July 19, 1949. J. G. A. JOHNSON 2,476,551

APPARATUS AND METHOD FOR AERATING CONCRETE

Filed April 24, 1947

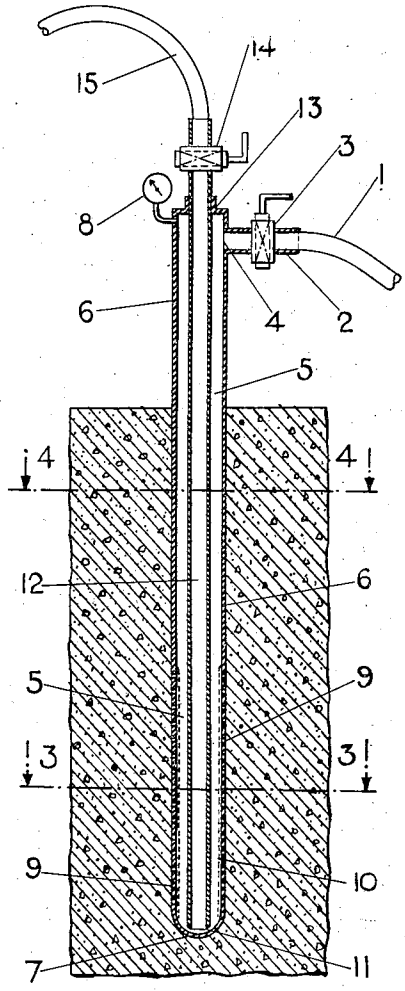


FIG. 1.

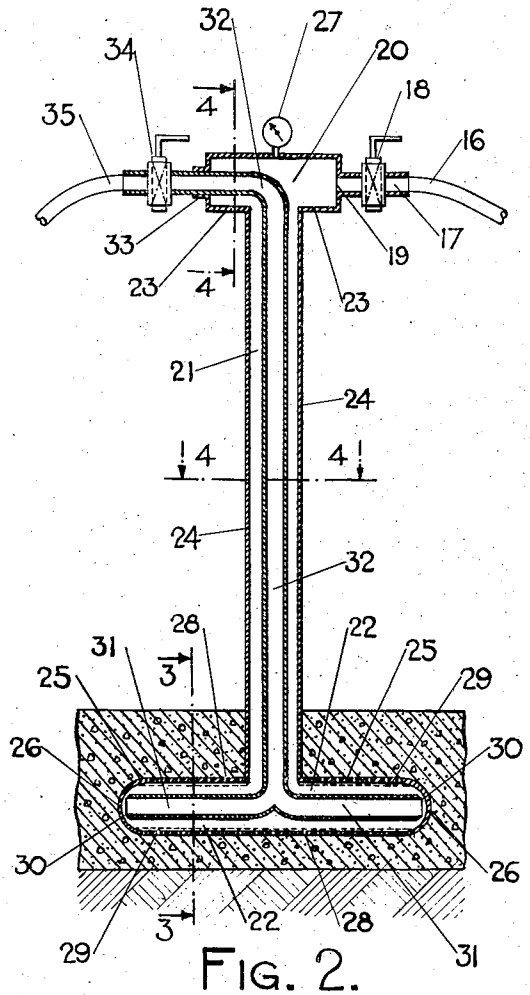


FIG. 2.

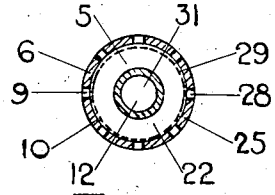


FIG. 3.

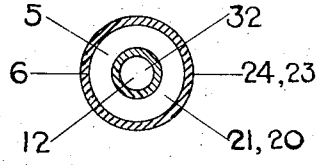


FIG. 4.

WITNESSES.

Gunnar C. Engstrand

Gunborg M. Widén

INVENTOR.

J. Gunnar A. Johnson

Patented July 19, 1949 2,476,551

UNITED STATES PATENT OFFICE

2,476,551

APPARATUS AND METHOD FOR AERATING CONCRETE

John Gunnar Amandus Johnson, New York, N. Y.

Application April 24, 1947, Serial No. 743,659

3 Claims. (Cl. 25—1)

1

My invention relates to a new method and apparatus for treating concrete and other hydraulic cement mixtures after being poured in place for hardening.

It is known that pores or cells within a concrete mass increase the insulating properties of concrete and decrease its weight. My proposed treatment produces a concrete which contains a multitude of air cells distributed in its mass and it holds therefore improved qualities against heat, cold and sound transmission as compared with ordinary concrete. Due to its cellular structure it also weighs less than untreated concrete composed of the same kind of aggregates. The treatment to which I propose to subject hydraulic cement mixtures before setting is applicable to wall and slab construction poured in situ and to precast concrete and artificial stone products. My proposed method of treatment also offers effective means of attaining and controlling the degree of porosity desired for different requirements and different types of applications.

The object of my invention is therefore to provide a method and apparatus for creating air cells within a plastic concrete mass. I accomplish this result by injecting compressed air into the wet concrete, using an air pressure equal to or higher than the fluid pressure of the concrete at the depth at which the air injection is applied, while simultaneously controlling and varying the air pressure to proper operating compressions. The proportion of voids and total volume of treated concrete is controlled by varying the duration of air injection. My preferred apparatus is designed to create air pressure inside an enclosed chamber and is preferably made of rigid metal construction. This processing tool is adapted to be submerged in freshly poured concrete and is provided with perforations through which compressed air is injected into the concrete. The compressed air, which escapes through the perforations, may be dispersed thoughout the concrete mass by moving the tool horizontally or vertically or in a rotational manner during the processing operations. The volume of the mass is thus increased in proportion to the volume of the entrapped air. My preferred apparatus is also provided with an air outlet at the bottom of the air chamber leading to a pipe riser which connects to the atmosphere and a vent valve is provided at the top of the outlet pipe to control the outflow of the air. Thereby the operator has a ready means of regulating the air pressure in the chamber from a maximum pressure obtained with the outlet pipe closed to a minimum pressure with an open outlet. This arrangement permits wide variations in the compression of the air that is injected into the concrete and the operator can thus at all times quickly change the compression in the air chamber to an operating pressure corresponding to the submerged depth of the tool. Any mixing water that should accidentally enter the air chamber can readily be ejected by a free flow of air through the outlet pipe.

2

Two forms which my invention may assume are exemplified in the following description and illustrated by way of example in the accompanying drawing, in which:

Figure 1 is a section through my preferred hand operated apparatus for treating deep concrete.

Figure 2 is a section through my preferred hand operated apparatus for treating slab concrete.

Figure 3 is a cross section on the lines 3—3 of Figures 1 and 2 on an enlarged scale showing the perforated part of the compression chamber.

Figure 4 is a cross section on the lines 4—4 of Figures 1 and 2 on an enlarged scale through the upper part of the compression chamber.

In the drawing where like reference numbers designate corresponding parts Figure 1 denotes my apparatus for treating deep concrete, which is preferably made of rigid metal tube construction. It comprises a flexible hose line 1 connected to an air compressor, not shown on the drawing, an entrance pipe 2 to the tubular body 6, which is provided with an air valve 3 and an opening 4 to the annular elongated compression chamber 5. The perforations 9 are provided in the lower portion of pipe 6 and inside the pipe a screen 10 is placed so as to prevent solid materials from entering the chamber through the perforations. An air pressure gauge 8 is preferably connected to the upper part of chamber 5. The outlet pipe 12 runs through the tubular body 6 with a restricted opening 11 close to the bottom 7 of the chamber 5 and it is shown secured to the upper end of the tubular body 6 by the connection 13. An air vent valve 14 is placed at the upper end of the outlet pipe 12 and a flexible exhaust hose 15 may be attached to pipe 12 when desired.

In Figure 2, which illustrates my apparatus for treating slab concrete, 16 denotes a flexible hose line connected to an air compressor, not shown on the drawing, 17 an entrance pipe connected to the tubular handle 23, 18 is an air con-

trol valve and 19 is the entrance opening to the upper part of the compression chamber. The compression chamber is composed of three parts, the top part 20 inside the tubular handle 23, the annular elongated duct 21 and the two symmetrical lateral extentions 22. The compressed air enters part 20 of the compression chamber and flows through the duct 21 down into the lower horizontal extensions 22, the walls 25 of which are provided with perforations 28 and a screen 29 is placed so as to prevent solid materials from entering the chamber 22. An air pressure gauge 27 is shown connected to the upper end of the chamber. The branch pipes 31 are inserted in the lateral extensions 25 and reach close to the ends 26 thereof so as to form a restricted inlet 30 thereto. The branch pipes combine into a riser pipe 32 which is provided with a connection 33 to the tubular handle 23. An air vent valve 34 is placed at the end of the pipe 32 to which an exhaust hose 35 may be attached.

The operation of my preferred apparatus is as follows: The air compressor is started and the air valve on the entrance line is opened. The air is compressed into the air chamber and as the tool is lowered into the concrete the air escapes into the mix through the small openings in the air chamber wall. The operator can readily adjust the compression to suit the known physical properties of the particular type of cement mixture being treated. This is done by observing the pressure indicated on the gauge and varying the pressure by means of the air outlet valve. It is a known fact that when compressed air is injected into water through a small opening the air will enter the water as a train of bubbles. The same action takes place in my preferred tool when the air pressure is rightly adjusted. However, without departing from the scope of my invention, a more positive insurance for a bubbling air injection is provided for in a tool in which a pulsating air pressure is created. I prefer to cause such a pulsating air injection by either a rotating valve element or a reciprocating piston action that intermittently admits the air into the tool chamber. The tool is preferably moved back and forth or up and down in the plastic concrete and may be provided with a rotating air chamber in order to still further aid the distribution of the air bubbles.

It is to be noted that I do not limit my invention to the forms shown on the drawing as it is

evident that alterations may be made in the modus operandi and in the construction of my device without departing from the spirit and scope of my invention. Inasmuch as I use a combination of known elements to achieve a new and useful result I do not only claim the apparatus as part of my invention but also the method described in the specification.

Having now described my invention, what I claim as new therein and desire to secure by Letters Patent as follows:

1. The method to aerate a plastic concrete mix prior to its setting characterized by injecting compressed air into the concrete mass by creating alternating low and high pressures, the low pressure substantially equal to or lower than the fluid pressure in the concrete and the high pressure higher than the fluid pressure therein, while controlling the pressure of the air that is injected into the concrete.

2. The method to aerate a plastic concrete mix prior to its setting characterized by injecting compressed air into the concrete mass by creating alternating low and high pressures, the low pressure substantially equal to or lower than the fluid pressure in the concrete and the high pressure higher than the fluid pressure therein, while controlling the pressure of the air that is injected into the concrete and moving the air injection to further the distribution of the compressed air.

3. An apparatus adapted to inject compressed air into a plastic concrete mass prior to its setting comprising in combination an air chamber, a perforated wall thereof to contact the concrete, a screener for the perforations, an outlet line from the bottom thereof, a restricted inlet to said line and an air control outlet valve.

J. GUNNAR A. JOHNSON.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,702,076	Ericson	Feb. 12, 1929
2,215,223	Lytle	Sept. 17, 1940
2,251,687	Norton	Aug. 5, 1941

FOREIGN PATENTS

Number	Country	Date
1,813	Great Britain	July 31, 1856