METHOD OF SLIDING-MOULD CONCRETE CASTING, AND A SLIDING MOULD FOR USE IN SUCH CASTING

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ABSTRACT OF THE DISCLOSURE

This disclosure pertains to a sliding mould useful for casting concrete structures that will have varying cross-sectional dimensions comprising at least two pairs of inner and outer mould walls that are composed of a plurality of removable segments, each of said inner mould walls at its closest point of intersection with a laterally adjacent inner mould wall being bridged by a plate member of non-variable width that is laterally slideable with respect to at least one of said inner mould wall surfaces, each mould wall being provided with at least one horizontally extending mould strip, yoke-like elements supporting each mould-strip by supporting means that permits horizontal movement of said horizontally extending mould strips, means for causing each yoke-like element to ascend, and means for bringing said yoke-like elements closer to each other as the yoke-like elements are raised.

Up till now sliding-mould concrete casting—excluding a few cases as indicated hereinafter—has been limited in use to such applications where it was possible to utilize structural elements having a cross-sectional area which was at least essentially constant in the sliding direction of the mould.

One of the exceptions relates to the erection of bridge columns and the like having a stepped cross-sectional area. In these cases it has thus been necessary to replace or re-build the sliding mould at certain predetermined levels.

A second exception relates to sliding-mould casting of factory chimneys where it has in fact been possible to build a mould which enables the casting of a chimney having progressively reduced cross-sectional dimensions. Such sliding moulds, however, are so complicated and costly that, for economical reasons, they can only be used where it is quite certain that one particular mould can be utilized several times, which makes it necessary when designing the chimney to adapt the design to any of a few standard sizes.

A third exception also relates to bridge columns and similar structural elements of a rectangular cross section, where it has been possible—again with comparatively complicated arrangements—to cause two of the four walls of the mould to converge, whereas its two remaining walls were maintained in parallel interrelation throughout the height of the column or the corresponding. In principle, however, as indicated hereabove, up till now, no satisfactory solution has been developed to the problem of providing a progressively tapering cross section as regards all the external sides of the concrete structure concerned.

The invention has for its object to provide a method and a sliding mould, respectively, which will enable, on an economical basis which is justifiable in practice, the utilization of sliding-mould casting for the erection of concrete structures having an all-sidedly decreasing cross-sectional area. The mainly characterizing feature of the invention resides in that a mould is employed, the walls of which comprise one or more segments, the width-measures of which are variable continuously and/or in step-by-step fashion by successively removing portions of the mould wall concerned.

A sliding mould according to the invention is mainly characterized in that its walls are easily displaceable relative to its supporting members, and in that its walls comprise one or more segments of variable width.

The invention will be described more in detail hereinafter with reference to the accompanying drawing, in which:

FIGS. 1 and 2 are perspective views exemplifying concrete structures which, owing to the present invention, can be cast by means of sliding moulds;

FIG. 3 shows a longitudinal section, and FIG. 4 a cross section through another concrete structure having a more complicated contour;

FIGS. 5 and 6, in side elevation and in top plan view, respectively, show a portion of a sliding mould made according to well-known design principles;

FIG. 7 shows a top plan view of a sliding mould constructed according to the present invention;

FIG. 8 is a perspective view of the sliding mould shown in FIG. 7; and

FIG. 9 in section elevation shows a portion of the sliding mould of FIGS. 7 and 8.

FIGS. 1 to 4, as mentioned above, merely exemplify a few different types of monolithic concrete structural elements susceptible of being produced by sliding-mould casting according to the invention. The structure of FIG. 1 has a rectangular contour, whereas the structure of FIG. 2 is hexagonal in cross section. The structural body of FIGS. 3 and 4 is composed of a central core of hexagonal cross section, and three external segments integrated therewith and having the cross-sectional shape of an equilateral trapezoid. What remains to be mentioned as to these four figures is only that each one of the structures shown therein is hollow. The invention involves very important advantages also in its application to solid structures, but its great value will be most apparent where, as in the present case, the concrete structure encloses one or more cavities having a progressively reduced cross-sectional area, since the essential difficulties are encountered at the inner walls of the mould. In this connection, it should be mentioned that the invention is applicable also to structures having a round cross-sectional shape, either such round shape being defined by a circle or by any other curved lines.

Numerals 1 designates a concrete wall being under erection by sliding-mould casting, the sliding mould employed having an outer wall 2 and an inner wall 3. The concrete wall, according to conventional practice, has embedded therein a plurality of iron rods 4, and climbing along these rods are hydraulic jacks 5 carrying yokes 6 having depending legs 7 carrying between them the sliding mould, the so-called mould-strips 8 of which rest on angle irons 9 or the corresponding rigidly connected to the legs 7. Numerals 1 to 8, inclusive, are also included in FIGS. 7, 8 and 9 where they relate to identically corresponding items. The difference between the construction subject of the present invention and the constructions already described in that, in the former construction, each mould wall, at one lateral edge thereof, at least, i.e. adjacent a corner, is replaced by a sheet-metal plate member 10, and in that said mould-strips 8 are easily displaceable along supports provided on the legs 7. These supports, in the embodiment illustrated, are constituted by rollers 9 journalled on trunnions 12. Numerals 13 designates essentially vertical posts or the corresponding, each such post securely holding one or more of the yokes 6 and associated elements,
and numeral 11 designates sheet-metal sealing plates disposed at the outer corners of the mould. The function of the arrangement just described will now be described, this description being at the same time an explanation of the method according to the invention, as well as of certain auxiliary elements for controlling the mould changing operations.

Say that it is desired, by means of a sliding mould, to cast a hollow concrete column according to FIG. 1, for example. The sliding mould is fabricated from wood in the conventional way and is mounted so as to impart to the mould sides an inclination identical with that of the wall surfaces of the column to be cast. In the course of this mounting operation, it is suitable to interconnect the mould strips temporarily at the corners. Thereafter, as soon as the yokes 6 disposed at the mould corners have been connected together, and screw-threaded spindles 14 associated with break-protecting sleeves 15 surrounding the same have been connected to the posts 13, the temporary connection between the mould-strips at the corners may be removed. The inner mould-strips which, as well as the outer ones, are supported on yokes with rollers 9, are now sawed off by a suitable length, such as 10 to 20 cms., whereby one or two boards of the mould wall can be removed. These are replaced by a sheet-metal plate of a width in excess of the total width of the removed mould wall boards, the overlapping portion of this plate projecting in between the adjacent ones of the remaining boards of the mould wall and the concrete. As directly apparent from the drawing, the mould is now susceptible of crimping in size, in that the portion concerned of the inner mould wall will slide in contact with the plate 10, the mould-strips 8 then passing over the rollers 9. Just before the mould-strips will have reached the crosswise extending mould wall, a new cut-off operation is carried out substantially as before, and the procedure is then repeated any number of times, as necessary. As regards the outer walls of the mould, no corresponding problems will arise since these may simply be allowed to slide past the crosswise mould wall while successively removing the protruding part of the mould wall. Control of the mould changing movement in the horizontal sense, i.e. the progressive reduction of the mould, can be carried out positively in a simple way by the aid of the spindles 14 and nuts associated therewith. In addition, as soon as the casting work has been started, the mould will automatically tend to maintain its inclined position unchanged, so that said positive control will have its greatest value when this inclination is to be varied, such as where the walls of the concrete structure being cast are curving, rather than straight-lined. It will also be necessary, as a rule, successively to shorten the spindles 14, but this may readily be done, of course, and the cost involved due to the successive consumption of these spindles, as well as of the mould proper, is quite negligible as compared to the extremely high gain involved in the fact that it has on the whole become possible to cast structures of the types here concerned by means of sliding moulds.

Where the inclination of the sliding mould is not constant, but varies as the structure being cast ascends, then the change in inclination required can readily be accomplished, for instance, by using a hinged connection 16 between one leg 7 of the yoke and the post 13, the angular displacement of the yoke about the pivot 16 being controlled by means of spacer bolts 17 which are screwed into post 13 and having their extreme ends supported on the just-mentioned yoke leg. Utilising these simple expedients, sliding-mould casting of concrete structures of the comparatively complicated type shown in FIG. 3 will be possible. The corresponding design calculation work may be reduced to the steps of drawing up a scheme based on the screw-thread pitch of bolts 17 and spindles 14 and the desired cross-sectional dimensions of the structure at various levels, and specifying the amounts by which the bolts and nuts, respectively, will have to be rotated when arriving at each one of a plurality of predetermined levels.

It should be understood that the description hereinbefore and the accompanying drawing are merely intended to illustrate one of many conceivable embodiments. Various modifications are possible, particularly as regards the purely mechanical arrangements for effecting the progressive reduction and control or guiding of the sliding mould. What is essential to the invention merely resides in this hand, the mould should be so arranged relative to the yokes or the equivalent as to enable the mould-strips to move horizontally, but not vertically, relative to the yokes, and, on the other hand, one or more segments of each mould wall are horizontally displaceable relative to the remaining portions of the mould wall. Hereinbefore, sheet-metal has been mentioned as an example of construction materials for these segments of the mould wall, but it will be possible, of course, to use any suitable material for this purpose.

I claim:

1. A sliding mould useful for casting concrete structures that will have varying cross-sectional dimensions comprising:
   (a) at least two pairs of inner and outer mould walls,
   (b) at least the inner of said mould walls being composed of a plurality of removable segments,
   (c) each of said inner mould walls, at its closest point of intersection with a laterally adjacent inner mould wall, being bridged by a plate member of non-variable width, said plate member being laterally slideable with respect to at least one of said inner mould wall surfaces,
   (d) each mould wall being provided with at least one horizontally extending mould strip,
   (e) yoke-like elements supporting each mould-strip by supporting means,
   (f) said supporting means permitting horizontal movement of said horizontally extending mould strips,
   (g) means for causing each yoke-like element to ascend, and
   (h) means for bringing said yoke-like elements closer to each other as the yoke-like elements are raised.

2. A sliding mould useful for casting concrete structures that will have varying cross-sectional dimensions comprising:
   (a) at least two pairs of inner and outer mould walls,
   (b) at least the inner of said mould walls being composed of a plurality of removable segments,
   (c) each of said inner mould walls at its closest point of intersection with a laterally adjacent inner mould wall being bridged by a plate member of non-variable width, said plate member being laterally slideable with respect to at least one of said inner mould wall surfaces.

3. A sliding mould according to claim 2 wherein said plate member comprises two intersecting planar members.

4. A sliding mould according to claim 2 wherein:
   (a) each mould wall is provided with at least one horizontally extending mould strip,
   (b) yoke-like elements supporting each mould-strip on supporting means,
   (c) said supporting means permitting lateral movement of said horizontally extending mould strips,
   (d) means for causing each yoke-like element to ascend.

5. A sliding mould according to claim 4 which additionally contains means for bringing said yoke-like elements closer to each other as the yoke-like elements are raised.

6. A sliding mould useful for casting concrete structures that will have varying cross-sectional dimensions comprising:
   (a) at least two sliding mould walls of variable width,
   (b) yoke-like elements supporting each mould wall,
(c) means for causing each yoke-like element to ascend, and
(d) means for bringing said yoke-like elements on adjacent mould walls closer to each other as the yoke-like elements are raised.

7. A sliding mould useful for casting concrete structures that will have varying cross-sectional dimensions comprising:
(a) at least one sliding mould wall of variable width,
(b) each mould wall being provided with at least one horizontally extending mould strip,
(c) yoke-like elements supporting each mould-strip on supporting means,
(d) said supporting means permitting lateral movement of said horizontally extending mould strips, and
(e) means for causing each yoke-like element to ascend.

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