

Aug. 3, 1965

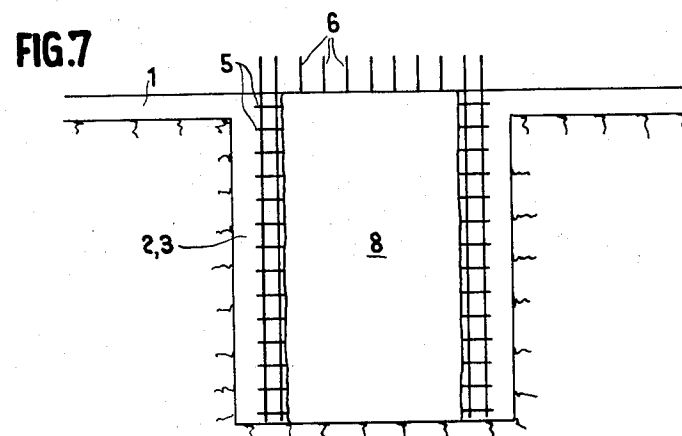
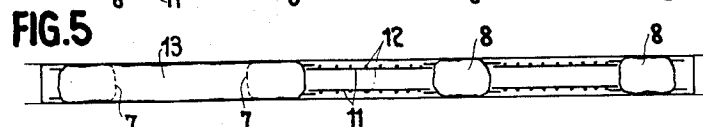
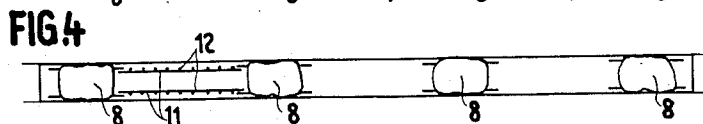
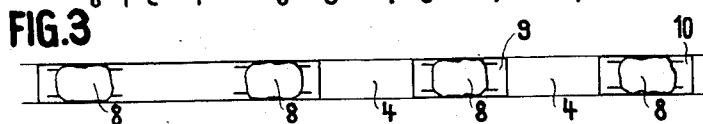
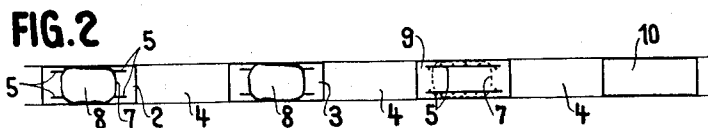
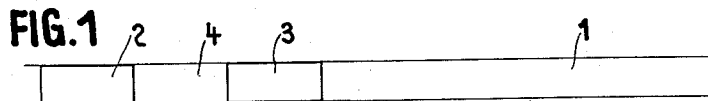
H. B. FEHLMANN ET AL

3,197,964

METHOD FOR MAKING A REINFORCED CONCRETE STRUCTURE

Filed Dec. 21, 1960

2 Sheets-Sheet 1



INVENTORS
Hans Beat Fehlmann and Max R. Schaub
BY

Richard Lind Agt

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H. B. FEHLMANN ET AL

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2 Sheets-Sheet 2

FIG. 8

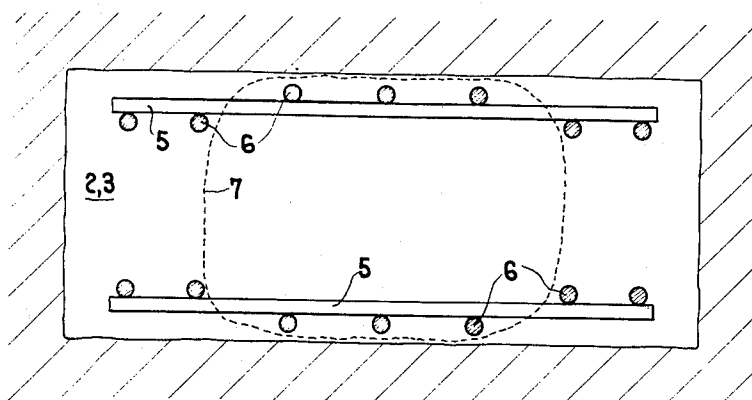
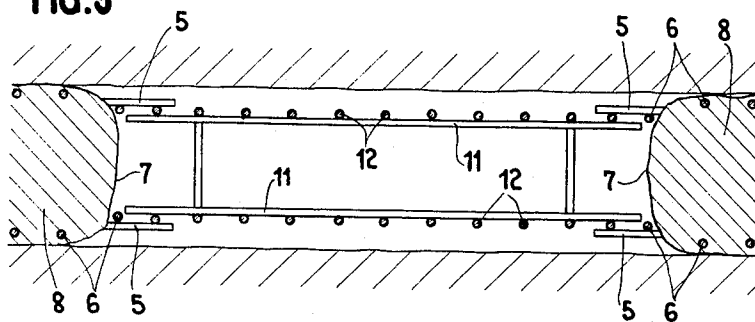


FIG. 9



INVENTORS
Hans Beat Fehlmann and Max R. Schaub
BY

Beh. and Co. Ag't

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3,197,964 METHOD FOR MAKING A REINFORCED CONCRETE STRUCTURE

Hans Beat Fehlmann, Klausstrasse 43, Zurich 34, Switzerland, and Max R. Schaub, Bern, Switzerland; said Schaub assignor to said Fehlmann

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4 Claims. (Cl. 61-35)

The present invention relates to a method for making a reinforced concrete structure consisting of column-shaped parts butting each other across vertical joints, in which individual parts butting each other are concreted one after another up to full height in spaces provided with a reinforcement and, as far as necessary, defined by sheathing means.

With this manner of construction where the individual column-shaped parts are concreted up to full height lateral forms or sheathings are to be provided in the spaces or cavities in the areas of the joints of the completed structure. If the concrete structure was to be made in a trench-shaped cavity, in prior methods iron pipes have been lowered into the cavity at both ends thereof to form lateral sheathings whereupon the column-shaped structure-part has been concreted up to full height between these two sheathings of pipes. A considerable disadvantage of such a procedure resides in the fact that the reinforcement of the individual column-shaped structure-parts can only extend to the pipe sheathings so that a subsequent establishment of a force-transferring bond between reinforcements of adjacent column-shaped parts is not possible because after the removal of the pipe-sheathing a reinforcement can be brought only into the adjacent zone of the cavity. The reinforcement extends only to the lateral walls of a structure-part and can, therefore, in no way be connected in a force-transferring manner with the reinforcement completely inside a previously erected structure-part. Therefore, with prior methods it was impossible to obtain a reinforcement acting continuously through the entire length of the erected concrete structure, that is, a force-transferring bond indispensable for getting high resistance and strength.

The invention aims at a method allowing to obtain a concrete structure of any length desired which comprises individual column-shaped parts and a reinforcement which is uninterruptedly effective through the entire length of the structure. The method according to the invention is characterized in that at least across joints of the completed structure sheathing means are used through which no concrete can escape but through which parts of the reinforcement project so that reinforcement parts pass through the joints. As sheathing means preferably nettings or grids of yieldable materials such as, for instance, wire netting, perforated sheet metal or the like are used, the mesh aperture of which is chosen in such a way that the reinforcing rods may pass through the meshes, while the concrete mixture cannot escape through the meshes. Because the sheathing has to stand the whole or a considerable part of the hydrostatic pressure of the filled-in concrete, it is preferably given the shape of a cylindrically closed basket, since wire netting, for instance, can practically only be subjected to pulling and not to bending forces. Individual cylindrical sheathing baskets can be connected with their respective reinforcement and afterwards inserted as assemblies at the desired places of the building site and then filled with concrete.

The method according to the invention offers special advantages when making concrete structures in trench- or shaft-shaped cavities, where the cavity is excavated under permanent filling with bentonite. The sheathing

and reinforcement are inserted into the cavity filled with bentonite, and finally the concrete is brought in. Apart from the well-known advantages of the bentonite-method on making a cavity, the additional advantage is offered in connection with the present invention that the bentonite liquid outside the sheathing produces a certain hydrostatic counter-pressure to the hydrostatic pressure of the concrete charge in the sheathing so that a relatively weak sheathing, such as, for instance, the above-mentioned wire netting offers sufficient resistance.

The structure made according to the invention has a reinforcement that is in a force-transferring bond over the entire length of the structure and is characterized in that each column-shaped structure part defined by vertical joints has an individual reinforcement, each point being traversed by the reinforcement of the structure part while, on the other side of the joint, this reinforcement is in force-transferring bond with the reinforcement of the adjacent structure part.

With reference to the drawings an embodiment of the method according to the invention and an example of the structure made according to this method will now be described.

FIGS. 1 to 6 schematically illustrate a construction in various stages of the method, and

FIGS. 7 to 9 show individual parts of the structure on a larger scale.

In the embodiment described and illustrated a trench-shaped cavity of any desired depth and of the total length shown in FIG. 6 is to be filled over its entire length with concrete by means of the method according to the invention, whereby the horizontal reinforcement of the filled-in concrete structure, such as, for instance, a foundation is in a continuous force-transferring bonding condition along the whole length. To achieve this aim, at first a shallow channel 1 (FIG. 7) is dug along the whole length of the construction site, said channel serving a purpose which will be described later on. Afterwards and as shown in FIG. 1 two cavities 2 and 3 are excavated, the length of which may, for instance, amount to 2.5 meters. However, other suitable lengths of the cavities such as, for instance, 0.6 to 6 meters may be chosen. Between the two cavities 2 and 3 there remains a web 4 of about the same length as the cavities 2 and 3. During their excavation the cavities 2 and 3 are permanently filled in a well-known manner with bentonite liquid or the like for the purpose of preventing the walls of the cavities from caving-in, avoiding in this way any special strutting of the walls. Once the cavities 2 and 3 having been completed, reinforcing grids consisting of horizontal rods 5 and vertical rods 6 (FIG. 8) are inserted into these cavities. Before inserting a reinforcing grid 5, 6 into a cavity a hose-shaped wire netting 7 is connected with the grid 4, 6, the mesh aperture of said netting being chosen so that the horizontal reinforcing rods 5 can pass through and project beyond the meshes of the netting 7 in longitudinal direction of the trench-shaped cavity 2 or 3 respectively (FIG. 8), while the concrete to be subsequently filled into the basket hose constituted by the wire netting 7 can, in general, not escape through the wire netting 7 to the outside. As an example, the mesh aperture of the wire netting 7 preferably amounts to about 15 to 20 millimeters and the netting must, of course, be rather strong in order to withstand the hydrostatic pressure of the concrete which will subsequently be poured. As mentioned above, the wire netting 7 is connected with the reinforcing grid 5, 6 prior to the lowering of the latter into the cavity 2 and 3 respectively. The wire netting 7 must be shifted toward the ends of the horizontal reinforcing rods 5 before the vertical rods 6 remaining outside the wire netting are fixed to the rods 5. The pro-

cedure of connecting the wire netting 7 with the grid 5, 6 may, for instance, be executed as follows: After having assembled the grid 5, 6 with the exception that those vertical rods 6 which are to lie outside the netting 7 are not fixed, and individual sheet of wire netting is shifted toward either end of the rods 5. Afterwards, the two netting sheets are bent around the vertical rods 6 and their adjacent edges connected with each other so that a hose 7 such as shown in FIG. 8 in dotted lines is formed. Then, the vertical rods 6 which are to lie outside the hose 7 are fixed to the horizontal rods 5. The rods 5 of the grid may be fixed to the rods 6 in any suitable manner, for instance, by means of wires, clamps or by welding. Another procedure of connecting the wire netting 7 with the grid 5, 6 would be first to complete the hose-shaped wire netting 7, then to bring the individual rods 5 and 6 into the position shown in FIG. 8 with regard to the netting 7, and finally to fix the rods 5 and 6 to one another for forming the reinforcing grid. The grids 5, 6 must have sufficient strength to allow transportation of the assembled grid and netting to the cavities 2 and 3 and lowering the assembly into the cavities. Once each of the cavities 2 and 3 is equipped with its individual grid 5, 6 combined with a wire netting 7, concreting may begin. This is performed as well-known in connection with the bentonite-method by lowering a hose or tube into the space surrounded by the wire netting 7 and by subsequently pouring the concrete through said hose or tube down to the bottom of the cavity 2 and 3 respectively. In this way, a concrete column is formed within the form or sheathing 7, the concrete column being built up to the total desired height (FIG. 7), and being designated 8 in FIGS. 2, 7 and 9. The individual completed concrete columns 8 are provided with a reinforcement consisting of horizontal and vertical rods and, since the length of the individual columns 8 in the longitudinal direction of the structure is defined by the wire netting basket 7, the horizontal reinforcing rods 5 project from the columns 8 in said longitudinal direction (FIG. 9).

Simultaneously with the insertion into the cavities 2 and 3 of the reinforcing grids 5, 6 combined with netting 7 and the pouring of concrete, other cavities 9 and 10 are excavated (FIG. 2). Bentonite liquid, expelled from the cavities 2 and 3 due to the concreting in the latter flows through the shallow channel 1 into the nascent cavities 9 and 10 so that a continuous procedure is possible without loss in bentonite. The cavities 9 and 10 are separated from each other and from the cavity 3 by webs whose length is equal to the length of the web between the cavities 2 and 3. Once the cavities 9 and 10 having been excavated they are each provided with a reinforcing grid combined with a wire netting in the manner described with respect to the cavities 2 and 3, and afterwards concrete is brought into the cavities 9 and 10 in a similar way. Thus, in the cavities 9 and 10 there are also individual concreted columns 8 formed (FIG. 3). During concreting in the cavities 9 and 10, the web 4 between the cavities 2 and 3 may be excavated; in FIG. 3 this web appears already removed. Between the two concrete columns 8 erected in the original cavities 2 and 3 there exists now an open space into which another reinforcing grid consisting of horizontal rods 11 and of vertical rods 12 can be inserted (FIGS. 4 and 9). The length of this grid 11, 12 is chosen so that end portions of its horizontal rods 11 overlap end portions of the horizontal rods 5 of the reinforcing grids of the columns 8 (FIG. 9). If, on further proceeding according to FIG. 5 the space between the columns 8 of the original cavities 2 and 3 has completely been filled with concrete, a continuous section of the concrete structure has been produced, this section consisting of two column pieces 8 and an intermediate piece 13, each two adjacent pieces engaging each other across vertical joints substantially defined by the netting 7 of the columns 8. In other words, the wire nettings 7 lie in the joints, which

results in an advantageous stiffening and strengthening of these joints. At the joints the reinforcing grids 5, 6 and 11, 12 overlap each other within the intermediate concrete piece 13 so that through the overlapping horizontal rods 5 and 11 and through the concrete of the piece 13 surrounding the rods 5 and 11 a transfer of forces is possibly to such an extent as if there were a continuous horizontal reinforcement or armor extending uninterruptedly through all the three pieces 8, 13 and 8. It is understood that the outer ends of the horizontal reinforcing rods 5 and/or 11 may be bent or otherwise formed in any well-known manner in order to increase their hold in the concrete.

During concreting of the piece 13, the remaining webs 4 between the cavities 3 and 9 and 9 and 10 can be excavated (FIG. 4), whereupon reinforcing grids 11, 12 are inserted in the newly excavated cavities and these sections concreted. In this way, the continuous concrete structure shown in FIG. 6 is finally completed, this concrete structure consisting of individual, column-shaped sections which engage each other across vertical joints and are stiffened by a continuous horizontal reinforcing structure.

As may easily be seen in FIGS. 1 to 6 the reinforcing grids of the columns 8 do not extend to the end walls of the cavities 2, 3, 9 and 10. This is because some space must be available on the sides of the respective grids for subsequently removing the webs 4. As can be seen from FIGS. 3 and 4, it thus happens that starting with equal lengths the cavities 2, 3, 9 and 10 and the webs 4 of the columns 8 become in the end substantially shorter than the columns 13. If it is desired that all the concrete columns of the structure have the same length, the cavities 2, 3, 9 and 10 must be made longer than the remaining webs 4 in order to obtain columns 8 and 13 of equal length in the completed structure.

From the foregoing description it also clearly follows that the forming or sheathing baskets 7 are so-called lost forms which remain in the completed structure. Therefore, it is important to use relatively cheap material for the basket 7 such as, for instance, commercial wire netting. Such lost forms can be avoided by laterally connecting with the reinforcing grids 5, 6 removable shutter-plates having perforations for the passage of the horizontal rods 5 of the reinforcing grids 5, 6 and which after completion of the columns 8 can be laterally drawn off the reinforcing rods 5 for repeated use. In such a case the vertical rods 6 of the grids 5, 6 lying outside the columns 8 (FIG. 9) cannot be brought into place and fixed to the end of the rods 5 before the shutter-plates have been drawn off the rods 5. Furthermore, in order to have a sufficient number of vertical rods 12 of the grids 11, 12 within the areas of the overlapping portions of adjacent grids, it is recommended to fix vertical rods 12 also to the inner side of the horizontal rods 11 within the overlapping reach. Such removable shutter-plates, which may, for instance, be made of timber or metal, will especially be suitable where absolutely even or particularly shaped joints between the individual parts of the structure are required.

While the invention has been described and illustrated with reference to a few embodiments thereof, it will be understood that other embodiments may be resorted to without departing from the invention. Therefore, the description of the invention set out above should be considered as illustrative and not as limiting the scope of the following claims:

I claim:

1. A method for making a reinforced concrete structure of column-shaped parts engaging each other across substantially vertical joints, forming a longitudinally extending trench-like excavation, inserting at least two first reinforcing means in said excavation at a distance from each other, inserting at least two sheathing means in said excavation, each of said sheathing means to extend ap-

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proximately coaxially with one of said first reinforcing means and to define a column-shaped space, each of said sheathing means having a longitudinal extension smaller than that of the respective first reinforcing means, having each of said first reinforcing means extend longitudinally at both ends beyond the respective sheathing means, filling each of said sheathing means with concrete for forming at least two spaced column-shaped concrete parts, inserting second reinforcing means into the space in said excavation between said column-shaped concrete parts in an overlapping relationship with said first reinforcing means, and filling said space between said concrete parts with concrete to form a further concrete part.

2. The method according to claim 1, wherein each of said first reinforcing means is assembled prior to its insertion in said excavation with one of said sheathing means, and is inserted in said excavation together with said one sheathing means as an assembly.

3. In the method according to claim 1, forming at least two spaced portions of said excavation first, inserting one of said first reinforcing means and one of said sheathing means in each of said spaced portions, filling each inserted sheathing means with concrete to form a column-shaped concrete part, forming the remaining portion of said excavation between the column-shaped parts, inserting said second reinforcing means in said remaining portion, and filling said remaining portions with concrete, thus forming said further concrete part.

4. In the method according to claim 3, filling said spaced portions with bentonite liquid prior to inserting

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therein said first reinforcing means and said sheathing means and prior to filling said sheathing means with concrete, displacing said bentonite liquid from said spaced portions while pouring concrete into said spaced portions, flowing said bentonite liquid into said remaining portion prior to inserting said second reinforcing means in, and prior to pouring concrete into, said remaining portion.

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FRANK L. ABBOTT, *Primary Examiner*.WILLIAM I. MUSHAKE, HENRY C. SUTHERLAND,
JACOB L. NACKENOFF, *Examiners*.