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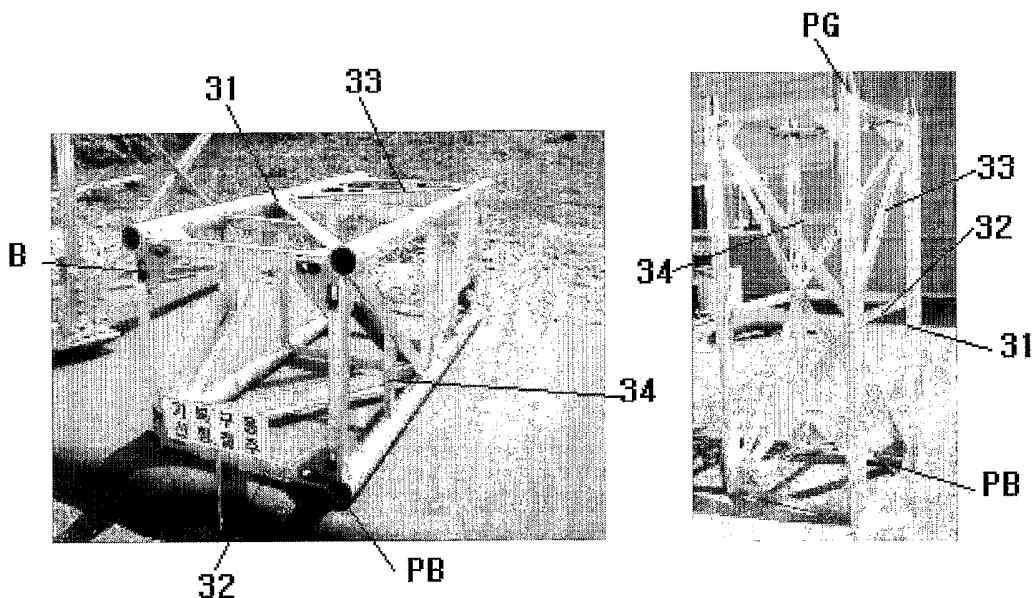
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(54) Title: QUICK ERECTED MODULAR STEEL TOWER



(57) Abstract: Disclosed herein is a quickly erected modular steel tower having a modular body structure consisting of simplified unit bodies, which are made of a lightweight material suitable to be carried by manual labor and each has reduced kinds and numbers of parts to be manually assembled with a reduced assembly time through the use of a quick fastening system.



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QUICK ERECTED MODULAR STEEL TOWER

[Technical Field]

The present invention relates to a quickly erected modular steel tower, and, more particularly, to a quickly erected modular steel tower having a modular body structure consisting of simplified unit bodies, which are made of a lightweight material suitable to be carried by manual labor and each has reduced kinds and numbers of parts to be manually assembled with a reduced assembly time through the use of a quick fastening system.

[Background Art]

When typhon Memi roared across Korea in 2003, power-transmission steel towers having a capacity of approximately 154000 V collapsed, causing interruption of electricity in large-scale industrial areas for several days. This incident illustrated the necessity of quick recovery of power-transmission systems. One of the reasons why electricity, which is essential to industry and home, is interrupted for such a long time is that conventional steel towers are too heavy to be moved by manual labor, inevitably requiring heavy construction machinery. Referring to Figs. 1(1) to 1(4), a steel tower construction method according to the prior art is illustrated in photographs. In the conventional steel tower construction method, after excavating the ground using an excavator (See. Fig. 1(1)), each unit section of a steel tower has to be transferred using a helicopter due to the heavy weight thereof (See. Fig. 1(2)). Also, erection and handling of the steel tower have to be performed using heavy construction machinery due to the heavy weight thereof (See. Fig. 1(3)). Thus, to lift respective sections being assembled to form the steel tower, so-called Gin-Pole construction equipment has been conventionally used (Fig. 1(4)). The use of the Gin-Pole construction equipment requires integral alignment of a plurality of bolt holes in order to vertically connect the sections of the steel tower one above another, resulting in a troublesome assembly operation and excess assembly time.

Referring to Fig. 2, a quick-recovery power-transmission steel tower construction method according to the prior art is illustrated in photograph. As shown in Fig. 2, after excavating the ground at a mounting location of an earth wire anchor, a base

platform is inserted into an excavated pit, and then, soil is covered thereon to achieve a soil bearing force. After that, steel reinforcements, anchor bolts, and concrete are placed at a base location, where a lowermost section of the steel tower will be seated, for the construction of the steel tower. However, this construction method requires the use of heavy construction machinery for the excavation of soil as well as an additional concrete curing period. To solve these problems, a steel tower having a modular body structure as shown in Fig. 3 has been developed. The modular steel tower is made of a lightweight material suitable to be transferred by manual labor.

However, it is still impossible to assemble respective modular bodies of the steel tower using only manual labor. That is, after being connected to have an elongated shape on the ground, the connected bodies of the steel tower are erected by making use of a hinge mounted on the ground and are lifted using bulky hydraulic equipment. Otherwise, each elongated body is lifted to be assembled using a helicopter. The use of the heavy equipment and helicopter disadvantageously increases construction costs and assembly/disassembly time of the steel tower.

[Disclosure]

10 [Technical Problem]

Therefore, the present invention has been made in view of the above problems, and it is an object of the present invention to provide a quickly erected modular steel tower which has a simplified modular body structure suitable for easy construction in mountainous and coastal areas without a concrete curing operation and also suitable for manual transportation and assembly by manual labor by virtue of the adoption of a lightweight material and reduced kinds and numbers of parts to thereby eliminate the necessity of a helicopter and other heavy construction machinery, and can achieve a reduced assembly time through the adoption of a quick fastening system to thereby minimize power interruption loss due to delay of construction of the power-transmission steel tower.

20 It is another object of the present invention to provide a quickly erected modular steel tower which can prevent falling of a worker as well as scattering of bolts and nuts upon assembly/disassembly operations through the adoption of a worker protective structure, thereby improving constructional safety and preventing industrial accidents.

[Technical Solution]

In accordance with an aspect of the present invention, the above and other objects can be accomplished by the provision of a quickly erected modular steel tower comprising: a plurality of unit bodies; a plurality of earth plates; and a hoist, wherein each

5 unit body includes: a plurality of vertical poles; a plurality of horizontal bars connected to the vertical poles at uppermost, lowermost, and middle locations of the vertical poles, the horizontal bars having the same length as one another to allow the vertical poles to define a square and being formed with bolt taps, at opposite ends of the uppermost horizontal bars, adjoined to each other, being formed upper key-holes through which bolts are

10 fastened, respectively, at opposite ends of the lowermost horizontal bars, adjoined to each other, being formed lower key-holes, each of the lower key-holes consisting of a circular hole, and a linear portion extending from one side of the circular hole for the insertion and fastening of a respective one of the bolts; oblique braces connected between the vertically spaced horizontal bars to diagonally connect the uppermost horizontal bars to the middle

15 horizontal bars and also the middle horizontal bars to the lowermost horizontal bars; ladder rods connected between the oblique braces and the vertical poles adjacent thereto; and upper and lower bolt fasteners mounted at corners of the unit body defined by the uppermost horizontal bars and the lowermost horizontal bars and having key-holes having the same location and size as the upper and lower key-holes formed at the uppermost and

20 lowermost horizontal bars, wherein each of the earth plates includes: an earth main plate having key-holes having the same location and size as the upper and lower bolt fasteners of the unit bodies, and triangular head seats of triangular head bolts to be coupled with the bolt taps of the horizontal bars; and earth extensions extending outward from respective sides of the earth main plate to protrude outward beyond the horizontal bars, each of the

25 earth extensions being formed with earth wire connection holes, and wherein the hoist includes: a pair of hoist rollers coupled, respectively, to the two vertical poles that are arranged in parallel to each other; a lower hoist body connected at opposite ends thereof to shafts of the hoist rollers; a hoist main shaft formed at the center of the lower hoist body; and an upper hoist body connected to an upper end of the hoist main shaft to rotate

30 about the main shaft by a predetermined angle.

[Advantageous Effects]

By virtue of a development of the above described construction method of the quickly erected, light, and safe steel tower, it is possible to considerably reduce an assembly time of power transmission steel towers, antennas, etc. upon emergency recovery thereof, thereby minimizing power interruption loss due to delay of construction of the power-transmission steel tower and achieving improved economic effectiveness in the management of the steel tower.

[Description of the Drawings]

The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

Figs. 1(1) to 1(4) are photographs illustrating a steel tower construction method according to the prior art;

Fig. 2 is a photograph illustrating a base construction method according to the prior art;

Fig. 3 is a photograph illustrating another steel tower construction method according to the prior art;

Figs. 4(1) and 4(2) are comparative photographs illustrating unit body transportation methods according to the prior art and the present invention;

Fig. 5 is a photograph illustrating constructional safety of unit bodies according to the present invention;

Fig. 6 is a schematic diagram illustrating a steel tower according to an embodiment of the present invention;

Figs. 7(1) and 7(2) are a schematic diagram and a photograph, respectively, illustrating an earth wire anchor according to the embodiment of the present invention;

Fig. 8 is a photograph illustrating a base plate according to the embodiment of the present invention;

Figs. 9(1) and 9(2) are photographs illustrating a unit body according to the embodiment of the present invention;

Figs. 10(1) and 10(2) are schematic top and bottom sectional views illustrating the unit body according to the embodiment of the present invention;

Figs. 11(1) to 11(4) are views illustrating quick fastening means according to the embodiment of the present invention;

Fig. 12 is a plan sectional view illustrating an earth plate according to the embodiment of the present invention;

5 Fig. 13 is a photograph illustrating a rotary-type hoist according to the embodiment of the present invention; and

Fig. 14 is a photograph illustrating a steel tower construction method according to the embodiment of the present invention.

[Best Mode]

10 Now, a quickly erected modular steel tower according to an embodiment of the present invention will be explained with reference to the accompanying drawings.

Referring to Figs. 8 to 13, the quickly erected modular steel tower comprises a plurality of unit bodies 30, a plurality of earth plates 40, and a hoist 60.

Considering first each of the unit bodies 30 with reference to Figs. 9 and 10, it
15 includes a plurality of vertical poles 31, and a plurality of horizontal bars 32 connected to the vertical poles 31 at uppermost, lowermost, and middle locations of the vertical poles 31. The horizontal bars 32 have the same length as one another such that the vertical poles 31 define a square. Here, each horizontal bar 32 is formed with bolt taps. Between the vertically spaced horizontal bars 32 are connected oblique braces 33 to
20 diagonally connect the uppermost horizontal bars 32 to the middle horizontal bars 32 and the middle horizontal bars 32 to the lowermost horizontal bars 32. Also, ladder rods 34 are connected between the oblique braces 33 and the vertical poles 31 adjacent thereto. At opposite ends of the uppermost horizontal bars 32, adjoined to each other, are formed upper key-holes B (See Fig. 10(2)), and bolts are fastened through the upper key-holes B,
25 respectively. Similarly, at opposite ends of the lowermost horizontal bars 32, adjoined to each other, are formed lower key-holes B (See Fig. 10(1)). Each of the lower key-holes B consists of a circular hole, and a linear portion extending from one side of the circular hole for the insertion and fastening of the bolt. The unit body 30 further includes upper and lower bolt fasteners PB mounted at corners of the unit body 30
30 defined by the uppermost horizontal bars and the lowermost horizontal bars. All the bolt fasteners PB have key-holes having the same location and size as the upper and lower

key-holes B formed at the uppermost and lowermost horizontal bars 32.

Referring to Fig. 12, each of the earth plates 40 includes an earth main plate 41, and earth extensions 42 extending outward from respective sides of the earth main plate 41 to protrude outward beyond the horizontal bars 32. Each of the earth extension 42 is
5 formed with earth wire connection holes GH. The earth main plate 41 has key-holes having the same location and size as those of the upper and lower bolt fasteners PB of the unit bodies 30, and triangular head seats TH of triangular head bolts to be coupled with the bolt taps of the horizontal bars 32.

Referring to Figs. 12 and 13, the hoist 60 includes a pair of hoist rollers 61
10 coupled, respectively, to the two vertical poles 31 that are arranged in parallel, a lower hoist body 62 connected at opposite ends thereof to shafts S of the hoist rollers 61, a hoist main shaft 63 formed at the center of the lower hoist body 62, and an upper hoist body 64 connected to an upper end of the hoist main shaft 63 to rotate about the hoist main shaft 63 by a predetermined angle.

15 Meanwhile, referring to Fig. 11, two unit bodies 30 are vertically coupled to each other as the bolts, fastened to the upper key-holes B (Fig. 10-(2)) of the lower unit body 30, are inserted into the circular holes of the lower-key holes B (Fig. 10-(1)) of the upper unit body 30, and are forced to be tightly fastened into the linear holes of the lower-key holes B.

20 As will be understood from Figs. 9 and 10, the vertical poles 31 serve as transfer rails of the hoist 60.

Each of the vertical poles 31 has a pipe shape. As shown in Fig. 9(2), conical vertical guides PG are formed at upper ends of the vertical poles 31 of the lower unit body 30 to be vertically inserted into hollow lower ends of the vertical poles 31 of the upper
25 unit body 30 being disposed thereon.

Now, the operational effects of the quickly erected modular steel tower configured as stated above will be explained.

The steel tower of the present invention has a modular structure to ensure easy construction thereof even in mountainous and coastal areas, and does not require a
30 concrete curing procedure. Differently from a conventional steel tower, which is transferred by a helicopter as shown in Fig. 4(1), the unit body 30 of the present invention is light to be transferred by manual labor as shown in Fig. 4(2). Also, by virtue of

reduced kinds and numbers of the parts thereof, the unit body 30 has a simplified structure suitable to be manually assembled without using heavy construction machinery. In the present invention, a quick fastening system is employed to thereby considerably reduce an overall assembly time and hence minimize power interruption loss due to delay
5 of construction of the power-transmission steel tower. In addition, as shown in Fig. 5, the modular steel tower of the present invention has a safe structure to completely prevent falling of a worker as well as scattering of bolts and nuts upon assembly/disassembly operations, resulting in improved constructional safety and stability.

To quickly and safely assemble the quickly erected modular steel tower, the
10 present invention adopts an assembly method comprising: a soil force increasing step of embedding a plurality of elongated bolt-shaped earth wire anchors under the ground and integrating the anchors to form a single anchor structure; a load-bearing base mounting step of flattening an inclined ground to set a mounting position of a lowermost unit body, and placing a base plate, that is used to transmit the load of the unit body to the ground,
15 on a base anchor after embedding the base anchor under the flattened ground; a unit body assembly preparation step of preparing a plurality of unit bodies, having the same size and shape as one another to define a modular structure, and various fastening elements in an affixed state to the respective bodies, thereby allowing the unit bodies to be vertically joined to one another in an automatic and safe body pole alignment manner; a unit body
20 assembly step of lifting each unit body up to the top of the already assembled unit body as the hoist slides vertically along the vertical poles of the already assembled unit body, and rotating the lifted unit body about the main shaft of the hoist to have the same center axis as the already assembled unit body while allowing a worker to safely perform assembling operation of the unit bodies therein using the ladder rods; an earth plate assembly step of
25 assembling earth plates to upper ends of the unit bodies before completing assembly of the respective unit bodies; an earth wire fixing step of connecting iron wires between the earth plates and the earth wire anchors to thereby firmly mount the unit bodies in an erected state; and an insulator assembly step of assembling an insulator to the assembled unit bodies for the connection of a power cable. With the steel tower construction
30 method of the present invention, it is possible to safely and quickly assemble the steel tower even in mountainous and coastal areas without using heavy construction machinery.

Now, with reference to Fig. 6, the construction method of the quickly erected

modular steel tower according to an embodiment of the present invention will be explained in more detail.

First, in the soil force increasing step to increase a soil bearing force at a supporting point of an earth wire, a plurality of elongated bolt-shaped earth wire anchors 20 are embedded under the ground and are integrated to form a single anchor structure. Thereby, the earth wire anchors 20 are directly embedded in the ground while omitting a conventional procedure of embedding a base platform in an excavated pit and covering soil thereon. In this case, each anchor 20 has a lower soil bearing force as compared to the conventional base platform. For this reason, it is preferable that the plurality of earth wire anchors 20 are embedded and connected to one another to support a single earth wire.

Although a nail anchor having a relatively high soil bearing force may be used as the earth wire anchor 20 of the present invention, other kinds of anchors may be used so long as they achieve a high soil bearing force with a simplified construction manner.

As is well known in the art, British Platipus ® Stealth anchors are generally available, but the present invention is not limited thereto, and other various kinds of products may be used. Fig. 7(2) is a photograph illustrating the Platipus ® Stealth anchor, and Fig. 7(1) is a schematic diagram illustrating a constructed state of the platipus ® Stealth anchors.

Then, as shown in Fig. 8, in the load-bearing base mounting step, after flattening an inclined ground to set a mounting position of the lowermost unit body, bolt-shaped base anchors 12 are embedded under the flattened ground, and a flat base plate 11, that is used to transmit the load of the body to the ground, is disposed and fitted to the base anchors 12 so as not to horizontally move. In this way, the base plate 11 is able to be used as a base structure capable of preventing horizontal movement of the lowermost unit body of the steel tower.

The bolt-shaped base anchors 12, provided at the base plate 11, are arranged at predetermined positions corresponding to the contour of the lowermost unit body of the steel tower for the fixation thereof. Also, the base plate 11 is provided with a winch 14 thereon to raise or lower the rotary-type hoist 60 that is used for the assembly of all the unit bodies 30.

In succession, in the unit body assembly preparation step to prepare a plurality of unit bodies 30 having the same size and shape as one another to define a modular

structure, as shown in Fig. 9, each unit body is manufactured using vertical poles, horizontal bars, and oblique braces. Here, the vertical poles are made of duralumin pipe members to reduce the weight of the unit body. Also, the horizontal bars and the oblique braces are formed of angle type members to improve firmness of the unit body.

5 The respective unit bodies 30 contain various fastening elements for use in the fastening therebetween. Also, the upper portion of the respective unit bodies 30 is configured to allow the respective unit bodies to be centered to one another using an automatic and safe body pole alignment system when the vertical poles are vertically aligned through the use of the conical vertical guides PG.

10 For the smooth practice of the present invention, the above mentioned automatic and safe body pole alignment system will now be explained in more detail. The present invention is characterized in that a plurality of unit bodies, each being formed by arranging four vertical poles by a predetermined distance, are successively stacked one above another in an axial direction thereof so that lower ends of the vertical poles of the
15 upper unit body being newly assembled are bonded to upper ends of the vertical poles of the previously assembled lower unit body located therebelow. In this case, it is important to concentrically bond the lower ends of the upper vertical poles to the upper ends of the lower vertical poles. For this, the present invention employs the conical vertical guides PG at the upper ends of the vertical poles 31 of the unit body 30. Each
20 vertical guide PG has a conical shape to be closely fitted to an inner diameter of the vertical pole 31. Thereby, when the downwardly assembled lower ends of the vertical poles 31 access the vertical guides PG, they slide downward while surrounding the downwardly-tapered conical vertical guides PG. An outer diameter of the vertical guide PG is equal to the inner diameter of the vertical pole 31. The vertical guide PG is
25 concentric about the vertical pole 31. With this configuration, when the upper unit body is downwardly assembled to the lower unit body, an inner circumference of the lower end of the vertical pole 31 of the upper unit body 30 is engaged with an outer circumference of the conical vertical guide PG, as a sliding guide, mounted at the upper end of the vertical pole 31 of the lower unit body 30. This assembly manner can be easily
30 understood in consideration of a mechanical assembly principle in the connection of general pipes. When a conical member is inserted in only an upper portion of the pipe and a lower portion of the pipe has no decoration, centers of vertically assembled upper

and lower pipes are automatically aligned as the empty lower portion of the upper pipe is pushed downward into the upper portion of the lower pipe through the conical member.

As stated above, the unit body 30 includes the vertical poles 31, the horizontal bars 32 connected to the vertical poles 31, the oblique braces 33, the ladder rods 34 to
5 allow the worker to vertically move inside the unit body 30, and the bolt fasteners PB provided at upper and lower ends of the vertical poles 31 of the unit body 30 to vertically assemble the unit body 30 to another body located thereabove or therebelow.

Vertical connection of the respective unit bodies 30 is performed using key-hole type quick fastening means using the bolt fasteners PB. With the quick fastening means,
10 as shown in Figs. 11(1) to 11(4), the bolts, which are fastened to the upper key-holes B of the lower unit body, are inserted into the circular holes of the lower key-holes B of the upper unit body located above the lower unit body, and then are forced to be tightly fastened into the linear portions of the lower key-holes B. This bolt fastening is effective to considerably reduce a bolt fastening time and to eliminate the risk of falling
15 or loss of the bolts. The quick fastening means of the present invention can be easily understood and practiced with reference to a report by the ministry of Science-Technology, entitled "QUICK FASTENING SYSTEM FOR REDUCTION OF RADIATION LEAK"?(written by Soogon BAEK, et. al. of HanBal Corp., 2004).

Meanwhile, each earth plate 40 is manufactured by processing a flat plate made
20 of iron, stainless steel, duralumin, or the like, into a shape as shown in Fig. 12. The earth plate 40 is interposed between two unit bodies to be integrated therewith when the unit bodies are fastened by means of the bolts. As stated above, the earth plate 40 includes the earth main plate 41 and the earth extensions 42, and the key-holes are perforated through the earth plate 41 to have the same location and size as those of the
25 key-holes of the bolt fasteners PB of the upper and lower unit bodies. Each of the earth extensions 42 is connected to the earth main plate 41 and is perforated with a plurality of the earth wire connection holes GH. To the earth wire connection holes GH are connected shackles, etc. which can connect earth wires to the earth extensions 32 protruded beyond the horizontal bars 32 of the unit body 30. To allow the earth plate 40
30 to be firmly fastened to the upper and lower unit bodies 30 to thereby be lifted when the unit bodies 30 are lifted, the earth main plate 41 is processed with the triangular head seats TH of the triangular head bolts, while the horizontal bars 32 of the unit body 30 are

provided with the bolt taps that correspond to the triangular head seats TH. With this configuration, the assembly of the earth plate 40, integrated to the upper end of the unit body 30, is able to be completed simultaneously with the assembly of the upper and lower unit bodies 30. This has the effect of eliminating a separate lifting procedure and double
5 assembly operation of the earth plate. The earth plate 40 serves to support the earth wires, and is rounded at four corners thereof to enable free vertical movement of the hoist 60.

After that, in the unit body assembly step, first, the unit body 30 is simply assembled to the hoist 60 and then, is lifted up to the top of the lower unit body as the
10 hoist 60 slides vertically along the vertical poles of the lower unit body 30. Then, the lifted unit body is rotated about the main shaft 63 of the hoist 60 in a plane parallel to the ground to have the same center axis as the lower unit body, thereby being assembled to the lower unit body. After completing assembly of the unit body 30, the rotary-type hoist 60 is separated from the unit body 30 and is lowered. This method of assembly
15 enables a considerable reduction in the time required to align bonding point of the upper and lower unit bodies 30 as compared to a conventional Gin Pole method or other assembly methods.

Referring to Fig. 13, the rotary-type hoist according to the embodiment of the present invention is illustrated in photograph. Although a linear-type hoist may
20 substitute for the rotary type hoist, in the case of the present invention, the rotary-type hoist is more effective. Now, the rotary-type hoist will be explained in more detail.

The rotary-type hoist 60 of the present invention is coupled to the vertical poles 31 of the unit body 30, thereby utilizing the vertical poles 31 as driving rails. As shown in Fig. 12, each hoist roller 61 of the rotary-type hoist 60 has a cross section to surround
25 half of the vertical pole 31, and is connected to the lower hoist body 62 by means of the roller shaft. The hoist main shaft 63 is connected to the center of the lower hoist body 62, and at the upper end of the hoist main shaft 63 is provided the upper hoist body 64. The upper hoist body 64 is spaced apart from the lower hoist body 62 to freely rotate about the hoist main shaft 63. Thereby, as the unit body 30, that is fastened to the upper
30 hoist body 64 by means of quick fastening hooks, is lifted up to the top of the steel tower and is rotated by an angle of 180 degrees, the unit body 30 can be seated on an uppermost one of the existing assembled unit bodies of the steel tower. In operation of the rotary-

type hoist as stated above, it is essential that the pole center of the unit body 30 being lifted or lowered about the hoist main shaft 63 is symmetric to the pole center of the previously assembled unit body 30. Also, to achieve economical quick fastening/unfastening of the unit body 30 to or from the upper hoist body 64, the present invention employs a simple quick fastening system SC.

Meanwhile, in the earth plate assembly step, the earth plate 41 is placed on the unit body 30 and is fixed thereto by means of the triangular head bolts, resulting in integration of the earth plate 40 and the unit body 30. Thereby, the earth plate 40 can be lifted simultaneously with the unit body 30.

In the earth wire fixing step, iron wires are connected between the earth plates 40 and the earth wire anchors 20, allowing the unit bodies 30 of the steel tower to be stably and firmly erected.

Finally, in the insulator assembly step to prepare the connection of a power cable, an insulator is assembled to the completely assembled steel tower at appropriate locations using a conventional insulator assembly technique.

[Industrial Applicability]

As is apparent from the above description, the present invention provides a steel tower which can be assembled and mounted by manual labor without using heavy construction machinery even in mountainous and coastal areas.

To ensure safety of the steel tower based on structural analysis as stated above and a load test, an assembly test was performed on the steel tower, in a state wherein the system is surrounded by a scaffold, in connection with Korea Electronic Power Corporation and the ministry of Commerce, Industry and Energy on May 4, 2004. Through the assembly test performed by consumers rather than inventors, the effectiveness of the present invention has been widely proved.

Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

[CLAIMS]

[Claim 1]

A quickly erected modular steel tower comprising:

a plurality of unit bodies;

5 a plurality of earth plates; and

a hoist,

wherein each unit body includes:

a plurality of vertical poles;

a plurality of horizontal bars connected to the vertical poles at uppermost,

10 lowermost, and middle locations of the vertical poles, the horizontal bars having the same length as one another to allow the vertical poles to define a square and being formed with bolt taps, at opposite ends of the uppermost horizontal bars, adjoined to each other, being formed upper key-holes through which bolts are fastened, respectively, at opposite ends of the lowermost horizontal bars, adjoined to each other, being formed lower key-holes,
15 each of the lower key-holes consisting of a circular hole, and a linear portion extending from one side of the circular hole for the insertion and fastening of a respective one of the bolts;

oblique braces connected between the vertically spaced horizontal bars to diagonally connect the uppermost horizontal bars to the middle horizontal bars and also the middle
20 horizontal bars to the lowermost horizontal bars;
ladder rods connected between the oblique braces and the vertical poles adjacent thereto;
and
upper and lower bolt fasteners mounted at corners of the unit body defined by the uppermost horizontal bars and the lowermost horizontal bars and having key-holes having
25 the same location and size as the upper and lower key-holes formed at the uppermost and lowermost horizontal bars,

wherein each of the earth plates includes:

an earth main plate having key-holes having the same location and size as the upper and lower bolt fasteners of the unit bodies, and triangular head seats of triangular head bolts to
30 be coupled with the bolt taps of the horizontal bars; and
earth extensions extending outward from respective sides of the earth main plate to protrude outward beyond the horizontal bars, each of the earth extensions being formed

with earth wire connection holes, and

wherein the hoist includes:

a pair of hoist rollers coupled, respectively, to the two vertical poles that are arranged in parallel to each other;

5 a lower hoist body connected at opposite ends thereof to shafts of the hoist rollers;

a hoist main shaft formed at the center of the lower hoist body; and

an upper hoist body connected to an upper end of the hoist main shaft to rotate about the main shaft by a predetermined angle.

10 **【Claim 2】**

The steel tower as set forth in claim 1, wherein the respective two unit bodies are vertically coupled to each other as the bolts, fastened to the upper key-holes of the lower unit body, are inserted into the circular holes of the lower-key holes of the upper unit body, and are forced to be tightly fastened into the linear holes of the lower-key holes.

15

【Claim 3】

The steel tower as set forth in claim 1, wherein the vertical poles are used as driving rails of the hoist.

20 **【Claim 4】**

The steel tower as set forth in claim 1, wherein:

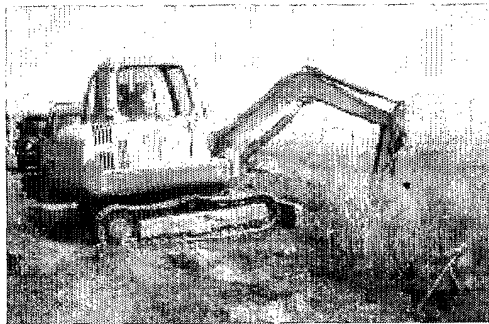
each of the vertical poles has a pipe shape; and

a conical vertical guide is formed at the upper end of the vertical pole of the lower unit body to be vertically inserted into a hollow lower end of the vertical pole of the upper unit

25 body being disposed thereon.

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FIG.1



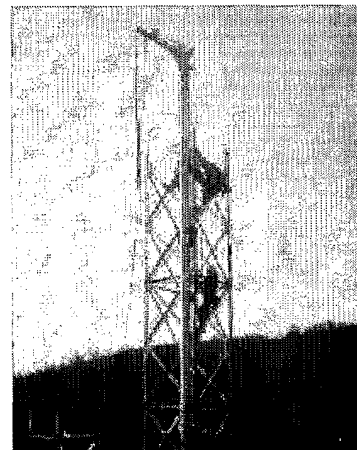
(1)



(2)



(3)



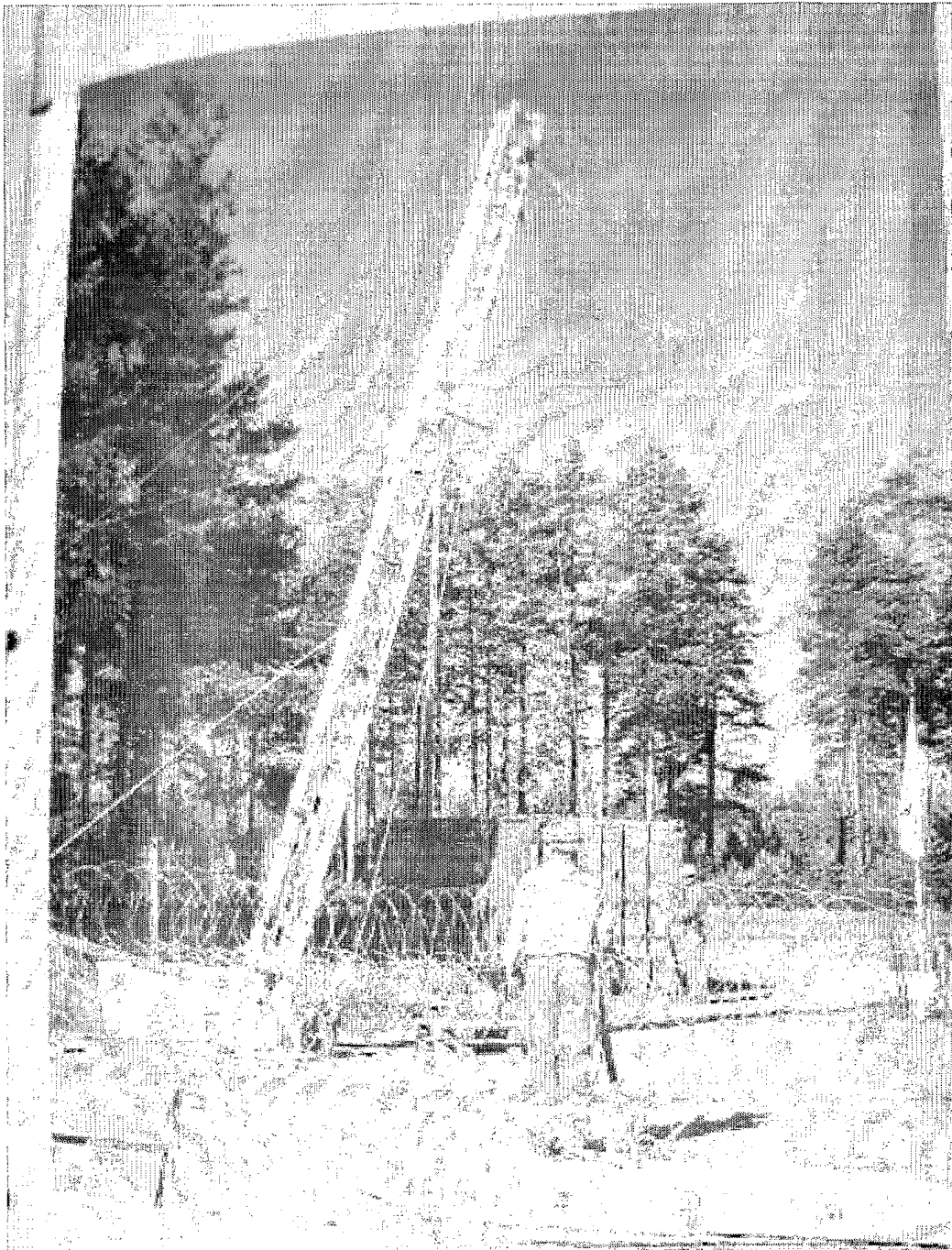
(4)

FIG.2



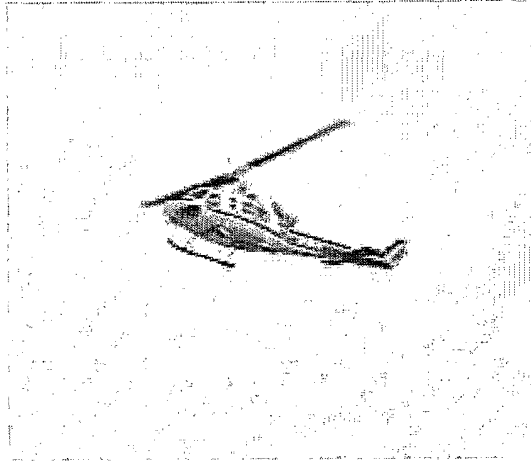
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FIG.3

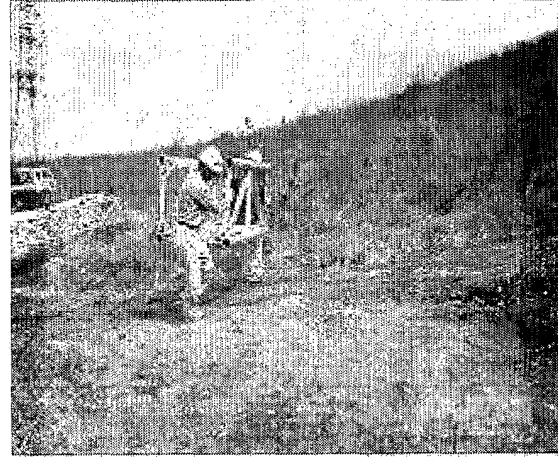


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FIG.4

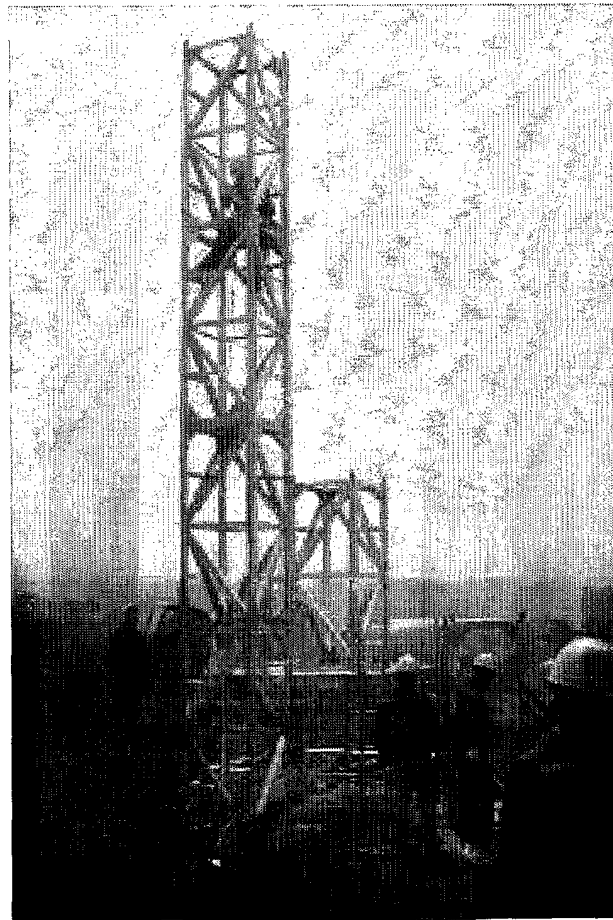


(1)



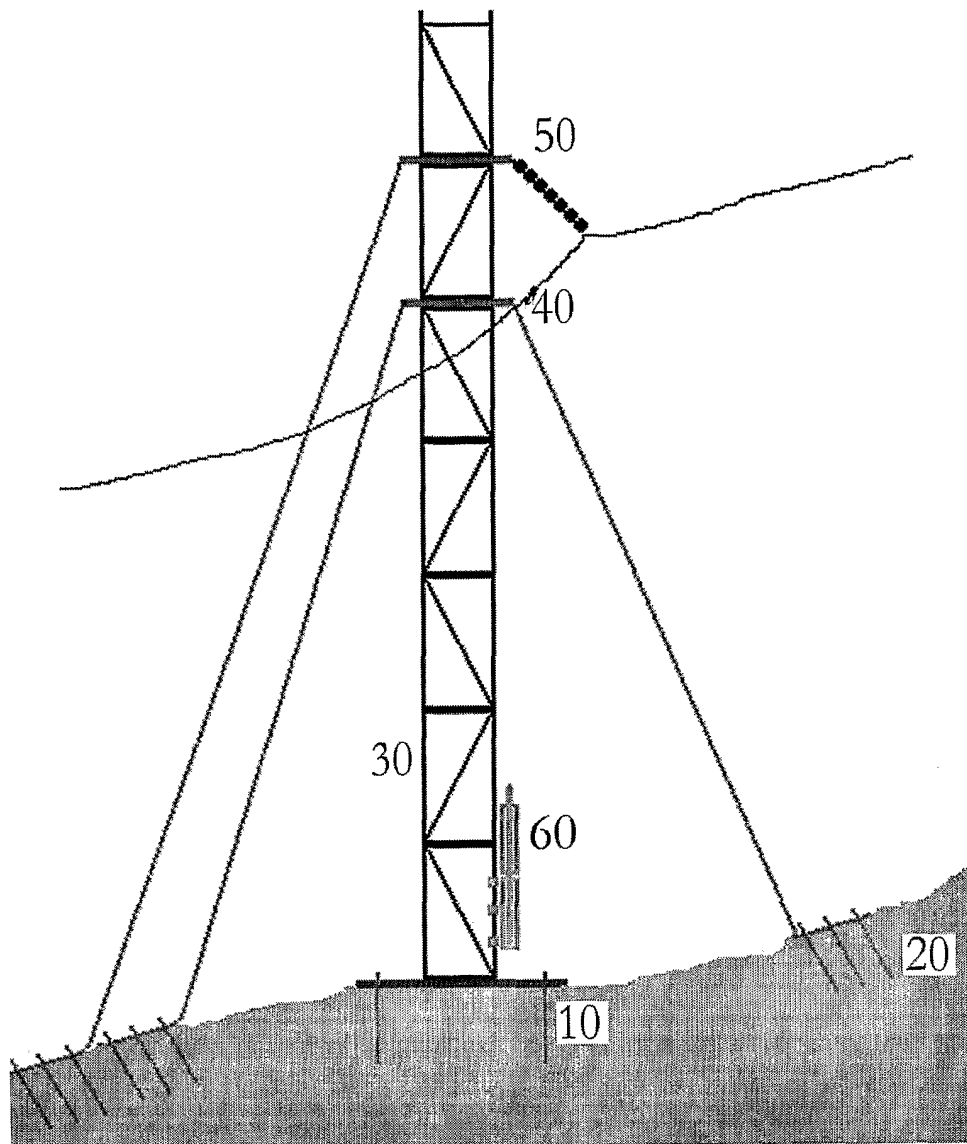
(2)

FIG.5



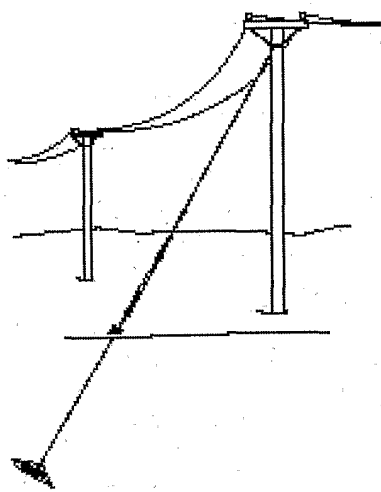
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FIG.6



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FIG.7

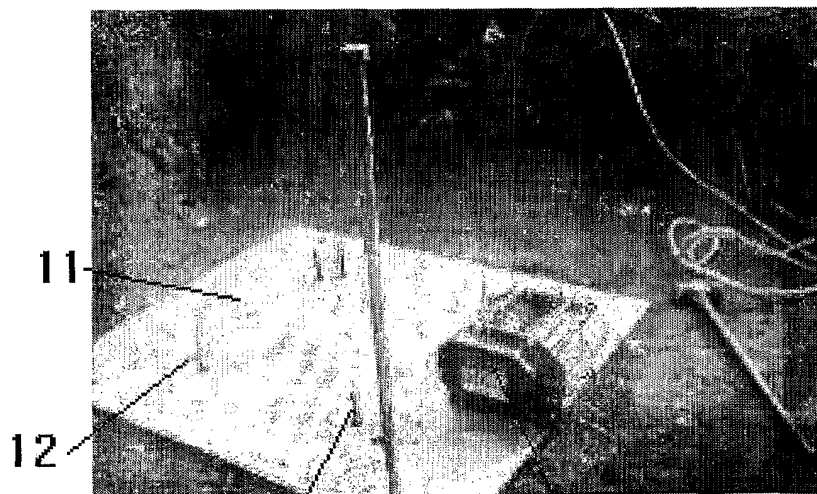


(1)



(2)

FIG.8



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FIG.9

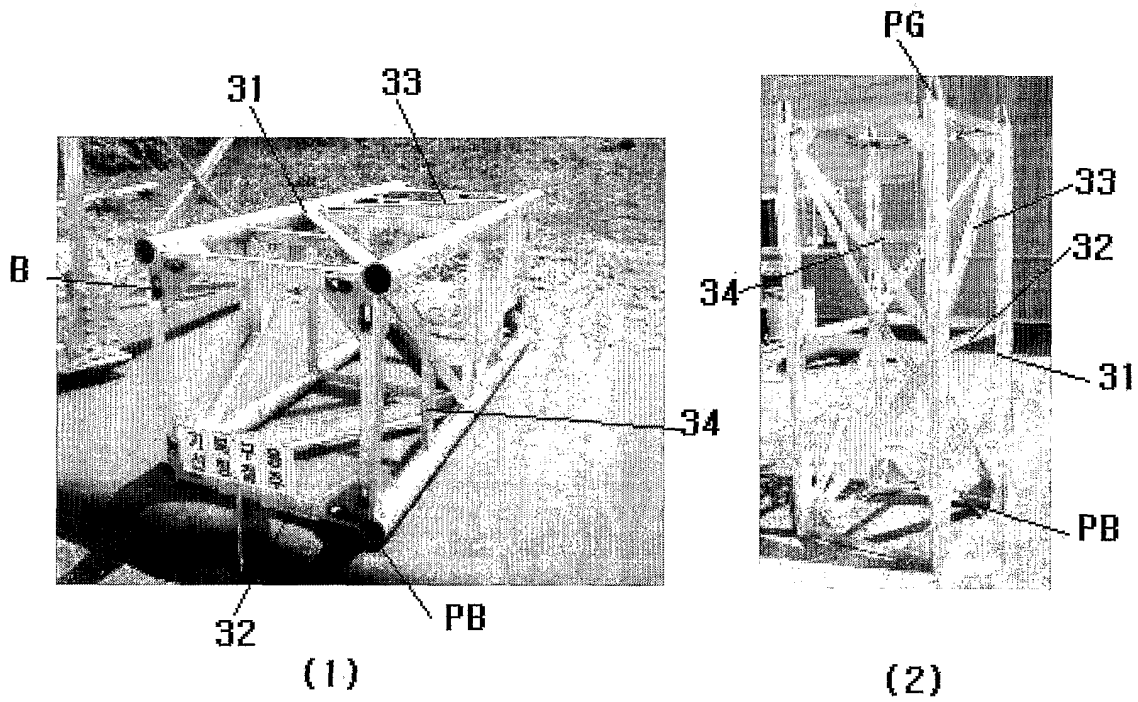
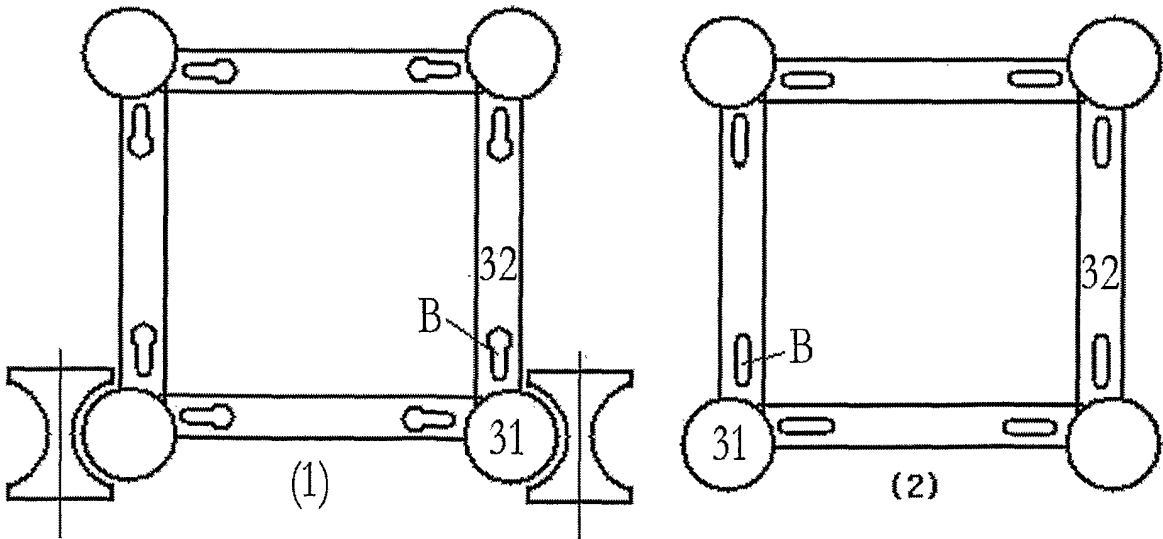


FIG.10



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FIG.11

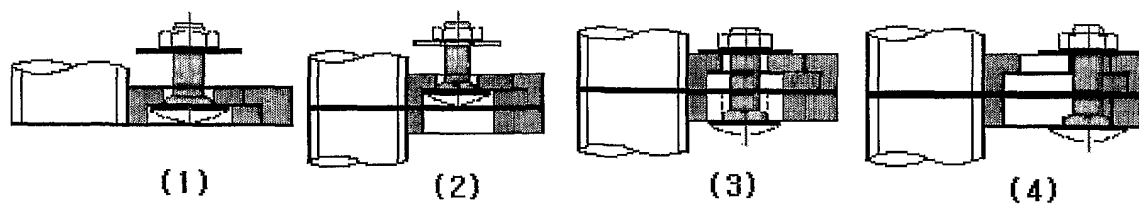
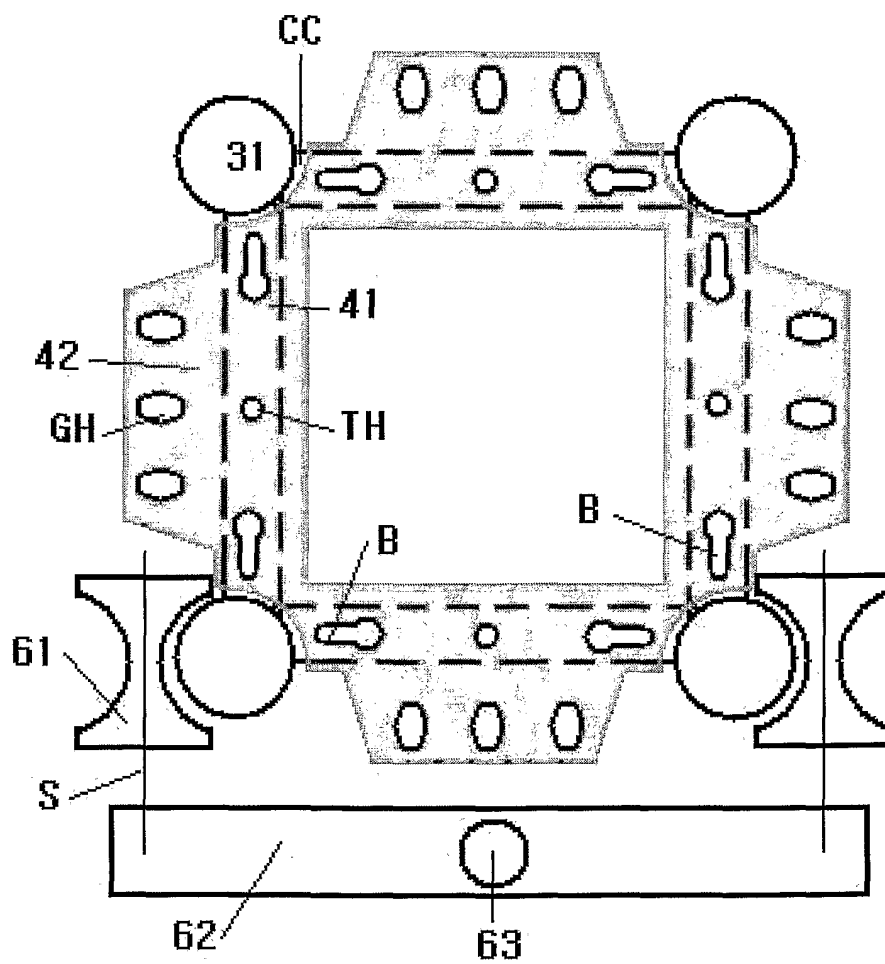
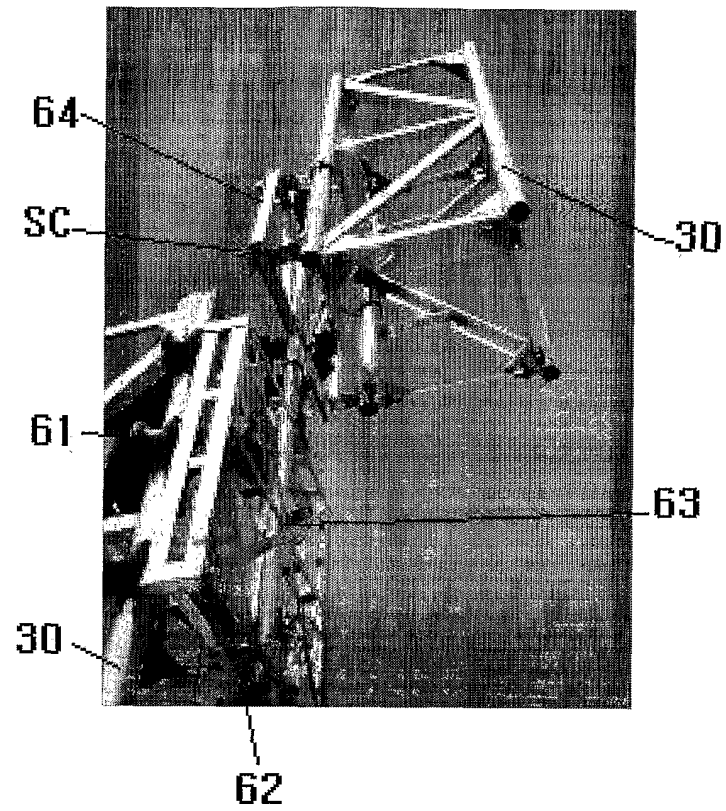


FIG.12



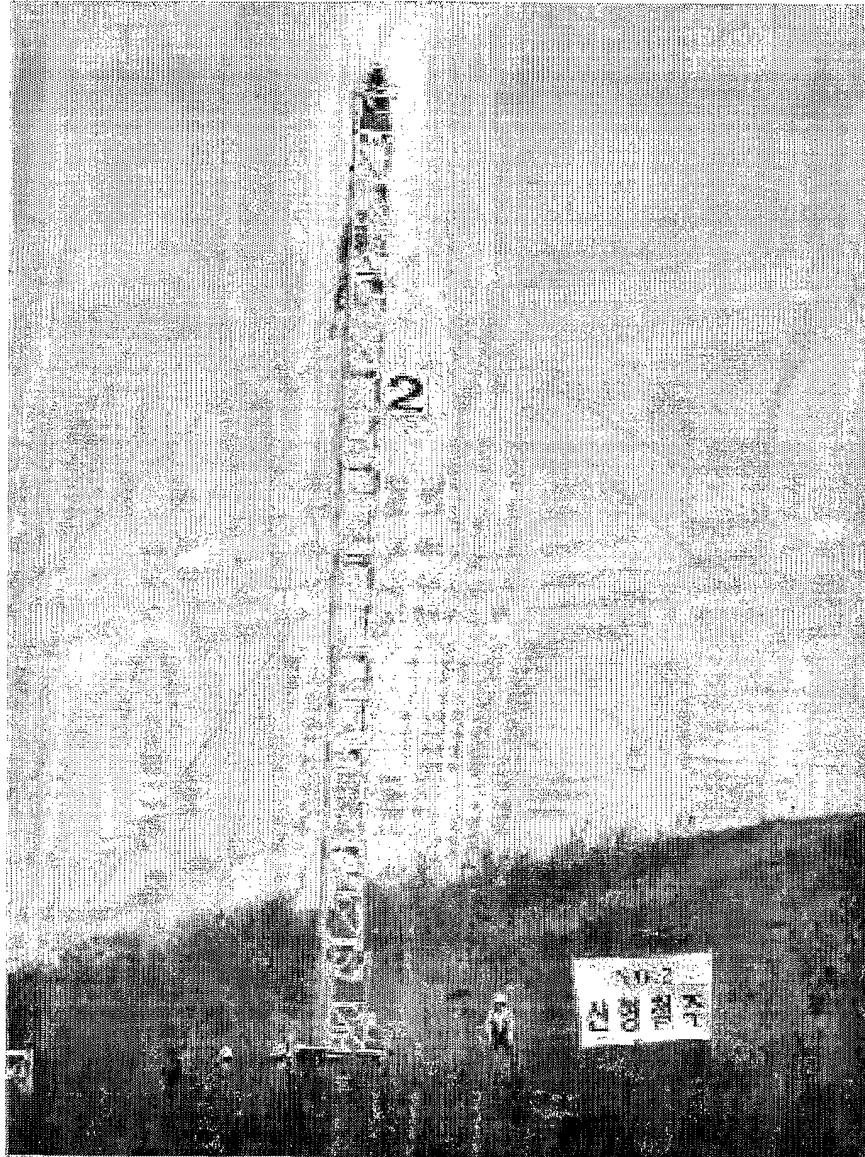
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FIG.13



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FIG.14



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2005/001636

A. CLASSIFICATION OF SUBJECT MATTER**IPC7 E04H 12/10**

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)

IPC7 E04H, B66C, E04G

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

KR.JP : classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 58-207294 A (HITACHI KENKI CO.) 02 December 1983	1-4
A	JP 13132274 A (SIMIZ KENSECH CO.) 15 March 2001	1-4
A	US 5617692 A (EBERT COMPOSITES CORP) 08 April 1997	1-4
A	US 4503645 A (NUDD CONRAD T, NUDD JR FREDERICK A) 12 March 1985	1-4

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search

13 SEPTEMBER 2005 (13.09.2005)

Date of mailing of the international search report

14 SEPTEMBER 2005 (14.09.2005)

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KIM, Hyun Woo

Telephone No. 82-42-481-5795



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2005/001636

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP58-207294	02.12.1983	NONE	
JP13132274	15.05.2001	JP13132274	15.05.2001
		JP2001132274A2	15.05.2001
US5617692A	08.04.1997	AU3603993A1	01.09.1993
		CA2154341C	26.12.2000
		CA2154341C	05.08.1993
		EP742862A1	20.11.1996
		EP742862A4	26.02.1997
		US05285613	15.02.1994
		US05319901	14.06.1994
		US05617692	08.04.1997
		US5285613A	15.02.1994
		US5319901A	14.06.1994
		US5597629A	28.01.1997
		US5617692A	08.04.1997
		US5644888A	08.07.1997
		US5749198A	12.05.1998
		US5795424A	18.08.1998
		W09315292A1	05.08.1993
US4503645A	12.03.1985	CA1220924A1	28.04.1987
		US04503645	12.03.1985