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[54] **METHOD FOR PLACING HYDRAULIC CONCRETE**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **61/46,** 61/53.52, 61/56.5, 61/63, 251/5

[51] **Int. Cl.** **E02d 5/40,** E02d 15/02

[58] **Field of Search** 61/63, 81, 82, 53.52, 46, 50; 106/97, 98; 138/137; 251/5

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Primary Examiner—Jacob Shapiro
Attorney, Agent, or Firm—Ostrolenk, Faber, Gerb & Soffen

[57] **ABSTRACT**

A method for placing hydraulic concrete to form a concrete structure in the water which is characterized in that a paste consisting of portland cement, fine aggregate and water is transferred to the bottom of the water through elastic and watertight tubes, each of said tubes being provided with a paste delivery apparatus having a control valve, and said control valve can be controlled from the remote place above the water surface by means of hydraulic pressure, and after the placement of the predetermined amount of the paste, said tubes are wound up for a certain height and transferring of the paste is repeated again to continue the placing.

6 Claims, 15 Drawing Figures

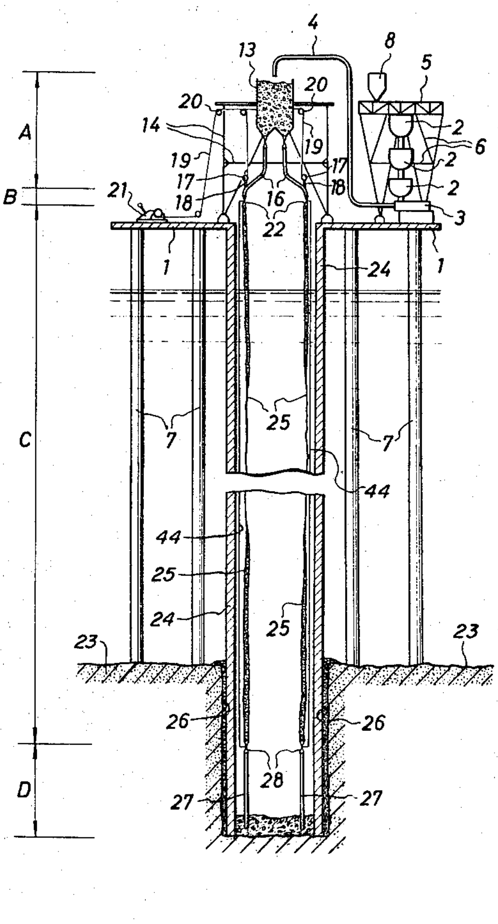

Fig.1

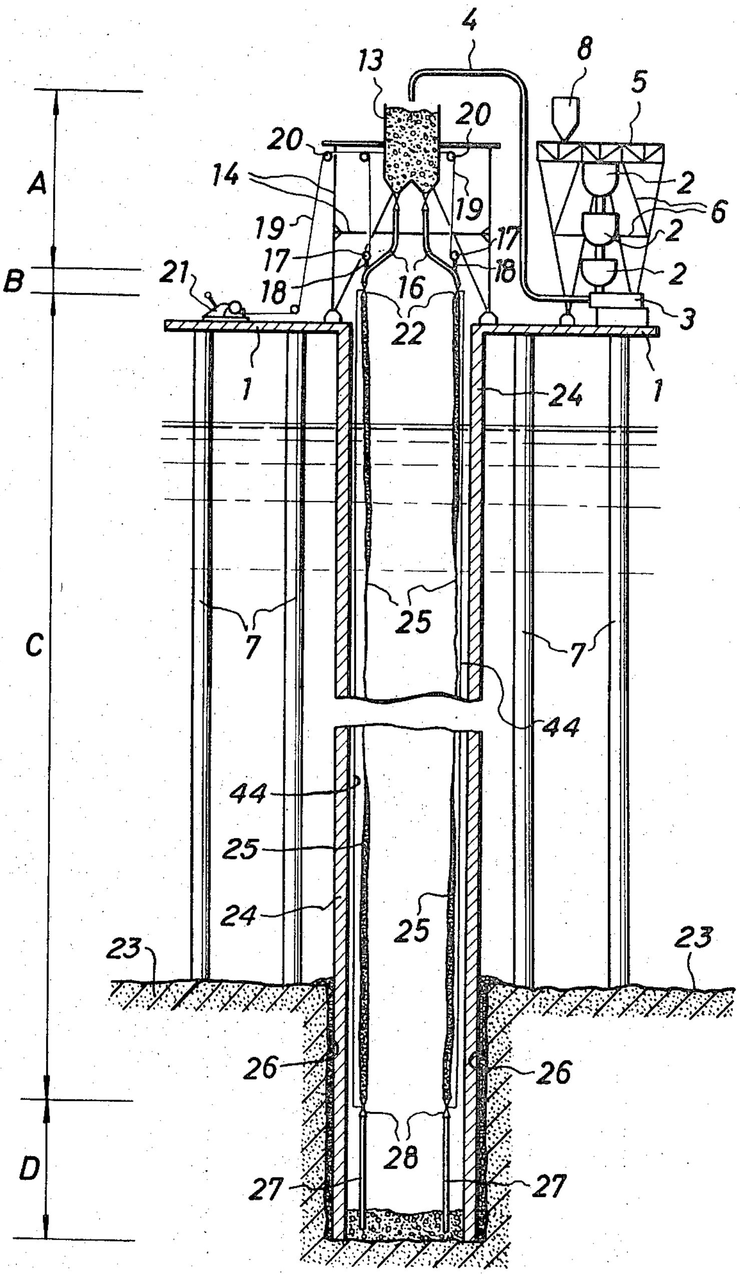
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Fig. 2

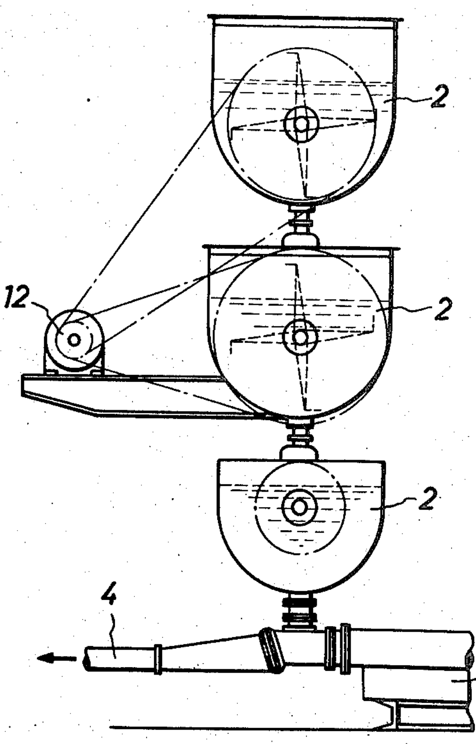

Fig. 3

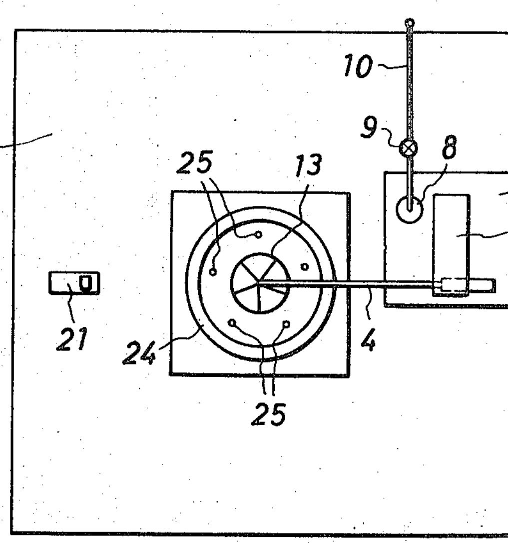

Fig.4

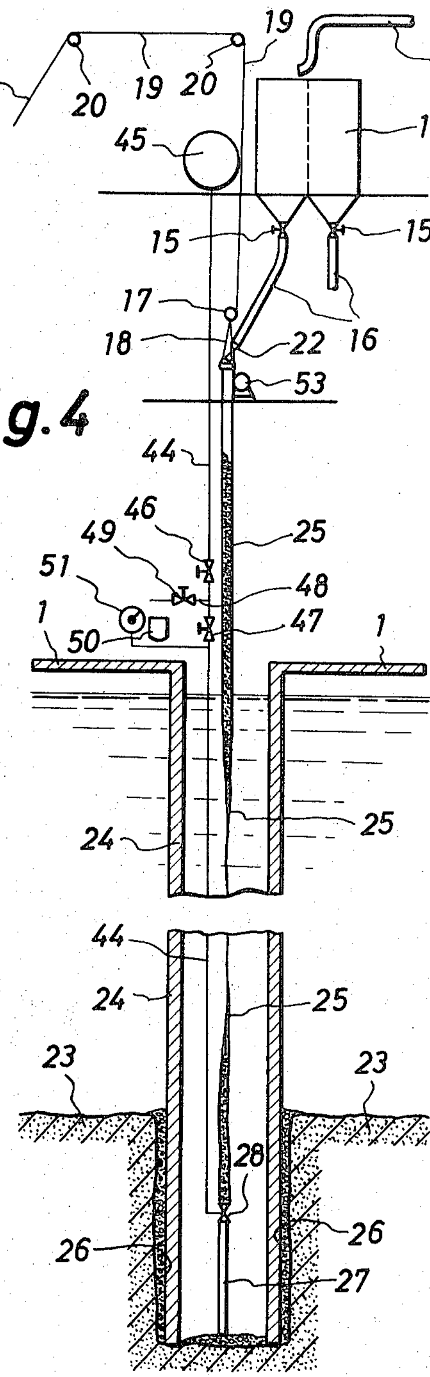
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Fig.5

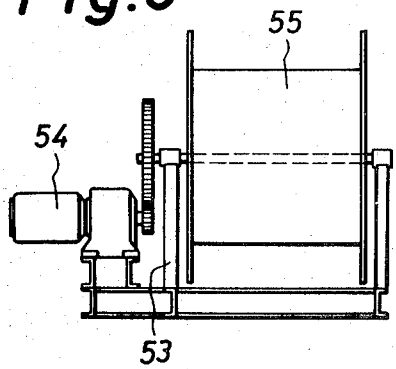


Fig.6

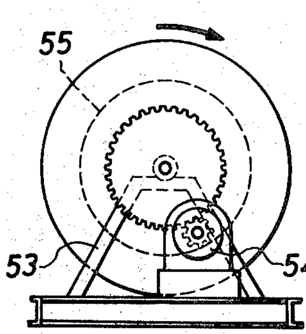


Fig.7

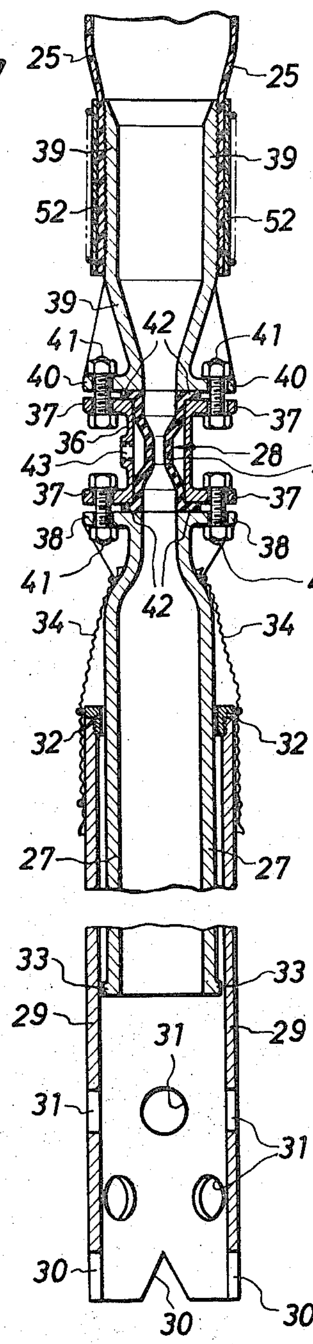


Fig.12

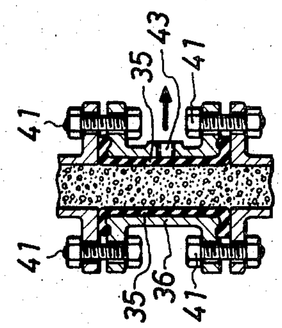


Fig.13

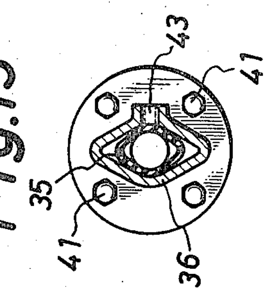


Fig.10

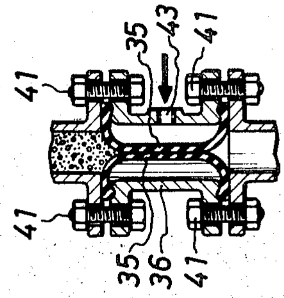


Fig.11

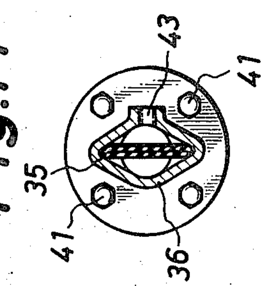


Fig.8

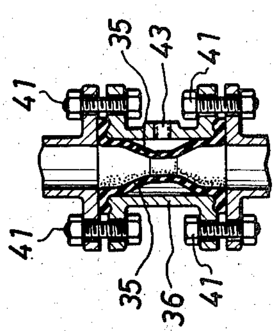


Fig.9

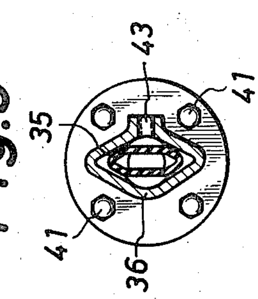


Fig.14

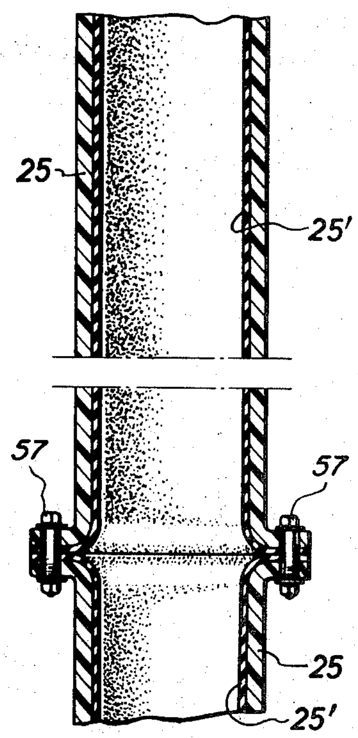
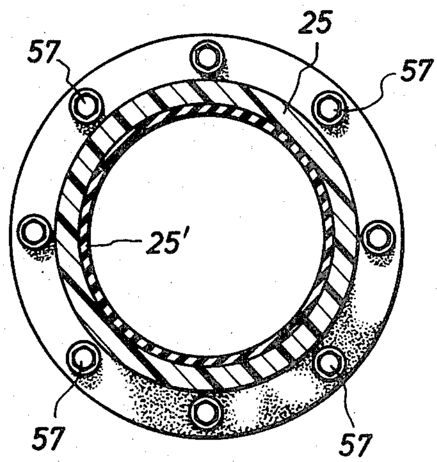


Fig.15



METHOD FOR PLACING HYDRAULIC CONCRETE

This invention relates to a method for constructing hydraulic concrete structures with using hydraulic materials on a firm ground in the water, for example a method for constructing piers of bridges or other foundations built on the bed of the sea, river and so forth.

In general, in placing concrete mixtures, separation of the mixed materials and crack formation after curing must be prevented, whether constuction is on the land or in the water. Therefore, in the field, very careful attention should be directed to the kinds of materials to be mixed, the composition of the concrete mixture, the method for placing the mixed concrete and the process for curing the placed concrete mixture in order to prevent the concrete from the separation of the mixed materials and the formation of cracks.

When the concrete is placed especially in the water, the method and apparatus prevent change of the concrete mixture on account of the immersion of water during placement.

In placing concrete in a construction site, where the working area is restricted, the difference in the large height distance between the hopper of the mixed concrete supplying pipe and the bottom receiving the concrete mixture and the passage of the concrete being vertical or nearly vertical, the placing of the concrete mixture must be carried out with the greatest possible care. In the prior art, Tremie method was employed in these occasions. However, this method can be employed only to place the concrete mixture in a relatively shallow bottom in the water, while in case of deep water, the concrete mixture is transferred irregularly when this method is used, and controlling over the falling velocity and feed velocity of the concrete mixture cannot be easily expected so as to regulate the transfer of the concrete mixture.

Further, in Tremie method, the air or water is liable to enter the pipe lines when the supply pipes are installed or when the concrete mixture is fed. Smooth supply of the concrete mixture cannot be carried out owing to the obstruction of the water or air contained in the pipes.

Accordingly, the present invention proposes a method to solve the aforementioned disadvantages and inconveniences, and which is also suitable for the placement of concrete mixture onto a very deep bottom in the water.

In the method of the present invention, the hydraulic concrete mixture consisting, for example, of portland cement, fillers or aggregates such as blast furnace slag powder, fly ash and siliceous sand and water, is supplied onto the bottom of water through flexible hoses or tubes which are hung and can be rolled up and are made of tough watertight material. A special automatic hydraulic valve is fixed to the bottom end of said flexible tube, and this automatic valve can be controlled by romote operation above the water surface. The concrete paste fed in said tube can be moved into the final position on the bottom in the water in which it is to be allowed to harden. After a certain amount of said paste is delivered through said tube, the tube is pulled up for a certain height to repeat the same operation. Accordingly the hydraulic concrete mixture can be placed in the water.

The method for placing hydraulic concrete mixture in the water in accordance with the method of the present invention will be explained in detail.

The requirements for hydraulic concrete to be both for the method of the invention as well as for the ordinary method, are good workability and high strength. The mixed materials such as cement, sand, gravel and water must not be separated in order that they be placed in the final position in the best condition.

In general, the composition and particle size distribution of the aggregates must be taken into consideration and the amount of water used is to be restricted in order to obtain a required strength and to prevent the occurrence of cracks during and after the curing. In the case of the construction in the water, the placing of the concrete mixture itself is very difficult, and it is commonly accepted that a relatively large amount of cement is to be used in order to prevent the separation of the aggregates contained in the concrete mixture. Therefore, the amount of the coarse aggregate is decreased in such compositions as 1:2:4 or 1:3:6 and much of cement, fine powder aggregates are used for the concrete mixture, that is, a concrete mixture containing larger amounts of mortar or cement paste has been recommended. In this case, blast furnace slag powder, fly ash and siliceous sand are used as said fine powder aggregates.

Blast furnace slag powder has been found to be the most suitable material as the fine aggregate for portland cement mixture which is used in hydraulic concrete, because the blast furnace slag powder has good hydraulic property, gives good workability and decreases the heat of hydration. Therefore, in the method of the present invention, the blast furnace slag is pulverized into fine powder of 3,500 to 4,000 cm^2/g and this may be admixed with portland cement in the ratio of 1:7 to 1:8. This is suitable for economic reasons and gives very desirable results from the point of concrete material engineering.

In the practical construction of such concrete structures, the stratum or the ground beneath the water has many defects such as unevenness of the surface, openings, gaps and cracks in several sizes. These defects must be strengthened with the concrete mixture as used. Accordingly, the mixture of hydraulic material is used to fill up such defects on the bottom and such material must be employed in the construction. Further, the construction work must be performed in a relatively limited space on the water surface, therefore the weighing of each material, mixing, feeding and controlling of the mixture must be carried out without difficulty and with reliability.

In order to attain the above-mentioned objects, the method of the present invention is carried out in accordance with the following description as explained with reference to the accompanying drawings, in which:

FIG. **1** is a partially cross sectioned front elevation of the series of apparatus to carry out the method of the present invention;

FIG. **2** is a front elevation of the measuring and mixing apparatus used for the series as shown in FIG. **1**;

FIG. **3** is a plan view of the series of apparatus as shown in FIG. **1**;

FIG. **4** is a front elevation of the main part of FIG. **1**;

FIG. **5** is a front elevation of the winding-up device for the tube;

FIG. **6** is a side elevation of the device as shown in FIG. **5**;

FIG. **7** is an enlarged sectional view of the paste delivery apparatus;

FIGS. 8 to 13, inclusive, are sectional views of the valve mechanism of the delivery apparatus, where FIGS. 8, 10 and 12 are vertical sections and FIGS. 9, 11 and 13 are plan sections; and

FIGS. 14 and 15 are cross sectional views of the connection of the transferring tube, where FIG. 14 is a vertical section and FIG. 15 is a plan section thereof.

HYDRAULIC MATERIAL

The preferable hydraulic material used for the method of this invention can be prepared by mixing the following materials:

Portland cement: one part by weight, and

Blast furnace slag powder (3,500 – 4,000 cm^2/g): 7 – 8 parts by weight, and the obtained mixture is further admixed with fresh water or sea water to form a paste.

APPARATUS TO PLACE CEMENT PASTE

The apparatus for placing the paste of hydraulic material consists of the following five apparatus (see FIG. 1).

i. Measuring and mixing apparatus,

ii. Paste reservoir tanks,

iii. Paste feeders,

iv. Tubes, and

v. Paste delivery apparatus.

The structures and functions of the above apparatus will be explained in detail in the following.

i. Measuring and mixing apparatus

As shown in the portion (A) in FIG. 1, this apparatus consists of a stand 1 above the surface of the water, screw paste mixers 2 installed on said stand 1 and a paste pump 3. The paste is mixed in of multi-stage mixers 2 with measuring and mixing blades as shown in FIG. 2, and the mixed paste is transferred into the paste reservoir tank 13 through the paste pump 3 and the forcing pipe 4. The numeral 5 denotes a stage and the numeral 6 denotes a supporting frame for the stage 5 which is built on the stand 1. The stand 1 is supported by poles 7 which are long enough to reach the sea bed. The numeral 8 denotes a water measuring tank, 9 an intake pump, 10 an intake pipe, 11 a stage for opening cement bags, and 12 an electric motor for the paste mixer (see FIGS. 2 and 3).

In the measuring and mixing apparatus, portland cement and blast furnace slag in the ratio of 1:8 and sea water or fresh water are measured and mixed with each other by the screw mixers 2 to obtain a pastelike mixture, and this is then transferred to the next paste reservoir tank by means of the pump 3, the capacity of which is, for example, 20 m^3/hr.

ii. Paste reservoir tank

This tank stores the paste which is moved from the above measuring and mixing apparatus through the pump 3 and the forcing pipe 4, and the tank is indicated by the numeral 13 in FIG. 1, part (A). The tank 13 is held by a frame 14 on the stand 1, and is for example 20 meters above the water surface. Each paste delivery apparatus which is explained below is provided with each of this paste reservoir tank so as to facilitate the controlling of operation as well as the measurement.

The bottom of said paste reservoir tank 13 is provided with a valve 15 and a pipe 16 which is to be connected to a tube.

iii. Paste feeder

As shown in the part (B) in FIG. 1, the paste feeder is suspended by a hanging device so as to be raised or lowered in the vertical direction.

In the paste feeder, the connecting pipe 16 for connecting the tube is made of flexible material. At the lower end, pipe 16 is provided with a suspension link 18 with a suspension ring 17 which is separably fixed to the top end of the tube as explained below. The suspension ring 17 is connected with a winding rope 19 which is led to a lifting winch 21 through pulleys 20. The suspension link 18 can be raised or lowered by winding up or releasing the winding rope 19 by means of the operation of said winch 21. Accordingly, said tube can be raised or lowered following the movement of said connecting pipe 16.

The suspension link 18 having the suspension ring 17 is secured to the pipe connecting portion at which the lower end of said pipe 16 is separably connected to the top end of the tube. The paste feeder having the above-mentioned structure is further provided with a valve 22 in order to control the flow of the cement paste.

iv. Tubes

The tubes for moving the paste from the above-mentioned paste feeder to the paste delivery apparatus (V) are shown in the part (C) in FIG. 1.

As shown in FIG. 1, a plurality of the tubes 25 are held inside a steel pipe column 24 having a large diameter and being set up into the firm ground. Said tubes 25 are made of a durable, watertight and flexible material in an appropriate length.

The cross section of said column 27 may be circular, oval or polygonal and having a large strength, and it is inserted into a pit 26 which is previously dug into the firm ground 23.

The size of said steel pipe column 24 is, for example, 8 to 10 m in the inner diameter and 30 m or more in the vertical head. Through varying with the place and the nature of the ground beneath the water, steel pipes generally 4 to 10 m in length are used and are suspended by a crane of a barge and are connected one by one by means of welding or riveting. Then the obtained column is inserted into the pit 26 which is dug previously in the firm ground 23 beneath the water. Above the water, further pipes are added by welding or riveting to form a long steel pipe column 24 as shown in FIG. 1. After being set up, the inside of the column 24 is filled with water.

The tube 25 which is made of flexible watertight cloth such as canvas or antifriction synthetic fiber fabric is preferably lined on the inside with an anticorrosive and antifriction coating 25′ such as natural rubber, snythetic rubber and synthetic resin layers. The size of the tube may be, for example, 30 to 100 m in length and 10 to 25 cm in outer diameter, and the thickness of said lining is 2 to 3 mm. Every 5 to 15 m of said tube is provided with a coupling or joint to form a long tube. For example, as shown in FIGS. 14 and 15, the flange portion of the tube 25 is secured with other flange portion of other tube 25 by bolts and nuts 57. Any other coupling means may be used to connect the tube 25 with each other. Appropriate number of such tubes 25 are installed in the steel pipe column 24. The tubes 25 are swollen or deflated by the differencial pressure of the water pressure from the outside and the inside pressure of the paste.

The tubes 25 can be provided with supports to prevent their swinging, and when the tubes 25 are very long ones, trunnions, flanges or other hanging devices can be employed.

v. Paste delivery apparatus

The paste placing and delivery apparatus is shown in the part (D) in FIG. 1, and is the apparatus to place the cement paste in a certain position in the water.

This paste delivery apparatus consists of a paste delivery pipe **27** which is connected to the lower end of said tube **25**, and a valve **28** which controls the quantity of the paste to be sent forth.

This valve **28** can be operated by hydraulic pressure from the operation stand **1** above the water surface, thus the valve **28** can be easily opened or closed by the remote operation, accordingly the quantity of the paste to be placed through said tubes can be controlled appropriately. This valve **28** is closed before and after the placing work, and is opened only when the cement paste is delivered.

As shown in FIG. **7**, the paste delivery pipe **27** is connected to the lowermost portion of the tube **25** through the valve **28** and the paste delivery pipe **27** which is made of metal is provided with a slidable delivery nozzle **29**. The paste is discharged from the notches **30** at the lower end of said nozzle **29** and from the perforations **31** around the periphery of said nozzle **29**. The upper end of the delivery nozzle **29** and the lower end of the delivery pipe **27** are provided with friction flanges **32** and **33**, respectively, in order to restrict the excessive sliding between the metal pipe **27** and the nozzle **29**. Further, between the upper ends of said pipe **27** and nozzle **29**, a bellows **34** which is made of expansible synthetic plastic film is provided so as to keep off the foreign matters such as sand, dirt and other fragments. The tube **25** is connected to the connecting pipe **39** with the aid of a clamping sleeve **52**.

The valve **28** can be controlled by means of hydraulic pressure from the remote place on the water surface, as shown in FIGS. **1, 4** and **7**. In the valve **28**, a rubber tube **35** is held within a metal casing **36** and both flanges **42** on both ends of said tube **35** are held tightly by the flanges **37** of the casing **36**, the flange **38** of the metal pipe **27**, and the flange **40** of the connecting pipe **39** with using the bolts and nuts **41**. In the middle portion of said casing **36**, screw threads **43** are provided to receive the fluid pressure line **44**, through which a fluid such as water is passed. As shown in FIG. **4**, this fluid pressure line **44** is led to a water tank **45** above the operation stand **1**. Two valves **46** and **47** are provided in the middle portion of said pressure line **44** and under said water tank **45**, and a water take-out line **48** with a valve **49** is connected to said line **44** between said two valves **46** and **47**, further a water measuring vessel **50** is positioned under the top end of said water take-out line **48**. By this vessel **50**, the volume of discharged water through the line **48** when the rubber tube **35** in the valve **28** is distended, can be measured, thereby the degree of the valve opening can be known. The numeral **51** in a pressure gauge for measuring the inside pressure of the line **44**.

When the inside pressure of the tube **25** and the control pressure in the pressure line **44** are zero, the rubber tube **35** in the casing **36** of the valve **28** is in the state of the natural opening as shown in FIGS. **8** and **9**. However, when the control pressure in the line **44** exceeds the inside pressure of the tube **25** as much as, for example, about 1 Kg/cm^2, the rubber tube **35** is pushed flat to close the valve **28** as shown in FIGS. **10** and **11**, and on the contrary when the inside pressure exceeds the control pressure with about, for example, 0.5 Kg/cm^2, the rubber tube **35** is forced to fully open as shown in FIGS. **12** and **13** which causes no resistance for the flow of the paste.

As shown in FIGS. **4, 5** and **6**, a winding-up device **53** for the tube **25** is installed on an appropriate rack above the stand **1**, whereby the drawing out or winding up of the tube **25** can be carried out by rotating the drum **55** through the motor **54**.

In the following, the method of the invention to place the cement paste onto the bottom of the water using the above-described apparatus, will be explained.

A set of tubes **25** having proper length is provided. Each of said tubes is wound on a drum. Then the paste delivery apparatus (v) is connected to the lower end of each tube **25**. The tubes **25** with the delivery apparatus (v) are put into the steel pipe column **24** and they are lowered to the bottom of the water by hanging. In this instance, each valve **28** at the lower end is closed.

By the time the paste delivery apparatus reaches the bottom of the water, only the short upper portion of the tube **25** is left on each drum.

Then the tube **25** is connected to the paste feeder (iii) and detached from the winding-up drum, and further passed to the tube hanging device. Each of the tubes **25** is supported.

The hanging device is then operated upward or downward to confirm that the delivery pipe **27** of the delivery apparatus (v) reaches the predetermined bottom of the water and further to check that the tube **25** is not slacked.

The valve **28** of the delivery apparatus (v) is still closed to that the air in the tube **25** is pushed out by the water pressure as the tube **25** is flattened.

Thereafter, the connecting pipe **16** from the paste reservoir tank **13** is connected to the paste feeder (iii), and after confirming all over the system, the valve **15** under the tank **13** and the valve **22** are opened slowly in order. Thus the paste in the tank **13** flows down slowly through the paste feeder (iii) and the lower valve.

The head from the bottom of the paste reservoir tank **13** to the water surface is, for example **20** meters. Therefore the flattened tube **25** is expanded by this pressure through which the paste is passed.

On this occasion, the feed velocity of the paste can be known from the expansion of the tube **25**, so that in accordance with the condition thereof, the valve **22** of the paste feeder (iii) is further opened gradually.

At this time, the valve **28** of the delivery apparatus (v) is still closed.

Then observing the down flow of the paste, the valve **28** of the paste delivery apparatus is opened slowly. However, when the valve **28** is opened, the system must be in such state that the pressure caused by the column of the paste in the tube **25** exceeds the pressure of the water around the tube **25** at the bottom.

The pressure A of the paste at the bottom of the tube **25** in terms of the head of water (meter) is represented with the following formula:

$$\frac{P}{\frac{\pi}{4}\times D^2}\times 1.9 = A,$$

wherein P is the quantity of paste as fed in cubic meter, D is the diameter of the tube **25** in meter, and the density of the paste is regarded as about 1.9.

The water pressure B at the lower end of the tube **25** is represented with the following formula:

$$L \times (1.0 \text{ to } 1.03) = B,$$

wherein L is the length of the tube under the free surface of water in meter.

The valve **28** at the bottom of the tube **25** can be opened when the above A is larger than B.

The valve **28** is operated from the remote place, that is, in order to close the valve **28**, the two valves **46** and **47** on the fluid pressure line **44** as shown in FIG. **4** are opened and the valve **49** of the take-out pipe **48** is closed, the pressurized water is passed from the water tank **45** into the casing **36** of the valve **28** by way of the pressure line **44**, thereby the rubber tube **35** is pushed flat and the valve **28** is closed. On the contrary when the valve **28** is opened, the upper valve **46** is closed and the lower valve **47** and the valve **49** of the pipe **48** are opened, the water in the casing **36** of the valve **28** is forced out by the inside pressure of the tube **35** from the take-out pipe **48**, while by controlling the volume of water discharged from the pipe **48**, the opening of the valve **28** can be regulated.

With the above-described operations, the valve **28** of the paste delivery apparatus can be opened and the feed of the paste, i.e., its falling velocity is then increased gradually to the normal value of the feed.

In this operation, the too rapid feed of the paste causes the tube **25** to expand excessively, and on the contrary the too slow feed causes the tube to become flat by the pressure of the outside water and suction from the bottom. At the lower end of the paste delivery apparatus (v), the water pressure and the inside pressure of the flowing paste must keep the balance with each other so as to pass the paste at a constant rate.

The velocity of the flow of paste may be preferably in the range of 0.2 to 0.4 m/sec.

The feed volume of the paste can be measured by the scale of the mixing apparatus or the changes in the paste surfaces in the paste reservoir tank.

When the predetermined amount of the paste is fed, the paste feeder and other parts are lifted up slowly a certain height by the hanging device, and the feed of the paste is continued.

It is preferable that at the bottom of the water paste is placed at a rate of the depth of about 1 to 1.5 meters per hour.

Therefore several number of the tubes **25** may be arranged at proper spaced intervals.

The necessary number of the following tubes **25** can be estimated by the method:

The area of the bottom to receive the cement paste — A m^2

Depth of depositing per hour — H m

Feed volume per hour of the paste per one tube V m^3

Necessary number of delivery apparatus = $A \times H \div V$

For example, assuming that H is 1.5 m, A is 30 m^2, and V's are 8 m^3 for 4 inch tube, 13 m^3 for 5 inch tube and 19 m^3 for 6 inch tube, the necessary number of tubes are six, four and three for the 4 inch, 5 inch and 6 inch tubes, respectively.

The operation to stop the placing will be explained in the following. After the predetermined amount of paste is placed, the valve **28** of the paste delivery apparatus (v) is closed, the tube **25** is disconnected from the paste reservoir tank **13**, and the paste feeder (iii) is lifted up by the hanging device. By this operation, the paste delivery apparatus (v) is removed from the paste layer on the bottom of the water. Thereafter, the paste feeder (iii) is detached from the hanging device, and each of the tubes is wound up by the winding-up drum. When the tube is expected to be used again, the tube is washed with water. However if the tube is discarded after use, the wound tube can be left as it is.

A paste placement test in accordance with the method of the present invention was carried out in the sea water. The results of the test were as follows:

1. Mixed cement

Portland cement — 1 part

Blast furnace slag powder (3,500 cm^2/g) — 8 parts

2. Paste placement test in the sea water

Feed velocity — 0.3 m/sec

W/C ratio — 38%

Inclination — 4 – 5%

With regard to the results after 24 hours, the setting of the surface was good, and no disagreeable effect of the sea water was observed.

3. The strength of the paste

1 day — 41 Kg/cm^2

3 days — 80 Kg/cm^2

7 days — 206 Kg/cm^2

28 days — 325 Kg/cm^2

4. Properties of the paste

W/C ratio	Flow	S. G.
30	240	2.04
35	245	1.97
38	273	1.95
40	286	1.94

The method of the present invention has the following characteristic advantages:

a. The placement of the paste can be carried out with great reliability, and the control for the operation is easy.

b. The entire area including every nook and corner can be filled up with the concrete.

c. Shrinkage is not caused. Accordingly cracks do not develop.

d. The mixed materials are not separated, and the fluidity is good.

e. Grouting can be carried out only by the natural flow of the paste.

f. The adherence to the steel reinforcing rods is good.

g. Blast furnace slag powder which has hydraulic property is used in place of sand and gravel. If a certain additive is used, the viscosity can be improved and the separation of the cement particles can be prevented.

h. The temperature is not raised during the hardening. In addition, the potential strength is high.

i. The placement by natural flow is possible as the paste is very fluid.

j. It is convenient that the tough, watertight and flexible tubes can be used as the transferring tubes.

k. The feed velocity can be controlled with ease.

l. The vertical placement is possible.

m. The placement work can be stopped at any time, because Torricelli's vacuum does not occur and water or air does not enter into the tube or paste.

n. The placing tube need not be jointed at the work site, whereby the apparatus are simple and convenient.

o. The placing tube can be wound on a drum.

p. The apparatus for the placement are compact and economical, whereby the construction is easy, reliable and not expensive.

g. By providing the paste delivery tube with a water pressure gauge or a feed detector, and interlocking the suspension ring with it, the movement of the tube can be controlled automatically.

What is claimed is:

1. A method for depositing concrete on a surface located in a pressurized medium, comprising the steps of:

placing within the pressurized medium a flexible tube that is capable of being selectively flattened, when the pressure outside the tube exceeds the pressure inside the tube, and enlarged, when the pressure inside the tube exceeds the pressure outside it;

valving the tube closed to prevent exit of concrete from the tube outlet;

applying the fluid medium under pressure to the exterior of the tube at a level greater than the pressure inside the tube, thereby collapsing the tube; gradually supplying concrete to the inlet of the collapsed tube and passing the concrete into the tube so that it applies pressure to the interior of the tube greater than the pressure exterior to the tube, thereby to enlarge the tube progressively along its length to the tube outlet and gradually move the concrete through the tube to and through the tube outlet;

opening the closed valving to permit concrete to pass through and out the tube.

2. The method for depositing concrete of claim 1, wherein the pressurized medium is water, concrete is being deposited on the ground beneath the water and the tube is hung down through the water to be above where the concrete is being deposited.

3. The method for depositing concrete of claim 1, wherein the valving step is accomplished by applying hydraulic pressure to the exterior of a section of the flexible tube to collapse that section, and the valving is opened by reducing this hydraulic pressure applied to the exterior of the flexible tube section.

4. The method for depositing concrete of claim 3, wherein the pressurized medium is water, concrete is being deposited on the ground beneath the water and the tube is hung down through the water to be above where the concrete is being deposited.

5. The method for depositing concrete of claim 4, wherein the valving step is preformed remotely from the flexible tube section and is performed out of the water and the valving operation is remotely controlled.

6. The method for depositing concrete of claim 2, wherein concrete is deposited for a predetermined period; then the tube outlet is raised and concrete depositing is continued from the higher level outlet position.

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