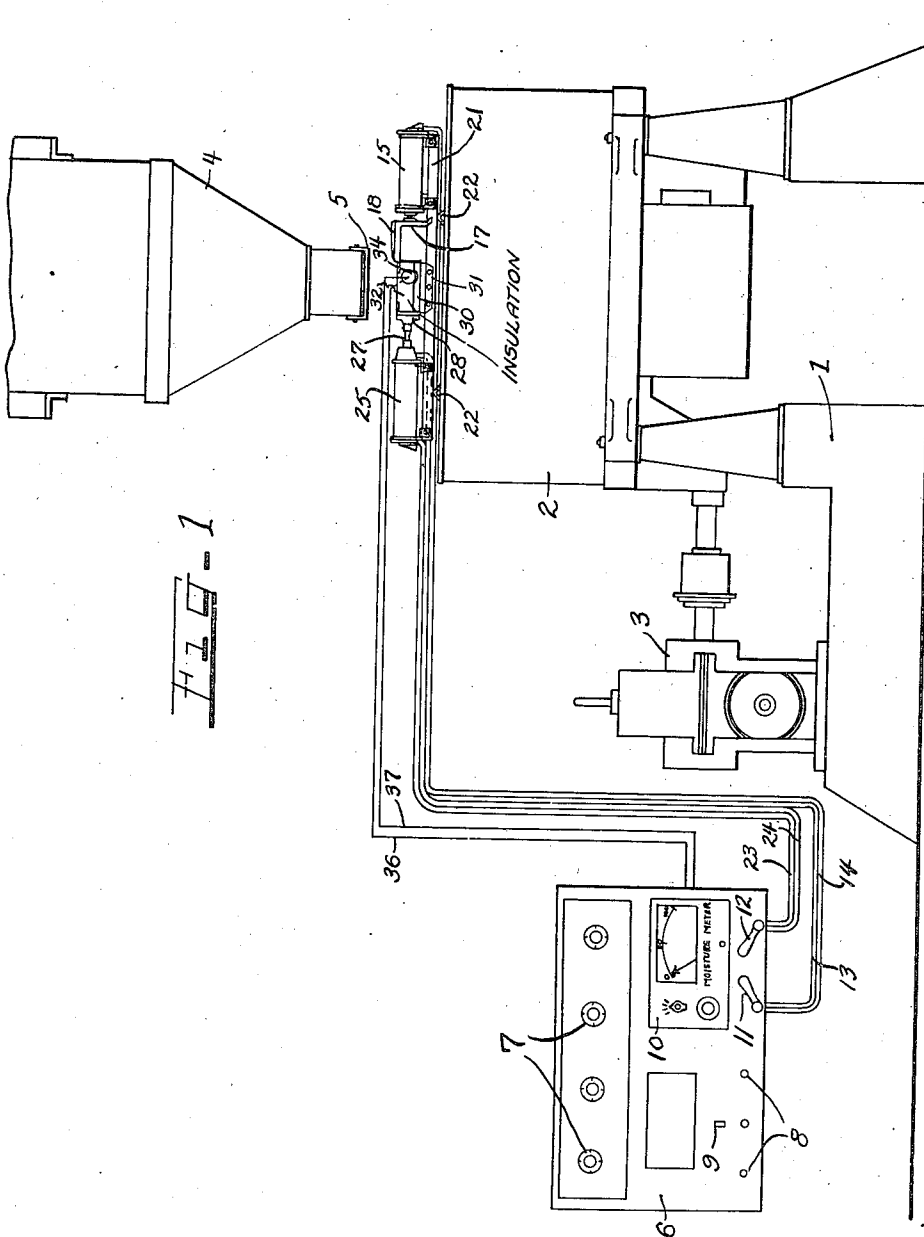
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FOUNDRY SAND MOISTURE TESTER

Original Filed July 10, 1940

2 Sheets-Sheet 1



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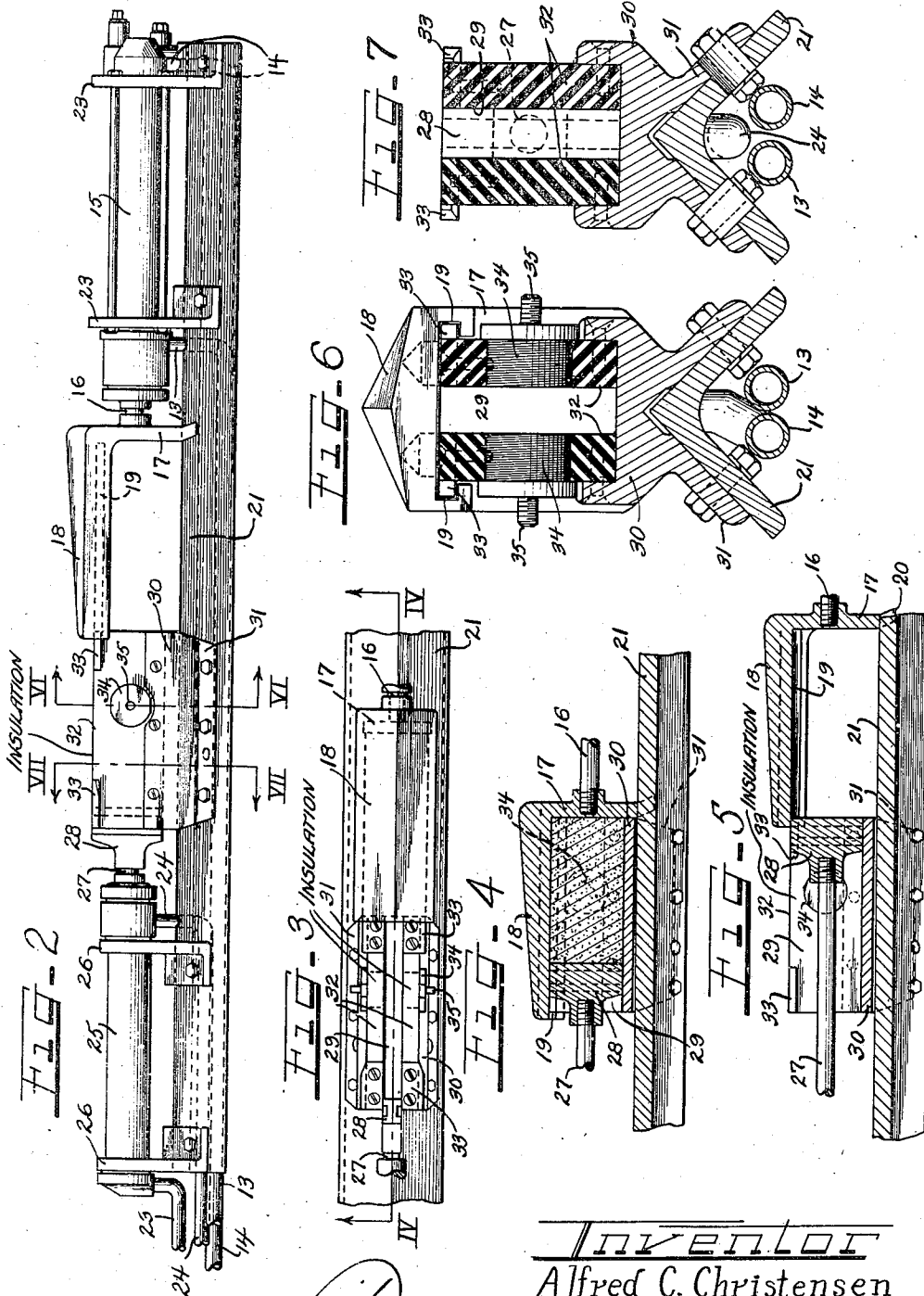
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UNITED STATES PATENT OFFICE

2,277,953

FOUNDRY SAND MOISTURE TESTER

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Original application July 10, 1940, Serial No.
344,756. Divided and this application July 10,
1940, Serial No. 344,757

10 Claims. (Cl. 175—183)

The present invention is a division of my co-
pending application for patent for a "Timer for
sand mixer," filed July 10, 1940, U. S. Serial No.
344,756, and relates to a moisture content tester
for foundry sand and the like, to permit moisture
readings to be recorded in terms of percentage
of moisture in the product being tested or in
gallons of water to be added to a batch of sand
during the reconditioning of the sand in a mull-
ing and mixing machine. The moisture tester
of the present invention definitely determines
the moisture content of a tested batch of sand,
thereby permitting a positive determination of
the amount of water necessary to be added to
a batch of sand or similar material which is
being conditioned in a sand mixer and thereby
eliminating the less satisfactory method of rely-
ing upon the judgment of an attendant relative
to the amount of water necessary to be added
to bring the mixture to proper or desired con-
dition.

It is an object of this invention to provide a
sand sampler and moisture testing unit for use
in connection with foundry sand mixers and
mulling machines, or with other machines in
which it becomes necessary to determine the
moisture content of the substance to be treated
and to which a definite quantity of liquid is to
be added for proper conditioning or recondition-
ing of the material.

It is also an object of this invention to provide
a foundry sand sampler or cell for the purpose
of receiving and trapping a sample of material
which is to be tested for moisture, sand cell hav-
ing connected therewith a moisture meter and
remote control operating means for the sampler
for the purpose of definitely determining the
necessary quantity of liquid to be added to a
batch of material to properly condition the same.

It is a further object of this invention to pro-
vide a material sampler provided with trapping
and ramming means for compactly concentrating
the sample between electrodes connected with a
moisture meter to permit moisture readings to
be made either before or during the mulling and
mixing operation on the material, to definitely
determine the amount of liquid to be added to
the material which is being conditioned for
foundry mold making or for other purposes.

It is furthermore an object of this invention
to provide a foundry sand treating and condi-
tioning system with a sand sampler disposed in
the path of travel of a batch of sand entering
a mixer to confine a sample of the sand and
permit a moisture reading to be instantaneously

obtained by means of a moisture meter con-
nected with the sampler at a remote control
station where operating means for the sampler
may also be located.

It is also an important object of this inven-
tion to provide a material treating system, such
as a foundry sand conditioner, with a material
sampler located in the path of sand entering a
mixing crib, in order to permit a sample of the
material to be trapped and compressed between
electrodes connected with a moisture meter which
is calibrated for the class of sand being tested
and which permits an instantaneous reading to
be obtained in terms of percentage of moisture
in the material or gallons of liquid to be added
to a batch of the material being treated in the
system.

An important object of the invention is the
equipping of a sand conditioning system with a
sand sampler and moisture content tester, said
sampler having a cell portion which may be
located outside or inside of a sand conditioning
crib forming a part of the system, in order that
moisture readings may be obtained either before
or during mulling and mixing operations to posi-
tively determine the amount of water or other
required liquid to be added to the sand or other
material which is being conditioned.

It is the purpose of this invention to provide
a material sampling cell in which a sample of
the material to be tested for moisture content
is trapped within the cell by means of pressure
operated mechanisms to confine a sample of the
material between electrode means connected with
a moisture tester, calibrated for the class of ma-
terial being tested and operable on the impedance
principle for recording either the percentage of
moisture in the material being tested or the
quantity of liquid required to be added to the
material for proper conditioning of the same.

Other and further important object of this
invention will be apparent from the disclosures
in the specification and the accompanying
drawings.

The invention (in a preferred form) is illus-
trated in the drawings and hereinafter more
fully described.

On the drawings:

Figure 1 is a schematic arrangement of a
foundry sand reconditioning system and a time
control unit having connected therebetween an
improved material sampler and moisture con-
tent recorder embodying the principles of this
invention.

Figure 2 is a side elevation of the material

sampler, including a part of the moisture testing unit and showing the material trapping means in open position with respect to the receiving cell.

Figure 3 is a fragmentary top plan view of the material sampling cell with the material trapping heads in retracted or open positions.

Figure 4 is a fragmentary vertical detail section taken on line IV—IV of Figure 3 but showing the trapping heads in closed position with respect to the cell, to trap and ram a sample of the material being tested.

Figure 5 is a fragmentary vertical detail section similar to Figure 4 but showing the location of the trapping heads at the end of a sampling operation resulting in the discharge of the trapped material from the testing cell.

Figure 6 is an enlarged vertical detail section taken on line VI—VI of Figure 2, showing the testing electrodes in elevation.

Figure 7 is an enlarged detail section taken on line VII—VII of Figure 2.

As shown in the drawings:

The improved sand or material sampler and moisture tester embodying the principles of this invention is illustrated in Figure 1 associated with a foundry sand conditioning system and with a time master control unit for governing and timing the operation of various mechanisms associated with the sand conditioning system.

Referring to Figure 1, the reference numeral 1 indicates the base of a foundry sand mixing and mulling machine. Supported on said base is a sand receiving and treating crib 2 containing the necessary mulling and mixing mechanisms for conditioning sand for use in the making of foundry molds and the like. Mounted on the foundation or base 1 is a driving motor unit 3 which is connected for transmitting a drive to the mechanisms within the crib 2. Mounted above the crib 2 is a sand measuring hopper 4 provided with a batch release door 5 for controlling the discharge of a measured batch of sand into the crib 2.

Mounted at a remote control station is a time master control board or case 6, including a plurality of electric time limit switches 7 for automatically controlling and timing the operation of parts of the sand conditioning system. Also mounted on the control board 6 are a plurality of manually operable switches 8 for manually controlling the operation of certain parts of the system. Also mounted on the control board is a main control switch 9 which may be thrown to connect up either the group of time switches 7 or the manually operated switches 8 of the sand conditioning system. Since the switch control mechanisms referred to cover no direct part of the present invention and are covered in my patent application hereinbefore referred to, no further description of the unit 6 will be made except in connection with those parts related to this invention.

As further illustrated in Figure 1, the material sampler and moisture tester of this invention is partly associated with the sand delivering and treating mechanisms of the system and partly associated with the time master control board 6. Mounted in the control board 6 is a standard moisture meter 10 which is adapted to be calibrated for the class of sand or other material which is to be tested for moisture content.

The moisture meter 10 is constructed to permit of instantaneous readings in terms of percentage of moisture in the sand or material be-

ing tested, or in gallons of liquid to be added to a batch of material in the conditioning unit 2. The moisture meter 10 operates on the impedance principle and permits of extremely accurate readings being made of the moisture content of a material being tested.

Also mounted on the control board 6 below the moisture meter are pressure control handles 11 and 12. The control handle 11 controls an air pressure supply valve connected in air pressure supply pipes 13 and 14, connected at one end to a suitable source of air pressure and at the other end to the opposite ends of an air pressure cylinder 15, to permit air to be alternately admitted into the cylinder on opposite sides of an operating piston mounted on the inner end of a piston rod 16 which projects out of one end of the cylinder 15. Secured on the projecting end of the piston rod 16 is an L-shaped or angled material snubbing and trapping head, comprising an end closure flange 17 and a top closure flange 18 for shutting one end and the top of a testing cell hereinafter to be described. As illustrated in Figure 6, the top closure flange 18 of the snubbing head is provided with inside guide grooves 19. The lower end of the snubbing head end flange 17 is provided with a V-shaped notch 20 (Figure 5) to permit the snubbing head to be guided in its reciprocating movement over the top ridge of an angle cross-sectioned supporting rail 21.

The supporting rail or base 21 forms the supporting base of the material sampler unit which is located beneath the material supply hopper 4 and above the conditioning bin 2 and is secured in its selected position upon supporting brackets 22 secured horizontally to the framework of the sand mixing machine.

As clearly illustrated in Figure 2, the air cylinder 15 is supported by means of brackets 23 upon the supporting rail 21.

The control handle 12 mounted on the control panel 6 is connected for operating an air control valve mounted in air supply tubes or pipes 23 and 24 connected at one end to a source of air pressure and having the other ends connected to opposite ends of an air pressure cylinder 25 supported by means of brackets 26 upon the supporting rail 21, in alignment with and opposite the air cylinder 15, as clearly illustrated in Figure 2.

When the control handle 12 is actuated air pressure is adapted to be alternately admitted into opposite ends of the air cylinder 25 to cause slidable operation of a piston within the cylinder 25 and a piston rod 27 connected therewith. The piston rod 27 projects slidably out of one end of the cylinder 25 and has secured on the outer end thereof a sand sample ramming head or plunger 28.

The air pressure operated ramming head 28 is positioned to register in one end of a sand sampler trapping chamber 29 provided in a channel-shaped sand trapping cell positioned between the cylinders 15 and 25 and beneath the outlet end of the material supply hopper 4 directly in the path of flow of a batch or charge of sand or material from the hopper 4 to the crib 2.

The sand sampler cell comprises a channel-shaped cell base 30 having a substantially angle-shaped bottom 31 shaped to seat over the supporting rail 21 and secured thereto by bolts or other suitable fastening means. Seated in the channel-shaped cell base 30, inside of and con-

tacting the inner walls of upright flanges thereof, are two spaced oppositely positioned insulation cell walls 32 which are secured in place by means of screws or other suitable fastening means. Secured upon the top edges on both ends of the cell walls 32, by screws or other suitable fastening means, are guide plates 33 having projecting margins adapted to engage in the guide grooves 19 of the snubbing head top flange 18 when the snubbing head is slidably moved into interfitting engagement with the sand trapping cell to trap a batch of sand within the chamber 29.

For the purpose of testing the moisture content of the batch of sand trapped in the chamber 29 of the testing cell each of the testing cell walls 32 is drilled to provide an opening which is threaded for the threaded reception of an electrode 34. The two electrodes are positioned opposite one another so that the inner ends thereof are flush with the inner surfaces of the cell walls 32. Each of the electrodes 34 is provided with an outwardly projecting brass stud or terminal post 35. Connected to the electrode terminal studs 35 are wires 36 and 37 which lead to the control board 6 and are connected to suitable terminals forming part of the moisture meter 10.

Attention is called to the fact that the diameter of the air cylinder 15 is greater than the diameter of the air cylinder 25, so that the air pressure operating the snubbing head 17-18 is greater than the air pressure operating the ramming head 28. This arrangement is necessary to permit a sample of sand which is caught in the testing cell chamber 29 to be trapped in said chamber by engagement of the snubbing head over the top of the testing cell and against one end thereof. The control handle 12 is then operated to cause the ramming head or plunger 28 to move inwardly within the cell chamber 29 under a lower pressure than that which holds the snubbing head in position, so that the trapped sand is packed or compressed within the cell and between the oppositely positioned electrodes 34. This causes the moisture meter 10 at the remote control station or in the master board 6 to cause the meter hand to move over the dial of the meter to register the percentage of moisture in the sample of sand or the quantity of water required to be added to the batch of sand in the machine bin 2, depending upon the type of moisture meter which is used.

From the foregoing description of the invention it will be noted that the material sampler and moisture tester unit may be used in connection with a foundry sand conditioning system such as illustrated in Figure 1, or in connection with any other material treating system in which it is desired to ascertain the moisture content of the material to be treated or used.

In the present disclosure of the sampler and moisture tester the sand sampling unit of the invention is mounted beneath the discharge gate 5 of the hopper 4 and above the machine sand receiving crib 2 or, if preferred, the sampling cell may be mounted within the crib 2 so that moisture test readings may be taken before or during mixing and mulling operations of the machine. It will of course be understood that the sampler section of the testing unit may be located, if desired, at the source of supply of the material which is to be tested for moisture content and that the moisture meter 10 and the control handles 11 and 12 may be located at any convenient position to permit reading of the

moisture meter to determine the moisture content of the material of which a sample is being tested.

The operation of the moisture testing unit, when used in connection with a foundry sand conditioning system such as illustrated in schematic form in Figure 1, is quite simple. Normally, the snubbing head 17-18 and the ramming head 28 are in the retracted positions as illustrated in Figure 2, thereby leaving the cell open. When the cycle of operations of the conditioning machine is started the release gate 5 is opened, thereby permitting the batch of material in the feed hopper 4 to drop by gravity into the treating crib 2. Since the sample cell is directly in the path of the entering charge of sand or other material which is being tested, a quantity of the sand enters the moisture testing chamber 29 of the testing cell. At this point in the cycle the attendant at the remote control station or at the point where the control board 6 is located grips the handle 12 and swings the same to permit a charge of compressed air to enter the cylinder 15 by way of the pipe 14 to cause the snubbing head 17-18 to move from the position illustrated in Figure 2 into the position illustrated in Figure 4 to trap a sample of the sand in the cell by closing both the top and one end of the cell opposite the ramming head 28. Practically simultaneously with the operation of handle 12 the operator actuates the handle 11, thereby admitting a charge of compressed air into the cylinder 25 by way of the air pipe 23, thereby causing the ramming head 28 to project into the testing chamber 29 and toward the snubbing head flange 17 to ram and compress the sample of sand within the chamber 29 between the two electrodes 34.

Since the diameter of the air cylinder 15 is greater than the diameter of the air cylinder 25 the inward movement of the ramming head 28 does not disturb the position of the snubbing head 17-18. As soon as the sample of the sand or material to be tested is trapped within the cell the attendant is permitted to almost instantaneously read the moisture meter 10, the hand of which moves over on the meter dial and indicates either the percentage of moisture in the sand or the gallons of water required to be added to the batch of sand which has been delivered into the mixing and mulling crib 2 of the machine.

As soon as the moisture content reading has been taken from the moisture meter 10 the attendant operates the handle 12 to permit a charge of compressed air to enter the cylinder 15 by way of the air pipe 13, thereby causing retraction of the snubbing head 17-18 and allowing the ramming head 28, which is still under air pressure, to continue its movement through the testing cell, thereby causing discharge of the trapped sample of sand out of the cell and permitting the sand to drop into the crib 2. As soon as the testing cell has been emptied the attendant actuates the throw handle 11 to permit a charge of compressed air to enter the cylinder 25 by way of the pipe 24, thereby causing retraction of the ramming head 28 back into its normal position as illustrated in Figure 2.

It will thus be noted that by use of the improved moisture testing unit the amount of liquid which is to be added to a batch of sand which is being conditioned in the machine may be definitely determined without any guesswork.

In the use of the moisture content tester, on a

material, it is not necessary to make a moisture test of each batch of sand or material which is delivered to the crib 2. The moisture tests are left to the discretion of the attendant. If it is desired to obtain moisture content readings during the mixing and mulling operations of the sand conditioning machine, the moisture content testing cell may be located within the crib 2 so that samples of the batch may be taken when desired to determine the moisture content as the conditioning process advances.

While the improved moisture content sampler and tester is illustrated and described in connection with a foundry sand reconditioning system, it will be understood that the moisture tester may be used in connection with the obtaining of the moisture content of any other kind of material.

The moisture tester unit may be of the portable type for moisture content determination in heap of facing sands, or for laboratory test work, and for other purposes.

It will of course be understood that various details of construction may be varied through a wide range without departing from the principles of this invention, and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. A material moisture content tester comprising a cell for receiving a sample of material to be tested, members movable inwardly from opposite ends of the cell for trapping and compressing the sample of material, pressure actuated means for governing the operation of said members to hold one of said members in place against the pressure exerted by the other of said members, electrodes supported by the cell in position to be contacted by the sample of material trapped therein, a moisture content indicating meter connected with the electrodes, and control means for the pressure actuated means to first cause trapping of a sample of material in the cell and then causing discharge of the sample from the cell.

2. A material moisture content tester comprising a support, a material receiving cell thereon, fluid pressure mechanisms on said support, pressure members operable by the fluid pressure mechanisms to project into one end of the cell and against the other end of the cell to trap and compress a sample of material therein, and control means for the fluid pressure mechanisms to cause the same to actuate said pressure members first in one direction and then in opposite directions at predetermined times.

3. A material moisture content tester comprising a support, a material receiving cell, fluid pressure mechanisms on said support on opposite ends of the cell and including fluid cylinders and piston rods, pressure members on said rods and operable by the fluid pressure mechanisms to coact with opposite ends and the top of the cell to trap and compress a sample of material therein, controls for the fluid pressure mechanisms to cause the same to actuate said pressure members, and a moisture content registering mechanism connected with the cell for indicating the moisture content of the sample of material trapped therein.

4. A material moisture content tester comprising a support, a material receiving cell, fluid pressure mechanisms on said support, pressure members operable by the fluid pressure mechanisms to coact with the cell to trap and compress

a sample of material therein, control means for the fluid pressure mechanisms to cause the same to actuate said pressure members, electrodes supported in opposite insulation walls of the cell and contacted by the material trapped therein, and a moisture content indicator connected with the electrodes to register the moisture content of the material trapped in the cell.

5. A material moisture content tester comprising a support, a material receiving cell mounted on the support, head members associated with the cell, control means for actuating the head members to coact with opposite ends and the top of the cell to trap a sample of material in the cell and for emptying the cell by the retraction of one of the head members and the continued advance of another of the head members through the cell after the test has been completed, and electric means connected with the cell and operable through the medium of the sample of material trapped in the cell to indicate the moisture content of the material.

6. A material moisture content tester comprising a support, a cell mounted thereon, a ramming head associated with one end of the cell, a snubbing head coacting with the opposite end of the cell, fluid pressure means for operating said heads, and control means for selectively causing operating of the fluid pressure means to first cause said heads to trap and compress a sample of material in the cell and then to empty the cell.

7. A material moisture content tester comprising a support, a channel shaped cell mounted thereon, a ramming head associated with one end of the cell, a snubbing head coacting with the opposite end of the cell, fluid pressure means of different intensities for selectively operating said heads first in opposite directions and then in the same direction, control members for selectively causing operation of the fluid pressure means to first cause said heads when moving in opposite directions to trap and compress a sample of material in the cell and when moving in the same direction to empty the cell, and an electric device connected with the cell and controlled by the medium of the sample of material trapped in the cell to register the moisture content of the trapped material.

8. A material moisture content tester comprising a base, a cell supported thereon, heads coacting therewith for compressing a material to be tested in said cell, pressure means connected with said heads, controls for the pressure means to selectively cause actuation of said heads first in opposite directions to first compress the material in the cell and then in the same direction to discharge the material from said cell, electrodes in the cell connected by the compressed material to be tested, and a moisture content indicating unit connected with the electrodes for registering the moisture content of the material in said cell.

9. A material moisture content tester including a cell for receiving a sample of the material to be tested, head members for closing the cell and compressing the sample, and pressure controls of different intensities for selectively actuating said head members to first compress the sample and then release and retract the head member under the greater pressure and allowing the remaining head member under less pressure to first continue movement through the cell to discharge the sample therefrom and then retreat back through the cell to clear the same.

10. A material moisture content tester including a cell for receiving a sample of the material

to be tested, an open circuit moisture content indicator connected with the cell, head members for closing the ends and the top of the cell and compressing the sample, and pressure controls of different intensities for selectively actuating said head members to move the same toward one another to first compress the sample between the head members to close the indicator circuit and register the moisture content of the material,

and then release and retract the head member under greater pressure and allow the remaining head member under less pressure to first continue through the cell to discharge the sample therefrom and break the indicator circuit, and then to retreat back through the cell to clear the same.

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