

Sept. 16, 1958

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2,852,740

MOISTURE CONTROL DEVICE FOR CONCRETE MIXERS

Filed Dec. 5, 1952

Fig 1

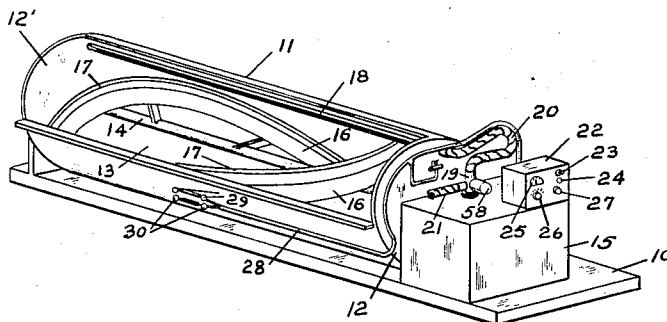


Fig 2

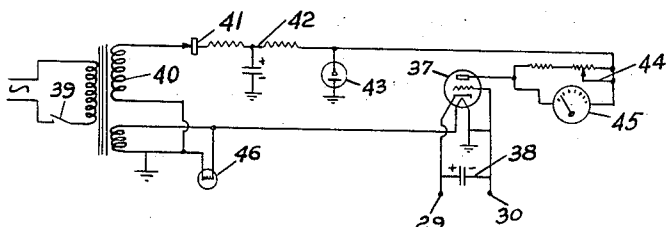


Fig 4

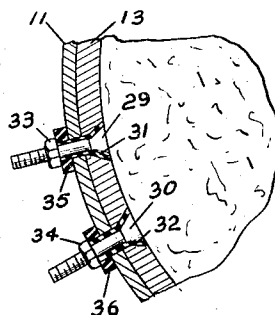


Fig 3

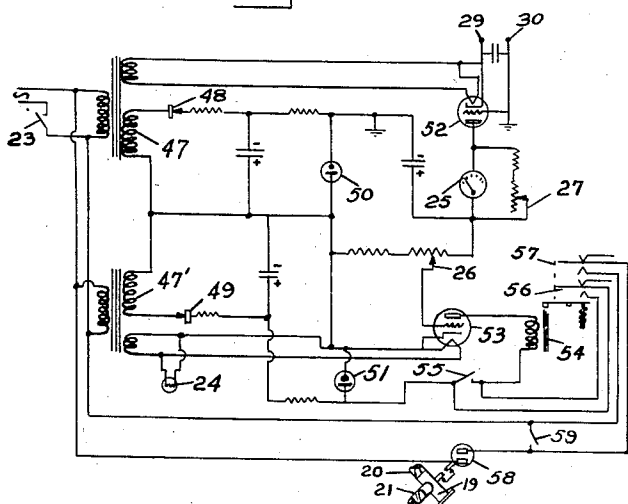


Fig 5



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MOISTURE CONTROL DEVICE FOR CONCRETE MIXERS

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Application December 5, 1952, Serial No. 324,230

4 Claims. (Cl. 324—65)

This invention relates to a moisture control device for concrete mixers, and more particularly to a device for ascertaining and controlling the amount of water added to a batch of concrete being commingled therewith in a mixer.

Since the sand and gravel which are ingredients of concrete are handled and shipped in the open, the water content thereof continually varies, thus rendering it difficult to estimate the amount of water contained by this sand or gravel at the time it is placed in a concrete mixer. Hence, it is equally difficult to estimate the proper amount of water to be added in making a batch of concrete. This problem is most acute when it is desired to manufacture a semi-dry mix.

In the past, devices have been built which attempt to measure the electrical resistivity of material in a concrete mixer, but these devices have not proved satisfactory since the resistivity of the electrodes themselves vary to such a degree that the reading obtained by the prior art devices were unreliable. This unreliability is especially true in machines mixing the so-called wet mix concrete.

The concrete industry has long needed and searched for a positive and practical method for determining the amount of water which is in a mixture at all times during the process of mixing of concrete.

Accordingly, it is an object of our invention to provide a concrete mixer with a moisture indicating and control device which will feed water into the mixer until the proper moisture content of the concrete batch is attained.

Another object of our invention is to provide an automatic moisture control and indicator device in combination with a concrete mixing machine wherein the electrodes of the device are continually cleaned so that a substantially accurate reading may be obtained therefrom at any time.

Another object of our invention is to provide a sensitive moisture indicator and control device which is simple in design, durable in structure, dependable in operation and economical to maintain.

Other and further objects and advantages of our invention will become apparent from the following description when taken in conjunction with the accompanying drawings wherein like characters of reference designate corresponding parts throughout the several views, and wherein:

Fig. 1 is an isometric view of an automatic mixing machine with a moisture control device constructed in accordance with our invention.

Fig. 2 is a wiring diagram of a moisture indicating device which is adapted to be incorporated in the machine illustrated in Fig. 1.

Fig. 3 is a schematic wiring diagram of the moisture indicator and control mechanism incorporated with the mixing machine illustrated in Fig. 1.

Fig. 4 is an enlarged cross-sectional view of a detail showing the positioning of the electrodes.

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Fig. 5 is a view of a detail showing the blade of the machine illustrated in Fig. 1.

Referring now in detail to the embodiment chosen for purpose of illustration, numeral 10 denotes a platform supporting a concrete mixing machine of the rotary blade type having a cylindrical outer housing 11 provided with ends 12, 12'. Housing 11 is provided with an inner liner 13, and a shaft 14 is supported axially by ends 12, 12' so as to be driven by a motor (not shown) in motor box 15. Helical blades 16 connected to shaft 14 are positioned to sweep adjacent lining 13 as shaft 14 is rotated.

To the prior art machine described above, we have provided an insulating edge 17 along the outer edges of blades 16 as more readily seen in Fig. 5. This insulating edge is preferable, when our concrete mixer is used for mixing a "wet mix," but may be eliminated when our machine is used for mixing a "semi-dry mix," the function thereof being described in detail later. Along the top of housing 11 is a transverse sprinkler pipe 18 which is supported by ends 12, 12' and through which water may be added to a batch of concrete within the mixer. For supplying water to pipe 18, we have provided a control valve 19, connected to pipe 18 through flexible hose 20, water being supplied to valve 19 by water inlet pipe 21. It is to be understood that water inlet valve 19 may either be manually operated or magnetically operated depending on whether or not the moisture indicating device as illustrated schematically in Fig. 2 or the moisture control and indicating device as illustrated schematically in Fig. 3 is used.

In Fig. 1, numeral 22 denotes a cabinet containing the moisture indicator and control device illustrated schematically in Fig. 3 and is shown as comprising an on-off switch 23, a pilot light 24, a moisture indicating meter 25, a moisture cut-off regulator 26 and a zero shunt adjustment 27. It should be pointed out that the indicating device illustrated schematically in Fig. 2 may be mounted in place of the device in Fig. 3.

A cable 28 having two wires, leads from panel 22 and each wire is respectively connected to pairs of electrodes 29 and 30 located centrally on the lower portion of housing 11. As seen more clearly in Fig. 4, electrodes 29 and 30, respectively, extend through insulating bushings 31 and 32 and terminate in wide flat heads which are flush with the inside periphery of lining 13. Nuts 33 and 34 are respectively threaded to the portions of electrodes 29 and 30 which extend outside housing 11, and insulating washers 35 and 36 between these nuts and housing 11 prevent electrical short circuiting of the electrodes.

It is apparent from the foregoing description that when our mixing machine is in operation, blades 16 will pass adjacent electrodes 29 and 30 thereby preventing faulty readings due to caking of the concrete mix in the area of the electrodes. As described above, when a so-called "wet mix" is being prepared, it is preferable to provide insulating edges 17 for blades 16 so that edges 17 will wipe against electrodes 29 and 30 to prevent caking which is more pronounced as the moisture contained therein is increased.

Indicating device

Since the electrical resistivity of the concrete mix within the mixer is a function of the moisture content of that mix, as illustrated schematically in Fig. 2, we have connected electrodes 29 and 30 to the cathode and grid of a triode tube 37 with a condenser 38 shunted across the electrodes to minimize current oscillation. By providing substantially constant potential between plate and grid of tube 37, the resistivity of the concrete mix may be read as a function of the current flowing between the cathode

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and the plate; therefore, we have provided a circuit comprising an on-off switch 39 which feeds alternating current to transformer 40. In order to obtain substantially constant D.-C. potential from transformer 40, we have provided a rectifier 41 in series with an R-C filter 42 and whose output voltage is regulated by voltage regulator 43, across the D.-C. output. The positive lead of this circuit is connected to the plate of tube 37 through an ammeter consisting of a variable shunt 44 in parallel with a galvanometer 45. The negative side of this circuit leads to the grid which in turn renders electrode 30 negative. The filament of tube 37 is heated in conventional manner with pilot light 46 being provided in that circuit to indicate that the device is operating.

Now it can be seen that when our machine is placed in operation and switch 39 is closed to provide current to our circuit, the grid bias is sufficiently negative to allow substantially no current to pass in the main circuit, thus the ammeter will not register. However, as liquid is added to the mix, the grid bias becomes less negative and allows current to pass in the circuit thus giving a reading on the ammeter. It can readily be seen therefore that by calibrating galvanometer 45 with respect to the percentage of water in the concrete mix, the indicating device disclosed can easily be used to determine the proper amount of water in the concrete mix.

Indicator and control device

In order to automatically control valve 19, we have provided a circuit illustrated schematically in Fig. 3 which is responsive to the percentage of moisture in the concrete mix to thereby open or shut valve 19. In this circuit, on-off switch 23, when closed furnishes current to transformers 47 and 47', each respectively having rectifiers 48 and 49 as well as R-C filters and voltage regulators 50 and 51. Therefore, it can be seen that substantially constant D.-C. potential is provided by these two transformers.

As illustrated, transformer 47 furnishes current for triode 52 with the grid of this triode being connected to electrode 30 and also the negative side of the circuit, through ground. The positive side of the circuit, on the other hand, is connected to the plate of triode 52 through an ammeter and a potentiometer, the ammeter consisting of moisture indicating meter 25 and a zero shunt adjustment 27 in parallel, the potentiometer being moisture cut-off regulator 26. Electrode 29 is connected to the cathode of the triode 52 with the filament being heated in conventional manner. Therefore, it is apparent that a negative bias exists between the grid and cathode of triode 52 and that this negative bias will decrease as the resistivity of the concrete mix decreases and current will pass in the circuit, thus giving an indication on meter 25 which is a function of the amount of moisture in the concrete mix.

Looking now at the circuit connected with transformer 47', it is seen that the cathode of a second triode 53 is connected to the negative side of this circuit while the plate of triode 53 is connected through relay 54 and "start" switch 55 to the positive side of the circuit. As seen, "start" switch 55 is normally open; therefore, current will not normally pass in this circuit until switch 55 is closed at which time switches 56 and 57 will be closed by relay 54, provided current is passing through triode 53. Thus, assuming that current is passing in triode 53, when switch 55 is depressed, current will continue to pass even though "start" switch 55 is then opened. Current will pass through switch 55 which is held closed by relay 54. Referring to potentiometer 26, it is seen that the positive side of transformer 47 and the negative side of transformer 47' form a common lead through this potentiometer and that a center tap from the potentiometer leads to the grid of triode 53. Therefore, it may be seen that the grid of triode 53 will normally be negative with respect to the cathode of that tube; thus, current will normally pass within tube 53. It should be remembered,

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however, that as moisture is added to the mix in the mixer, the current flowing through triode 52 will oppose the current flowing in tube 53 and thus increase the negative bias of the grid in tube 53, thereby decreasing the current flowing through relay 54 until this relay opens. It is apparent that by varying the positioning of the tap on potentiometer 26, that the amount of current flowing in tube 53 which would cause relay 54 to open, may be varied. An examination of Fig. 3 will indicate that switch 57 which is closed by the closing of relay 54 operates to close a circuit furnishing current to magnetic control 58 which in turn opens valve 19.

It is apparent from the foregoing description that when on-off switch 23 is closed, and "start" switch 55 depressed, valve 19 will be opened until the resistance of the concrete mix drops to a predetermined point at which time magnetic control 58 will no longer be actuated and thus allow valve 19 again to close under spring pressure.

In event that valve 19 does not operate automatically as described above, bypass switch 59 which will furnish current directly to control 58, may be closed to open valve 19.

It will be obvious to those skilled in the art that many variations may be made in the embodiment chosen for purpose of illustration without departing from the scope of our invention as disclosed by the following claims.

We claim:

1. A moisture indicating device for aggregate mixers of the type having a stationary casing and rotating agitator blades, said device comprising a plurality of electrodes extending through the central portion of said casing, said electrodes being provided with wide flat heads which are flush with the inner periphery of said casing, insulating bushings between said casing and said electrodes, said blades being positioned to sweep over said electrodes, a triode electronic tube, the cathode of said triode being electrically connected to certain of said electrodes, the grid of said triode being connected to other of said electrodes, an ammeter in series with the plate of said triode and calibrated to indicate percentage of moisture in aggregates contacting said electrodes, means providing substantially constant direct current to the plate of said triode through said ammeter and also to the grid of said triode, and a condenser electrically connected between said electrodes to prevent rapid current fluctuation of current between said electrodes.

2. The device as claimed in claim 1 wherein insulating edges are provided on said agitator blades to wipe the heads of said electrodes as said blades rotate.

3. A moisture indicating device for aggregate mixers of the type having a stationary casing and rotating agitator blades, said device comprising a plurality of electrodes extending through a wall of said casing, said electrodes being provided with heads which are substantially flush with the inside periphery of said casing, insulating bushings between said casing and said electrodes, a triode electronic tube, the cathode of said triode being electrically connected to certain of said electrodes, the grid of said triode being connected to other of said electrodes, an ammeter in series with the plate of said triode and calibrated to indicate percentage of moisture in aggregates contacting said electrodes, means providing substantially constant direct current to the plate of said triode through said ammeter and also to the grid of said triode, and insulating edges on said agitator blades to wipe the heads of said electrodes as said blades rotate.

4. A moisture indicating device for aggregate mixers of the type having a stationary casing and rotating agitator blades therein, said device comprising a plurality of electrodes extending through a wall of said casing to contact aggregates therein, said electrodes being provided with heads which are substantially flush with the inner periphery of said casing, insulating bushings between said casing and said electrodes, an electrical circuit including an ammeter connected to said electrodes, said

ammeter being calibrated to indicate percentage of moisture in aggregates contacting said electrodes, and insulating edges on said agitator blades to wipe the heads of said electrodes as said blades rotate.

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