Feb. 14, 1939. W. D. OWSLEY 2,147,053

CEMENT MIXER

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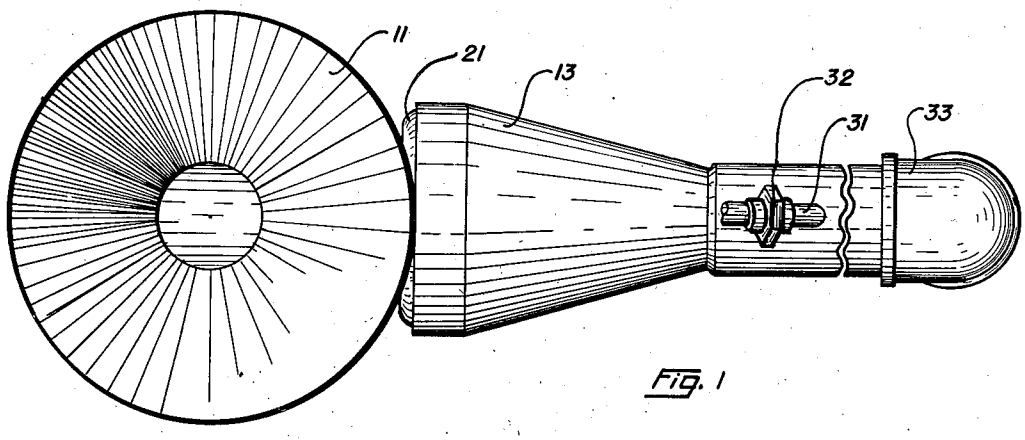


Fig. 1

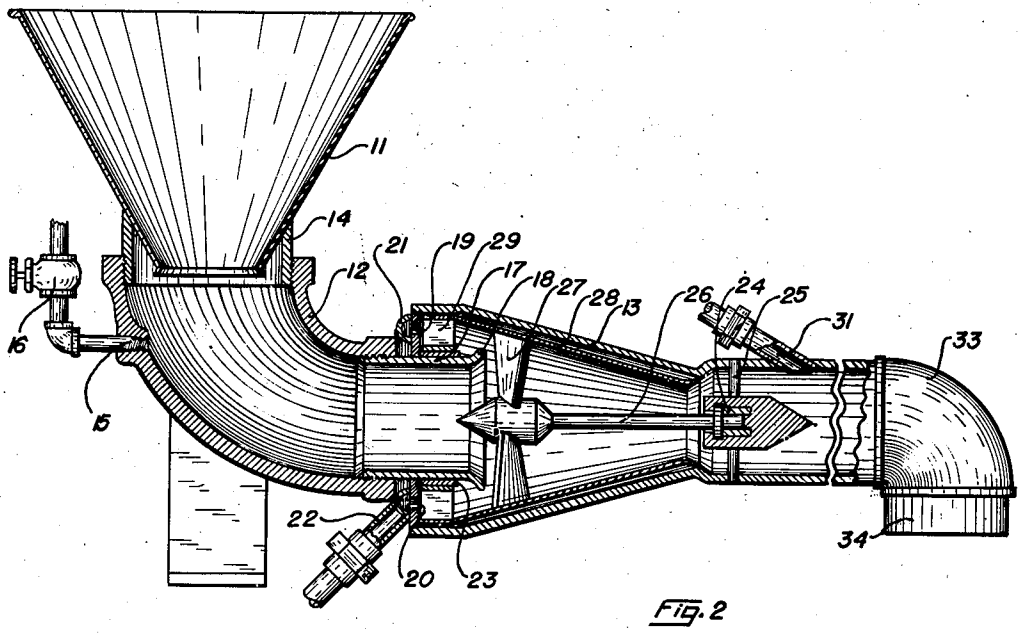


Fig. 2

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CEMENT MIXER

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8 Claims. (Cl. 259—151)

This invention relates to mixing solids and liquids, and more particularly to means and methods for quickly, accurately and intimately mixing cement and water.

Means and methods for hydrating cement, using a jet of water, are well known and are particularly useful where high speed mixing is required as in the cementing of oil wells. Apparatus for this purpose is disclosed in the U. S. patents to Halliburton, Nos. 1,486,883 and 1,500,385.

The present invention relates to cement mixing apparatus and methods which are similar to those described in the Halliburton patents just mentioned but in which a rotor is employed and driven by some or all of the water which is to be mixed with the cement.

The main objects of the invention reside in the provision of novel means and methods for mixing cement or other finely divided or pulverized material with a liquid, such as water, in order to obtain an even consistency in the mixture, with accurate control of the proportioning, and which mixes the materials rapidly and thoroughly.

It is another object to provide means and methods in which suction is created on a body of cement to draw it into a mixing chamber, the amount of suction being controlled to govern the percentages of cement to water.

It is another object of the invention to employ power driven movable means to create suction to draw cement into a mixing chamber to mix it with water.

It is another object of the invention to provide a novel mixing chamber in a cement mixer, in which the cement and water will be brought into intimate contact and thoroughly mixed.

It is another object of the invention to provide a cement mixer in which a water turbine is employed to drive an agitator used in mixing the cement, the water flowing from the turbine into the agitator.

Other objects and advantages reside in certain novel features of the arrangement and method employed, as will be more apparent from the following description taken in connection with the accompanying drawing, in which:

Figure 1 is a plan view of a cement mixer constructed in accordance with the present invention; and

Figure 2 is a vertical cross-sectional view of the cement mixer shown in Figure 1.

Referring to the drawing in detail, it will be seen that the cement mixer there illustrated includes a hopper 11 which discharges into an elbow 12 to the lower and horizontal portion of which a swaged or restricted casing 13 is attached, this casing having a water turbine and an agitator mounted therein. The hopper 11 may be conical in shape and made of metal. The upper end may be provided with a screen or the like to prevent sacks or other obstructions from entering the mixer. The lower end or throat is preferably connected to a nipple 14 which is screw threaded into the elbow 12. The lower end of the hopper is preferably of smaller diameter than the nipple 14 so as to extend down into the same a slight distance, as shown in Figure 2.

It is preferable to have the axis of the mixing chamber horizontal, and for this reason, an elbow is used instead of a straight pipe in connecting the mixing chamber to the hopper. It is, of course, within the purview of the invention to have the axis of the mixing chamber vertical, however.

At a point slightly below the lower end of the hoppr 11 an air inlet duct 15 is connected to the elbow 12, this duct being open to the atmosphere but provided with a control valve 16 which may be opened or closed as desired to regulate the amount of air which enters the elbow 12 independently of any air which may enter through the hopper 11.

To connect the casing 13 and the apparatus which it contains to the elbow 12, a nipple 17 is screw threaded to the horizontal portion of the elbow. The righthand end of this nipple, as viewed in Figure 2, is preferably flared outwardly slightly as illustrated at 18. The casing 13 is welded or otherwise integrally secured to the nipple 17, an annular disc 19 being provided on the lefthand end of the casing 13 to make this connection. The disc 19 also provides means for conducting water into the turbine and the agitator within the casing 13. For this purpose the disc is provided with a number of ports or openings 20 at spaced points on its surface, equidistant from the center of the casing. To supply water to these ports a ring-shaped trough 21 is provided and welded to the disc 19. Water is supplied to the trough by means of the water conduit 22 which may be connected to a pump or other source of high pressure water supply. Within the casing 13 and supported by the nipple 17 is a bearing 23. This bearing may be of rubber and lubricated by water, but any other bearing may of course be employed.

There is but one rotating element within the casing 13. It is supported partly by the bearing 23 just mentioned and partly by a thrust bearing

24 mounted on a spider 25 at the righthand end of the casing 13, as viewed in Figure 2. The rotating element includes a shaft 26, agitator elements or propellor blades 27, a conically shaped shroud 28 and the turbine blades 29, all integrally connected.

The turbine blades 29 are mounted upon a journal fitted to the bearing 23 and have their outer ends integral with the shroud 28. In accordance with known turbine construction the blades 29 are curved and the ports 20, which act as nozzles, are disposed at such an angle that the rotor is driven counter-clockwise when viewed from the left in Figure 2.

As the water supplied to the turbine blades 29 leaves the same it will travel to the right at a high velocity, the velocity increasing as the water moves farther to the right, due to the shape of the shroud 28. The passage of the water through the shroud at this high velocity will tend to suck cement from the hopper 11 and the elbow 12 into the mixing chamber provided by the shroud. This action will be aided by the agitator blades 27. While only one set of agitator blades 27 are shown, it is obvious that more than one set may be employed and that these may extend out radially only a short distance from the shaft 26 or may consists of annular rings or segments of rings fixed to the shroud 28 but which do not extend inwardly radially to the shaft 26. Thus, any suitable system of baffles or agitating elements may be employed.

A particularly intimate and effective mixing action is attained within the shroud 28 due to the fact that this shroud is rotating and due to the fact that the water supplied to the shroud enters through the turbine blade and is directed outwardly by the flared portion 18 of the bushing 17. This water will thus form a hollow body of revolution or whirlpool on the inner surface of the shroud 28. The cement or mixture of cement and air entering the shroud will be sucked into the center of the whirlpool and then thrown outwardly by centrifugal force, due to the agitator blades 27. The cement will thus be forced into the sheet or body of water within the shroud in addition to being propelled with the water into the restricted portion of the shroud. The cement being heavier than water, it readily passes outwardly and an effective and even mixture will thus be obtained.

Since the shroud 28 is rotating with the turbine blades and the agitator blades and since there is a high velocity through the shroud, there will be but little tendency for cement to creep back between the shroud and the casing 13. The righthand end of the shroud 28 is preferably flared outwardly slightly, as illustrated, and this will also tend to prevent any cement creeping back into this annular space. However, it is preferable to so design the turbine blades 29 and to so space them from the end plate 19 that some water will be thrown outwardly from the turbine blades by centrifugal force, thus causing water to flow through the annular space between the shroud and the casing 13 in a righthand direction and thus keep this annular space clean.

In order to properly proportion the amount of water and cement, an additional supply of water may be admitted at the righthand end of the casing 13 through a duct 31 which may be controlled by means of a valve 32. Proportioning is also effected by means of the air supply through the duct 15 and the valve 16. Due to the suction created by the high velocity of the stream of water through the mixing chamber and due to the rotation of the propeller blades there will normally be less than atmospheric pressure within the elbow 12. If the valve 16 is closed, this will cause a large supply of cement to enter the mixing chamber from the hopper 11. If the valve 16 is open, there will be less suction on the cement in the hopper and less cement supplied to the mixing chamber. The valve 16 may thus control and accurately regulate the consistency of the mixture. On the other hand, by controlling the amount of water fed through the turbine supply conduit 22, the speed of rotation of the rotor may be governed to vary the suction and thus proportion the mixture. If additional water is needed to obtain the desired consistency, it may be supplied through the conduit 31.

The discharge end of the mixer is connected to an elbow 33 and to a nipple 34 which may discharge the mixture into a sump or suitable receptacle from which it may be picked up and pumped into an oil well, as described in detail in the Halliburton patents mentioned above.

Only the preferred form of the invention has been described in detail herein, but the apparatus may take a wide variety of shapes. For example the shroud 28 and casing 13 may be cylindrical rather than conical as shown, and in fact may be conical with the smaller end to the left and adjacent to the turbine's blades.

It will also be obvious that the apparatus and method may be applied to the mixing of other than cement and water and may be used to mix any finely divided material with any liquid. The use of the words "cement" and "water" in the claims are therefore intended to be merely descriptive rather than limitative.

While only one embodiment of the invention has been described herein, it is thus obvious that various changes may be made in both the apparatus and methods of mixing, without departing from the spirit of the invention or the scope of the annexed claims.

I claim:

1. A cement mixer including a passageway for the flow of cement and water, agitating means mounted for rotation within said passageway, a water turbine for driving said agitating means, means for conducting water from the turbine into said passageway, and means for supplying cement to said passageway.

2. A cement mixer including a passageway for the flow of cement and water, rotary centrifugal agitating means within said passageway, a water turbine for driving said agitating means, means for conducting water from the turbine into said passageway near the periphery thereof, and means for supplying cement to said passageway near the center thereof, said agitating means causing the cement to move outwardly into contact with the water to intimately mix the water and cement.

3. A cement mixer including a hopper, a mixing chamber, means for supplying water under pressure to said chamber, rotary means in said chamber driven by water supplied to the chamber, said rotary means having blades for creating suction therein, the combined effect of the rotary means and entrance of water in the chamber being such as to suck cement from the hopper into said chamber and means for controlling the speed of rotation of said rotary means to influence the consistency of the mixture of cement and water.

4. A cement mixer including a mixing chamber, a rotor in said mixing chamber, said rotor

having agitating elements and driving elements consisting of turbine blades mounted along the periphery thereof and means for directing water under pressure into said mixing chamber and against said driving elements to cause the rotor to revolve and to create suction within said mixing chamber.

5. A cement mixer including a mixing chamber, a conduit mounted for rotation in said mixing chamber, means for supplying cement to said conduit, means for supplying water to said conduit and means for causing the water supplied thereto to rotate the conduit.

6. A cement mixer including a hopper, a mixing chamber, a tapered conduit mounted for rotation in said chamber, means for supplying water to said conduit, means for causing the water supplied thereto to rotate the conduit and create a suction therein and means utilizing the suction thus created for causing cement to flow from said hopper into said mixing chamber.

7. A cement mixer, including a conduit, means for rotating the conduit, means for supplying water to the conduit, the conduit being adapted upon rotation to cause the water supplied thereto to assume the shape of a hollow body of revolution, and mechanical power-driven means for driving cement from inside the conduit into the body of water therein while the water has assumed the shape of a body of revolution.

8. A cement mixer, including a conduit, a water turbine for rotating the conduit, means for conveying water from the turbine to the conduit, the rotation of the conduit causing the water therein to assume the shape of a hollow body of revolution, and means also driven by said water turbine for driving cement into the body of water in the conduit while the body of water has assumed the shape of a body of revolution.

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