ABSTRACT: A device comprises a framework and a movable panel attached to at least one side of the framework by movable connecting arms. The movable panel is prevented from pivotally moving upward but is permitted to move downward, pivotally supported at supporting points in the arms while the vertical position of the panel is maintained during said movement. After a concrete wall is hardened supported by the panel, the whole device is lifted up by a lifting device. At this time, the panel is set apart from the wall surface due to the pivotal movement, and then the device is placed into the next position of construction by means of the lifting device.
The present invention relates to a method and device for building concrete walls and columns of buildings or protective banks of channels for drainage and irrigation.

Conventionally, as metal form most of the works for building the above-mentioned concrete structures have involved complicated steps comprising forming spaces for pouring concrete by assembling a number of frames, placing concrete therein, and disassembling and removing the frames upon hardening of the concrete, the frames thereafter being sorted out into each group of the constituent members and well cared for to be assembled again for the next use. Therefore, the conventional method has such disadvantages that the work efficiency is markedly impaired resulting in cost increase of the concrete construction while the workers are always exposed to danger during the assembly of the frames.

On the other hand, in case concrete structures are built according to sliding form, concrete pouring, once started, has to be carried out successively before the concrete already placed hardens. Until the whole structure is finally formed, this operation must be performed day and night without interruption; a method requires a great number of workmen and which is subject to objective results should any of the devices concerned get out of order.

A principal object of the present invention is accordingly to overcome such conventional defects and to provide a device and method for building concrete structures by which, by employing one or more in series, concrete structures can be constructed extremely easily yet rapidly in a successive manner.

More particularly, an object of the present invention is to provide a device for building concrete structures comprising a framework constructed of a material having sufficient physical strength such as angle iron and the like and a movable panel attached to at least one side thereof through movable connecting arms, said movable panel being prevented from pivotally moving upwardly but permitted to move downward a predetermined distance pivotally supported at supporting points in said arms, with approximately vertical position of said panel maintained during said movement, by which pivotally movement said movable panel is set apart from a concrete wall surface constructed thereby enabling the removal of the entire body of said device. Thus, according to this device, concrete structures can be built rapidly and successively without complicated steps of handling frames such as assembling, disassembling removal, reassembling and the like.

Other objects and advantages of the present invention will become apparent from the detailed description of the following with reference to the accompanying drawings, in which:

FIG. 1 is a schematic perspective view showing a device in accordance with the present invention;

FIG. 2 is a fragmentary enlarged view in cross section showing a device of the present invention;

FIG. 3 is an enlarged view in cross section, similar to FIG. 2, showing the movement of the parts of the device;

FIG. 4 is a fragmentary enlarged view in cross section showing a device of the present invention with some modifications to alter the position of a movable panel;

FIG. 5 is an enlarged view in cross section of the device taken along the line 5-5 in FIG. 2;

FIG. 6 is an enlarged view in cross section taken along the line 6-6 in FIG. 4;

FIG. 7 is a schematic front view showing a device of the present invention which is slightly modified for forming tunnel linings;

FIG. 8 is a schematic front view showing a device of the present invention which is slightly modified for forming tunnel linings;

FIG. 9 is a schematic plan view showing an embodiment of the present invention in which movable panels are formed in curved shape; and

FIG. 10 is a schematic plan view showing an embodiment of the present invention in which movable panels are disposed within the framework in facing relationship for building concrete columns.

Now, as shown in FIGS. 1 and 2, a device of the present invention for building concrete structures principally consists of a framework A formed of angle iron and the like in a solid shape such as a cubic body and movable panels B attached to the four sides of the framework A by means of movable connecting arms 1. At least two positions, at the lower and the upper parts of the framework A, each of the movable panel B is supported, through the movable connecting arms 1, by the end portions of quadrangular hollow beams 2, constituent members of the framework A. Between the movable panel B and the end portions of the beams 2 is maintained a suitable clearance C, which normally permits the movable panel B to move inward still in its vertical position and pivotally supported at supporting points D in the movable connecting arms 1 due to the weight of its own (See FIG. 3). Furthermore, the movable connecting arms 1 are as shown in FIG. 2 so designed as to contact the upper walls 2A of the beams 2 when positioned horizontally thereby upward pivot movement thereof being precluded.

In order to help prevent this pivotal movement and lessen the loading on the movable connecting arms 1, the rear side of the movable panel B is provided with arresting protrusions 3 which, when said arms are brought in horizontal position, contact the lower walls of the beams 2 and reduce the loading.

The movable connecting arms 1 are also prevented from unlimitedly moving downward by the lower edges thereof being brought into contact with the lower walls 2B of the beams 2 in the downward movement. The movable panel B is also on its rear side provided with arresting protrusions 4 which reduce the load on the arms 1 upon contacting the upper surfaces of the beams 2 (See FIG. 3).

The elements forming the device of the present invention, the framework A, movable connecting arms 1, beams 2 and movable panels B should be provided with sufficient strength to withstand the load exerted thereon in pouring concrete and during construction works. The movable panels B should preferably be formed of plate such as metal plate which is damageproof even subject to repeated use.

This device is lifted up by a lifting device (not shown in the FIG.) disposed above the device, the desired portions in the upper surface of the framework A being caught by a rope 5 hung down from the lifting device.

The present device will be hereinafter described as it is employed in building concrete walls.

As shown in FIG. 2, the entire body of the device is supported at the bottom portion of the panel B by pins 7 inserted in cylinders 6 previously embedded in the already hardened concrete wall E and then concrete is poured into a space formed between the panel B of the device and a frame F of a conventional type which is disposed in facing relationship with the panel and spaced with a width of the concrete wall to be constructed therebetween. At this time, cylinder 8 to receive pins for supporting the device in the next step are disposed in advance at upper portions of the space by a suitable means. After the hardening of the concrete thus placed, the entire body of the device is lifted up by the rope 5 and placed into the next position of the construction. In this step the movable connecting arms 1 supported at the supporting points D pivotally move downward up to a position where the arms are brought into contact with the lower walls 2B of the beams 2 thereby causing the movable panel B to get separated from the concrete wall, so that the entire device can be lifted up smoothly without marring the wall. In this manner, the steps described above are repeated and concrete construction is carried out in succession.

In the embodiment of the present invention stated above, only one side of the device is put to use. However, other sides thereof can of course be employed simultaneously. Although the above embodiment also shows the case in which one side
of the wall to be constructed is supported by a conventional frame with the device of the present invention applied on the other side thereof, concrete structures can be built in succession by a pair of the devices of the present invention which are employed on the opposite sides of the structure.

Furthermore, the device of the present invention is also applicable in constructing concrete protective walls in channels for drainage, irrigation and the like. FIG. 7 illustrates such application, in which movable panels B and B are attached to the opposite sides of the framework A in the same manner as in the foregoing embodiment by means of movable connecting arms 1. Upon the hardening of the concrete 10 provided between the panels B and B and the ground formation 9, the device is lifted up by the rope 5 and moved along the channel and placed into the advanced position where concrete is poured next as in the above step. Following such continuous steps, the construction works for building concrete protective walls can be carried out by one device in rapid and successive manner.

FIG. 9 shows another embodiment of the present invention in which, for successive construction of a concrete lining of manholes or circular vertical holes, the framework A is surrounded in circular form by movable panels H which are provided therearound by means of the movable connecting arms 1 as in the above-mentioned examples. Thus, the panels in the device of the present invention can be formed in any desired shape depending upon the positions and types of the concrete structures.

Furthermore, in order to build concrete structures in the form of quadrangular columns, the movable panels J can be attached to the inner sides of the framework A in facing relationship as shown in FIG. 10.

In each of the embodiments detailed above, the position of the movable panel is adjustable as desired, in order to construct concrete walls different in size. For instance, as shown in FIGS. 4 and 6, the beams 2 which support the movable panel B, are each formed of two portions 2a and 2b, the mating end portions thereof being telescopic in slidable manner and fastened together securely by means of bolts 16 inserted in one of the holes 15 provided in the opposite end portions, so that by changing the position of said hole 15, the movable panel B can be placed in advanced or withdrawn position whereby the concrete wall can be formed with a desired size.

From the detailed description stated above, it will readily be understood that the present invention has, in particular, following advantages.

The device of the present invention, while dispensing with repeated assembling, disassembling and removal of frames conventionally necessary, enables to build concrete structures simply by carrying the device over to the next position of construction, so that the device is provided with such advantages that not only the time for the construction is reduced but also the manpower can be markedly decreased thereby resulting in a substantial cost reduction of concrete construction while safety operation is ensured by eliminating danger to the workmen.

Although the present invention has been described with respect to typical embodiments, the inventor does not wish to limit the invention only to the embodiments, but it is to be understood that the invention may also reside in all of the substitutes, equivalents and alterations without departing from the principle of the present invention and the spirit of the inventor as set forth in the claims stated hereinafter.

I claim:

1. A device for building concrete structures comprising a frame, means for lifting the frame, a generally vertically extending panel, a pair of vertically spaced generally parallel elongated connecting arms pivotally secured to the panel and pivotally secured to the frame, first stop means on the frame for preventing upward pivoting movement of the connecting arms relative to the frame beyond generally horizontal position of the arms in which the panel is disposed in its most spaced position from the frame, and second means on the frame spaced from the first stop means for permitting limited downward pivotal movement of the connecting arms relative to the frame for moving the panel toward the frame but preventing further downward pivotal movement of the arms relative to the frame, said parallel connecting arms maintaining said panel generally vertical during pivotal movement of the connecting arms, the first and second stop means including beams having top, bottom and sidewalls, each connecting arm being pivotally secured to the sidewall of a beam, the top wall of each beam being engageable with the associated connecting arm for preventing upward pivotal movement of the connecting arm relative to the frame beyond the generally horizontal position of the arm, the bottom wall of each beam being engageable with the associated connecting arm for preventing further downward pivotal movement of the arm relative to the frame after predetermined downward pivotal movement of the arm from its horizontal position.

2. The device of claim 1 including first abutment means on the panel engageable with the bottom wall of one of said beams when the connecting arms are in their generally horizontal position, and second abutment means on the panel engageable with the top wall of one of the beams when the connecting arms engage the bottom walls of the beams.

3. A device for building concrete structures comprising a frame, means for lifting the frame, a generally vertically extending panel, a pair of vertically spaced generally parallel elongated connecting arms pivotally secured to the panel and pivotally secured to the frame, a pair of beams on said frame extending toward the panel, each beam comprising telescoping engaged first and second portions and means for releasably securing the first and second portions, each connecting arm being pivotally secured to one of the beam portions whereby the length of the beam may be adjusted to vary the spacing of the panel from the frame, first stop means on the frame for preventing upward pivoting movement of the connecting arms relative to the frame beyond the generally horizontal position of the arms in which the panel is disposed in its most spaced position from the frame, and second means on the frame spaced from the first stop means for permitting limited downward pivotal movement of the connecting arms relative to the frame for moving the panel toward the frame but preventing further downward pivotal movement of the arms relative to the frame, said parallel connecting arms maintaining said panel generally vertical during pivotal movement of the connecting arms.