The present invention discloses a method for building a dome by reusing a basic segment. The method comprises the steps of determining a shape of the dome and determining a structure and dimensions of a basic structure unit of the dome named as a formwork. The method further comprises bending the formwork in a desired shape, pivoting the formwork and supporting the pivoted formwork through a support truss and mounting the formwork over a basic structure. The method further comprises pouring a filler material in the formwork and repeating the filling work in positions that are adjacent to an initial positioning of formwork.
FORMWORK AND METHOD FOR CONSTRUCTING FAMILY OF DOME-LIKE SHELL STRUCTURES

BACKGROUND

Technical Field of Invention

[001] The embodiments herein generally relates to an efficient method for building a structural formwork and particularly relates to a method for dome shaped structure by using a single structure formwork. The embodiments herein more particularly relates to a formwork and method of using the same repeatedly to complete a building structure.

Description of Related Art

[002] A formwork in construction is the use of support structures and moulds to create structures out of concrete which is poured into the moulds. The formwork is also used by creating moulds out of steel, wood, aluminium or prefabricated forms into which the concrete is poured.

[003] One of the prior arts discloses a reinforcing structure of a concrete formwork convenient to remove. The formwork is fixed by reinforcing pieces, reinforced steel ropes penetrate through steel rings of stressed reinforced steel bars, and the formwork is pulled through the reinforced steel ropes.

[004] Another prior art discloses a permanent plastic formwork system formed by two parallel surfaces, namely an outer surface and an inner surface. The plastic formwork consist a plurality of flat or longitudinally curved, hollow plastic slats obtained by means
of extrusion. The slats are provided internally with metal sections providing them with rigidity and joined longitudinally by means of tongued-and-grooved ends, separators existing between the two surfaces. The said separators are provided with a threaded area and an inclined appendage for securing the rebar mesh located between the surfaces. The slats are secured to the ground using U-shaped parts containing a threaded rod that can be used to clamp and fix same.

[005] However, the prior arts a permanent formwork that are rigid or non-removable thus increasing an overall cost of a structure. The prior arts' formworks are implemented for a single time use that needs an increased amount of formwork structure at a single time.

[006] In the view of foregoing, there is a need for a method of implementing a formwork in an efficient manner.

[007] The above mentioned shortcomings, disadvantages and problems are addressed herein, as detailed below.

OBJECT OF THE INVENTION

[008] The primary object of the embodiments herein is to provide a method for implementing a formwork in an iterative manner for building a suitable structure.

[009] Another object of the embodiments herein is to provide a removable and reusable formwork.

[0010] Yet another object of the embodiments herein is to provide a method for dynamically determining a basic formwork structure for a dome structure to be built and hence the method for using the same.
These and other objects and advantages of the embodiments herein will become readily apparent from the following detailed description taken in conjunction with the accompanying drawings.

SUMMARY OF THE INVENTION

The various embodiments herein disclose a method for building a dome by reusing a basic segment. The method comprises the steps of:

a) determining a shape of the dome;

b) determining a structure and dimensions of a basic structure unit of the dome named as a formwork, wherein the basic structure unit is a small fraction or unit to form the dome structure on its symmetrical and repetitive application;

c) bending the formwork in a desired shape, wherein the a desired shape is symmetrical small foundation of the dome;

d) pivoting the formwork and supporting the pivoted formwork through a support truss;

e) mounting the formwork over a bas structure;

f) applying a construction material like concrete onto the formwork, wherein the applied material is settled in predetermined amount of time;

g) repeating the steps from (a) to (f) adjacent to an initial positioning of formwork, wherein the repetition is continued till the formwork reaches a final position symmetrically opposite to the initial position.

According to an embodiment herein, an alternative method for building a dome shaped structure comprises the steps of:

a) combining a plurality of formwork to prepare a dome shaped formwork;

b) applying a building material like concrete onto the dome shaped formwork;
c) allowing a settling of the building material resulting in completion of the dome structure.

[0014] According to an embodiment herein, a ring beam form a base support the formwork is directly mounted onto the base support provided the base support is wide enough. A pivot point resides on the base support.

[0015] According to an embodiment herein, a spacing between two base supports is equal to the diameter of the sphere in case of a hemispherical dome. The spacing is increased or decreased in case of an ellipsoidal dome.

[0016] According to an embodiment herein, the formwork is made up of a plastic or a metal or a polymer with high flexibility and stiffness.

[0017] These and other aspects of the embodiments herein will be better appreciated and understood when considered in conjunction with the following description and the accompanying drawings. It should be understood, however, that the following descriptions, while indicating preferred embodiments and numerous specific details thereof, are given by way of illustration and not of limitation. Many changes and modifications may be made within the scope of the embodiments herein without departing from the spirit thereof, and the embodiments herein include all such modifications.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The other objects, features and advantages will occur to those skilled in the art from the following description of the preferred embodiment and the accompanying drawings in which:

[0019] FIG. 1 illustrates a development of a hemispherical dome through a formwork, according to an embodiment herein.
FIG. 2 A and 2 B illustrates a dome shell design with even complete formwork segments, according to an embodiment herein.

FIG. 3 A, 3 B and 3 C illustrates a dome shell and a drum shaped base support design, according to an embodiment herein.

FIG. 4 A and 4 B illustrates a dome shell design with odd complete formwork segments, according to an embodiment herein.

FIG. 5 A, 5 B and 5 C illustrates a dome shell and a drum shaped base support design with odd complete formwork segments, according to an embodiment herein.

FIG. 6 A and 6 B illustrates an embedded reinforced rod pattern support (rebar) for dome construction and a rebar pattern for a formwork segment, according to an embodiment herein.

DETAILED DESCRIPTION OF THE DRAWINGS

In the following detailed description, a reference is made to the accompanying drawings that form a part hereof, and in which the specific embodiments that may be practiced is shown by way of illustration. The embodiments are described in sufficient detail to enable those skilled in the art to practice the embodiments and it is to be understood that the logical, mechanical and other changes may be made without departing from the scope of the embodiments. The following detailed description is therefore not to be taken in a limiting sense.

FIG. 1 illustrates a development of a hemispherical dome through a formwork, according to an embodiment herein. With respect to FIG. 1, a foundation is laid for supporting the dome shaped structure. The foundation is either in cylindrical shape or a shell structure is directly developed over a ground surface. The unit structure of the
formwork is bent into a desired shape on the basis of curvature angle and area coverage for a shell structure to be made (101). The formwork is fixed two pivot anchors on its two corners and a support rod runs at its central axial line of the formwork connecting the pivot anchors (102). A support truss is connected to the support rod and the pivot anchors (103). The pivot anchors are supported on a base or a mounting structure (104). Further a filling material is poured into the formwork to cast a position of the dome structure. The formwork is removed after solidifying of the filler material and repeating the filling procedure at adjacent positions (105). The dome structure is revealed in its desired shape after solidification of the filler material (106).

[0027] According to one embodiment of the present invention, the foundation for the structure is desired made to suit the local conditions. Then, the objective is to have the support in place according to the position of the pivot point of the structure to be built. In cases where the dome does not have a drummed base, and the pivot point is directly on the surface onto then the support for the formwork is mounted directly onto the ground surface. In cases where we have a ring beam, the support for the formwork can be mounted onto it directly with the pivot points on the ring beam. In cases where the support cannot be directly mounted onto the ring beam, a temporary firm base is built to mount the supports for the formwork. In cases where we have a drum for the dome, a pier or similar support is erected to mount the supports for the formwork. The supports are positioned on the basis of the shape of the desired sphere. In the case of a perfect hemisphere, the spacing between two supports is the diameter of the sphere. This can be increased or decreased to form ellipsoids, but the segment shape is modified accordingly.

[0028] According to one embodiment of the present invention, the formwork segment is made out of plastic, metal or any other such sheet of desired flexibility and stiffness. In case of larger domes, a truss-like support for the segment is built of bamboo,
wood or metal rods. This adds to the stiffness as well as ensures easy operability. If the shell is reinforced, an appropriate pattern for the reinforcement rods are decided based on the site conditions and the recommended pattern for the shape desired.

[0029] According to one embodiment of the present invention, a pattern of anchored reinforcement rods and the support rod/truss together balance the load of the filler material that is placed over the formwork segment. Now, the formwork is mounted on the supports, and placing it in the position to support the first segment that is to be constructed. The designs of the pivot anchor and mount depend on the context, site and other extraneous parameters.

[0030] FIG. 2A and 2B illustrates a dome shell design with even complete formwork segments, according to an embodiment herein. The FIG. 2A shows an elevated view of the dome shell. The dome shell is comprised equally angled sectors. The FIG. 2B shows a side view of the unfolded formwork segment with semi-circular circumference of \( TIR \), wherein \( r \) is the radius of the segment from a central axis of the hemispherical dome.

[0031] FIG. 3A, 3B and 3C illustrates a dome shell and a drum shaped base support design, according to an embodiment herein. The FIG. 3A shows an elevated view of the dome shell with cylindrical support. The dome shell comprises even number of complete formwork segments with sector angle \( \Theta \) and two half segments \( \Theta/2 \) at symmetrically opposite positions. The half segments are also end segments as they are applied at initial and final position. The FIG. 3B shows a side view of the unfolded segment with circumference of \( nr \), wherein \( r \) is the radius of the segment from a central axis of the hemispherical dome. The FIG. 3C shows a side view of the unfolded drum with outer circumference of \( nr \).

[0032] FIG. 4A and 4B illustrates a dome shell design with odd complete formwork segments, according to an embodiment herein. The FIG. 4A shows an elevated
view of the dome shell. The dome shell is comprised equally angled odd number of sectors. The FIG. 4B shows a side view of the unfolded formwork segment with semi-circular circumference of $nr$, wherein r is the radius of the segment from a central axis of the hemispherical dome.

[0033] FIG. 5A, 5B and 5C illustrates a dome shell and a drum shaped base support design with odd complete formwork segments, according to an embodiment herein. The FIG. 5A shows an elevated view of the dome shell with cylindrical support. The dome shell comprises odd number of complete formwork segments with sector angle $\Theta$ and two half segments $\Theta/2$ at symmetrically opposite positions. The half segments are also end segments as they are applied at initial and final position during a construction of the dome shell. The FIG. 5B shows a side view of the unfolded segment with circumference of $nr$, wherein r is the radius of the segment from a central axis of the hemispherical dome. The FIG. 5C shows a side view of the unfolded drum with outer circumference of $nr$.

[0034] FIG. 6A and 6B illustrates an embedded reinforced rod pattern support (rebar) for dome construction and a rebar pattern for a formwork segment, according to an embodiment herein.

[0035] According to an embodiment herein, an appropriate pattern for the reinforcement rods is decided based on the site conditions and the recommended pattern for the shape desired for a reinforced dome shell construction. As an example, the rebar pattern shown in FIG. 6A and 6B is used for a perfect hemisphere. In this case, the formwork segment is pre-marked with the positions of the rods to ensure fast and efficient work on the site. The rebar is positioned at an appropriate distance from the formwork using mountable supports that enable the reinforcement bars to stay in place. After laying the reinforcement rods, the next step is to apply cement concrete over the formwork. It is
done by hand rendering the cement onto the surface of the segment or by other such means like shotcrete, etc. Once the concrete has hardened (admixtures may be used to speed up this process), the formwork is systematically pulled out so as to leave the hardened segment behind, and placed in position to support and create the next segment of the shell. The segment has been designed to structurally take its own load through the cantilevered stage it is in, and the progressive stages it will encounter, until the completion of the entire shell.

[0036] According to an embodiment herein, the application areas include shells for homes, storage spaces, industrial infrastructure or any space that requires an enclosure.

[0037] The embodiment herein reduces the cost of construction by reusing a formwork. It also adds easier operability to the construction process and speeds up the construction procedure.

[0038] It is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation. Therefore, while the embodiments herein have been described in terms of preferred embodiments, those skilled in the art will recognize that the embodiments herein can be practiced with modification within the spirit and scope of the claims.
CLAIMS:

I claim:

1. A method for building a dome by reusing a basic segment comprising:
   a) determining a shape of the dome;
   b) determining a structure and dimensions of a basic structure unit of the dome named as a formwork, wherein the basic structure unit is a small fraction or unit to form the dome structure on its symmetrical and repetitive application;
   c) bending the formwork in a desired shape, wherein the a desired shape is symmetrical small foundation of the dome;
   d) pivoting the formwork and supporting the pivoted formwork through a support truss;
   e) mounting the formwork over a base structure;
   f) pouring a filler material in the formwork, wherein the poured material is settled in predetermined amount of time;
   g) repeating the steps from (a) to (f) adjacent to an initial positioning of formwork, wherein the repetition is continued till the formwork reaches a final position symmetrically opposite to the initial position.

2. The method according to claim 1, wherein a ring beam forms a base support, wherein the formwork is directly mounted onto the base support provided the base support is wide enough, wherein the pivot point resides on the base support.

3. The method according to claim 1, wherein a spacing between two base supports is equal to the diameter of the sphere in case of a hemispherical dome, wherein the spacing is increased or decreased in case of an ellipsoidal dome.

4. The method according to claim 1, wherein the formwork is made up of a plastic or a metal or a polymer with high flexibility and stiffness.
5. The method according to claim 1, wherein the formwork is modular in nature and is used in repetitions from one position to another in the dome structure.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
E04G11/04, E04B01/32 Version=2015.01
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E04G11/04, E04B01/32

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database consulted during the international search (name of database and, where practicable, search terms used)
IPO INTERNAL DATABASE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>EP1315873 B1 (Rene Trottmann) Publication date 2 September 2009 (Abstract, Page-10, paragraph-1, figure-1)</td>
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<td>Y</td>
<td>CN203247831 U Publication date 15 May 2013 (Abstract, Page-1, paragraph-1, figure-1)</td>
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☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
  "A" document defining the general state of the art which is not considered to be of particular relevance
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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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Date of the actual completion of the international search
11-08-2015

Date of mailing of the international search report
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Name and mailing address of the ISA/
Indian Patent Office
Plot No. 31, Sector 14, Dwarka, New Delhi-110075
Facsimile No.

Authorized officer
Kumar Raju
Telephone No. +91-1125300200

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