United States Patent

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[54] **ARRANGEMENT IN SLIDING FORM EQUIPMENTS FOR ERECTING CONCRETE STRUCTURES HAVING AT LEAST ONE INCLINED WALL SURFACE**

8 Claims, 3 Drawing Figs.

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[51] Int. Cl. E04g 11/22
[50] Field of Search ..... 249/20, 33; 264/33; 25/131A, R, SA, SB, YA, YF, 1A, B, 118R

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ABSTRACT: A pair of sliding forms are supported by a yoke, at least one of the sliding forms being supported for movement in a horizontal direction. A climbing rod is adapted to be gradually imbedded in the erected concrete structure, and lifting means is operatively associated with the climbing rod for lifting the yoke along the climbing rod. Wedge means is mounted on the climbing rod and cooperates with a portion of the yoke for moving at least one of the sliding forms in a horizontal direction upon lifting the yoke along the associated climbing rod.

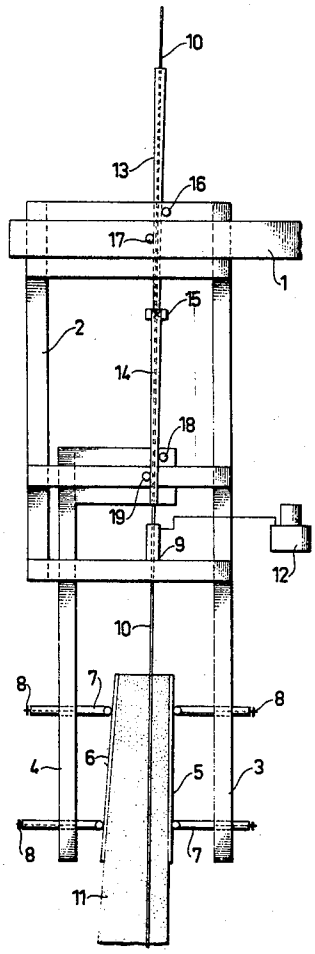

Fig.1

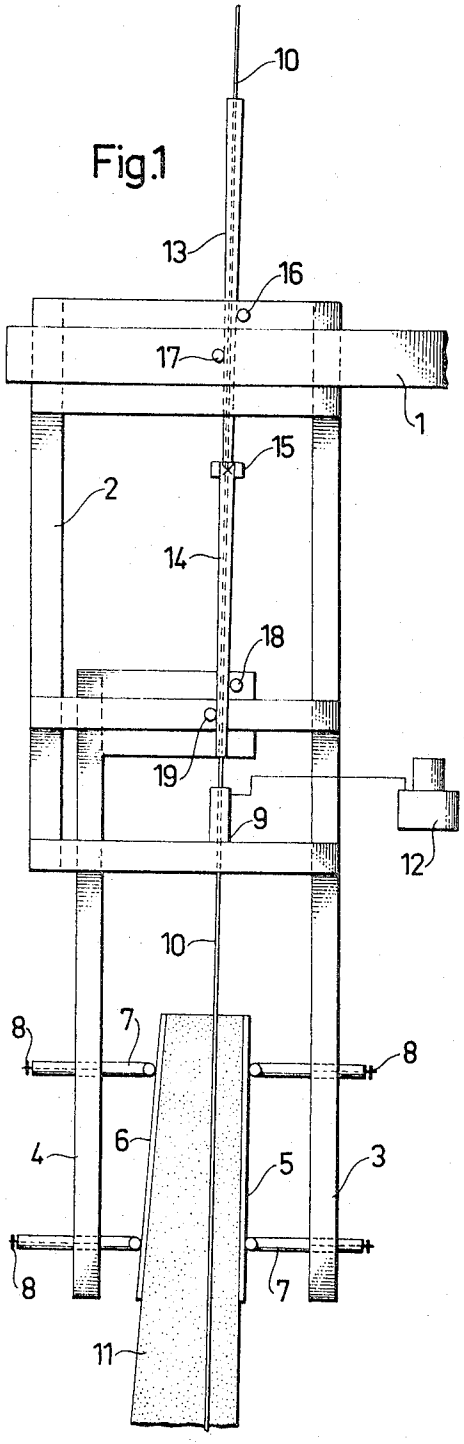
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Fig.2

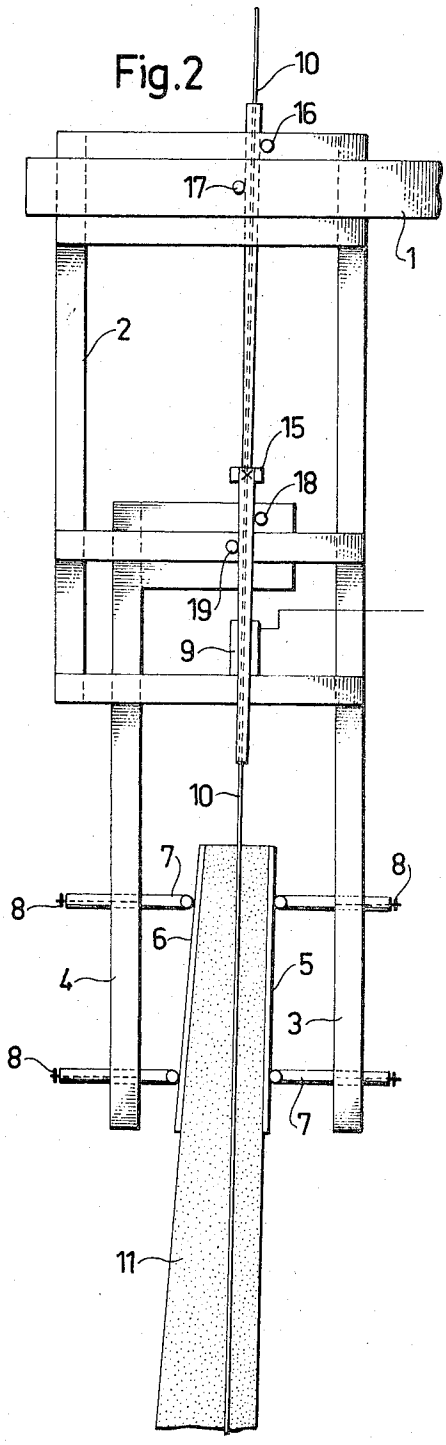
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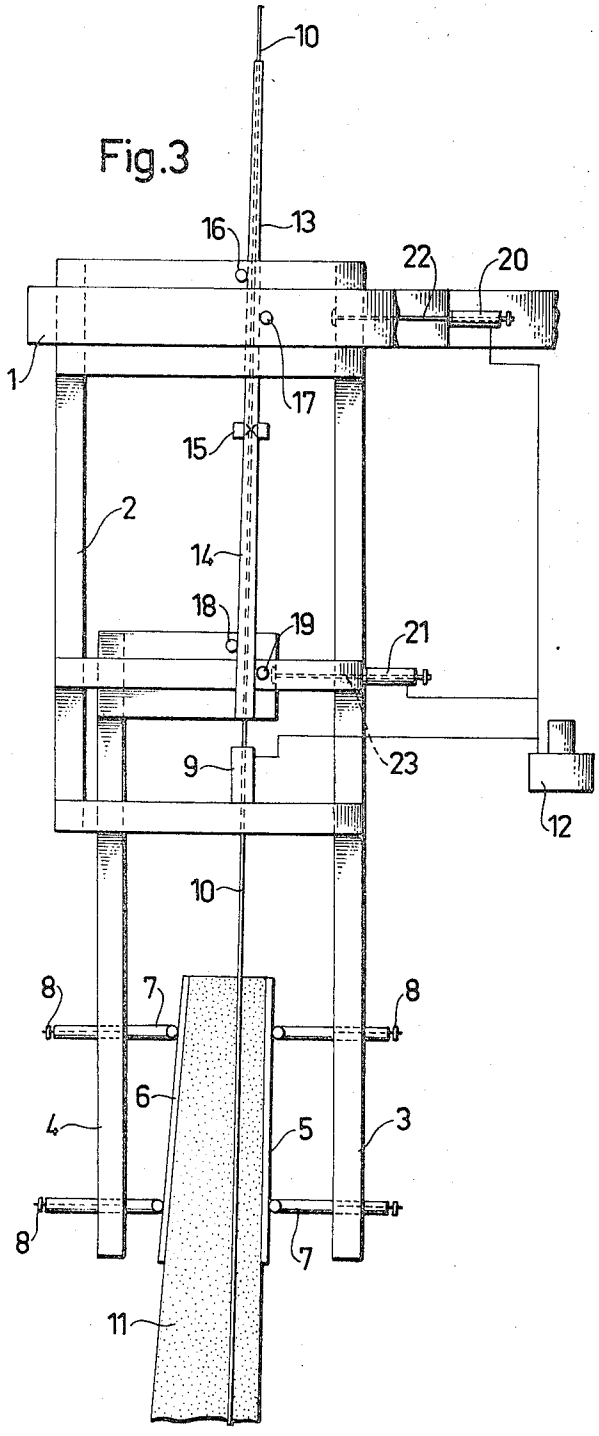
Fig.3



ARRANGEMENT IN SLIDING FORM EQUIPMENTS FOR ERECTING CONCRETE STRUCTURES HAVING AT LEAST ONE INCLINED WALL SURFACE

In the erection of concrete structures having one or more inclined wall surfaces by means of sliding form equipments mainly two alternative methods have been used. One of these methods has been based on the provision of wedge means between the sliding forms used to produce said inclined wall surfaces, and the adjacent vertical legs of the liftable yokes carrying said forms. These known equipments have, however, found a limited use. The reason is that they have been relatively complicated and difficult to operate and that their field of use has been restricted to such concrete structures in which the two opposite surfaces of an erected wall are located between the two vertical planes containing the base edges of the wall structure. As a consequence sliding form equipments of this sort cannot be used for erecting such concrete structures, e.g. chimneys, where the inner wall surface as well as the outer wall surface has a considerable conicity in an upward direction. According to the alternative method the lateral displacement of the sliding forms has been obtained by the use of horizontally movable yokes or yokes having horizontally movable legs. In this case the displacement of the yokes or of their movable legs has been carried out as a purely manual operation in connection with the elevation of the yokes. However, this method is very unfavorable in view of the high consumption of manual power and the amount of time required for a gradual manual displacement of the yokes or yoke legs.

The present invention has for its object to provide an arrangement in sliding form equipments for the erection of concrete structures having at least one inclined wall surface which arrangement eliminates the drawbacks of the above-described known equipments and presents an efficient highly automatic method for building concrete structures having arbitrarily wall surface inclinations. More particularly, the invention relates to an arrangement in sliding form equipments of the kind comprising a plurality of form carrying yokes arranged to be elevated along climbing rods by means of lifting means cooperating with said rods which are embedded in the concrete structure, at least one sliding form of each yoke being arranged synchronously with the lifting of the yoke to carry out a horizontal movement through the action of wedge means.

The arrangement according to the invention is primarily characterized in that said wedge means are mounted on the climbing rods and adapted to act between the respective yoke and a horizontal beam or similar means along which the yoke is horizontally displaceable, said beam being unmovable in the horizontal plane and arranged to be elevated with the yoke, and/or between a movable leg of the respective yoke and the remaining part thereof.

The invention will now be described more in detail, reference being had to the accompanying drawings, in which:

FIGS. 1 and 2 schematically illustrate a yoke of a sliding form equipment according to a first embodiment of the invention with the yoke located on two different levels; and

FIG. 3 shows a yoke of a sliding form equipment according to a second embodiment of the invention.

In the drawings reference numeral 1 generally designates a horizontal beam serving as a guide means for a form carrying yoke 2 displaceably mounted thereon, said yoke 2 having a fixed vertical leg 3 and a movable leg 4 horizontally displaceable with respect to the remaining part of the yoke, each yoke leg 3 and 4 carrying a sliding form 5 and 6, respectively. The two sliding forms 5 and 6 are secured to the respective yoke legs 3 and 4 by means of carrying arms 7 pivotably connected to said sliding forms, said carrying arms 7 being longitudinally movable in the yoke legs 3 and 4 by means of threaded bolts 8 in order to enable the desired inclination of the sliding forms 5 and 6 to be set at the starting moment of the casting operation. For gradually raising the yoke 2 and the sliding forms 5 and 6 carried thereby a lifting device 9, for instance a hydraulic lifting jack, is mounted on the yoke 2. By means of said lifting device 9 the yoke 2 can be elevated in small steps along a climbing rod 10 cooperating with said lifting device. In the course of the casting said climbing rod is gradually embedded in the concrete wall 11 formed by means of the forms 5 and 6. The required driving power is supplied to the lifting device 9 from a power source 12. On the climbing rod 10 there is mounted a wedge device comprising two wedge members 13 and 14 located one above the other. By means of an interconnecting fastening element 15 said wedge members 13 and 14 can be secured to the climbing rod 10 on any desired level. The wedge members 13 and 14 serve to provide a horizontal displacement of the yoke 2 along the beam 1 and of the movable yoke leg 4 with respect to the remaining part of the yoke 2 in synchronism with the lifting movement of the yoke.

In order to facilitate said function of the wedge members 13 and 14 the different elements which are horizontally displaceable with respect to each other, i.e. the yoke 2 and the beam 1, and the yoke leg 4 and the remaining part of the yoke 2, respectively, are provided with rotatable rollers 16, 17, 18 and 19 which engage the wedge members 13 and 14. During the stepwise elevation of the yoke 2 along the climbing rod 10 the yoke 2 will, due to the cooperation between wedge member 13 and rollers 16 and 17, become displaced along the beam 1 in a rightward direction on the drawing. This movement is directly transmitted to the sliding form 5. Due to the cooperation between the wedge 14 and the rollers 18 and 19 the movable yoke leg 4 will simultaneously move in the same direction relatively the remaining part of the yoke 2 and bring the sliding form 6 to carry out a corresponding movement. Through suitably dimensioning the wedge angles and positioning the rollers 16, 17, 18 and 19 it is possible to obtain any desired inclination of the wall 11 formed by means of the sliding forms 5 and 6.

In the embodiment shown in FIGS. 1 and 2 the rollers 16, 17, 18, and 19, respectively, cooperating with the wedge members 13 and 14 will remain in contact therewith through the contact pressure between the concrete wall 11 and the sliding forms 5 and 6. In the embodiment according to FIG. 3 said contact is obtained by using separate fixed hydraulic means 20 and 21, for instance of the same type as the lifting device 9, which by means of pulling rods 22 and 23, respectively, are coupled to the yoke 2 and to the movable yoke leg 4, respectively. The main functional difference between the two embodiments consists in that the required force for moving the yoke 2 on the beam 1 and the yoke leg 4 with respect to the remaining part of the yoke 2, respectively, is obtained by means of the lifting device 9 in the embodiment according to FIGS. 1 and 2, while according to FIG. 3 separate driving means are required to provide the desired relative movements in the horizontal direction.

The only manual operation required during the use of a sliding form equipment of the kind above described is the adjustment of the wedge device 13, 14, 15 which has to be made each time the rollers 16, 17, 18 and 19 reach the upper end of the wedges 13 and 14, respectively. However, since the wedges 13 and 14 can have a length of 1 to 3 meters this adjustment does not involve any inconvenience to speak about.

Naturally, the invention is not restricted to the embodiments shown on the drawings. Thus, many different modifications are feasible within the scope of the invention. For instance it is possible to use only one of the wedge members 13 and 14, in which case an automatic relative movement in a horizontal direction is obtained only between the yoke leg 4 and the remaining part of the yoke 2 or between the yoke 2 and the beam 1, respectively. Moreover, the wedges can be provided with nonlinear contact surfaces for the guiding rollers. The wedge members can also be of a kind permitting an adjustment of their wedge angles. Further, the lifting device 9 and the hydraulic means 20 and 21 can be of any suitable type operating in steps or continuously. It should also be mentioned that the described equipment can be modified so as to permit the use of travelling forms instead of sliding forms.

I claim:

1. Sliding form equipment for erecting a concrete structure having at least one inclined wall surface and comprising, a yoke, a pair of sliding forms supported by said yoke, at least one of said sliding forms being supported for movement in a horizontal direction, a climbing rod adapted to be gradually embedded in the erected concrete structure, lifting means operatively associated with said climbing rod for lifting said yoke along said climbing rod, and wedge means mounted on said climbing rod and cooperating with a portion of said yoke for moving said one sliding form in a horizontal direction upon lifting said yoke along the associated climbing rod.

2. Sliding form equipment as defined in claim 1, including support means fixed against horizontal movement, said yoke being movable horizontally with respect to said support means, said wedge means causing horizontal movement of said yoke and said one sliding form upon lifting said yoke along the associated climbing rod.

3. Sliding form equipment as defined in claim 1, wherein said yoke includes a movable portion mounted for movement horizontally with respect to said yoke, said one sliding form being supported by said movable portion, said wedge means

causing horizontal movement of said movable portion and said one sliding form upon lifting said yoke along the associated climbing rod.

4. Sliding form equipment as defined in claim 2, wherein said yoke includes a movable portion mounted for movement horizontally with respect to said yoke, said one sliding form being supported by said movable portion, and including further wedge means mounted on said climbing rod and causing horizontal movement of said movable portion and said one sliding form upon lifting said yoke along the associated climbing rod.

5. Sliding form equipment as defined in claim 1, wherein said wedge means is adjustable along said climbing rod.

6. Sliding form equipment as defined in claim 2, wherein said wedge means is adjustable along said climbing rod.

7. Sliding form equipment as defined in claim 3, wherein said wedge means is adjustable along said climbing rod.

8. Sliding form equipment as defined in claim 4, wherein said further wedge means is adjustable along said climbing rod.