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(54) **MULTI-PURPOSE LOAD LIFTING WORKING PLATFORM OR/AND COMPOSITE BRIDGE STRUCTURE**

(57) The present invention discloses a multi-purpose load lifting work platform or/and composite bridge structure, comprising a framework, at least one work platform, a drive mechanism, and an electrical control devices. One end of the pole-shaped structure is connected with the framework in a movable manner, and the other end of the pole-shaped structure is connected with the work platform in a movable manner, the work platform can run

with the pole-shaped structure together. The work platform can run in a curve track relative to the framework by power, and can stop at any position in running track. This invention can provide two platforms working coordinately or a single platform working independently. The working area of the two platforms greatly exceeds that of the existing common equipment with a single platform. It can load bulky objects without sway, and can also be used as composite or assembly bridge structure.

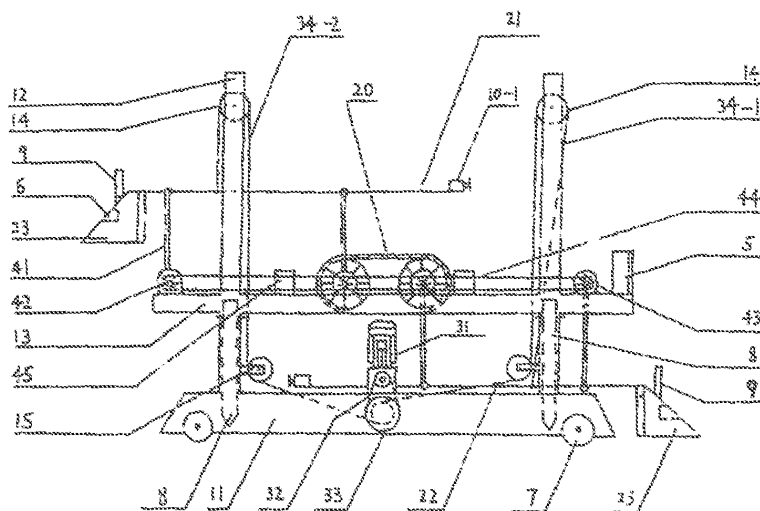


FIG. 1

Description

Field of the Invention

[0001] The invention relates to a multipurpose load lifting work platform, which can be also used as a modular structure for assembling a bridge. The multipurpose load lifting work platform is applicable to the following fields: crane, load lift, elevator, stage equipment, movable foundation for mobile house, stereoscopic parking equipment, stereoscopic storing and logistics equipment, carrying equipment, and bridge structure.

Background of the Invention

[0002] Most of current cranes, lifts, elevators or other carrying equipment works with the track of vertical lifting, the loads lifted sway back and forth and the horizontal stability of the load is poor. Also, only one work platform is provided. These defects result in their limited scope of use. In addition, each of the equipment consumes a considerable amount of energy during operation.

[0003] On the other hand, in bridge construction, modular manufacturing and assembly have been achieved, but still need bridge machine or crane hoisting modular construction for accurate installation, and need a large number of artificial precision operations, and need a long period time of building. Furthermore, there are problems which remain to be solved in bridge construction, including long construction period and high degree of difficulty in construction and dismantling. In addition, most of the composite rapid bridging structures or machineries can be used only for bridging rather than for other purposes.

Summary of the Invention

[0004] The invention aims at overcoming the above deficiencies and providing a load lifting equipment with a curve trajectory. The load lifting equipment can provide the cooperated work of two platforms or the independent work of one platform. The pole-shaped structure is hinged with and supports the work platform. The work platform can move relative to the framework in a curve track and can stop at any position on the movement track. The working area of the two work platforms is substantially larger than that of the currently common load lift, elevator, crane and other lifting and carrying equipment operated with a single platform. The equipment can load large-size objects such as construction materials, automobiles, ores, ships, mobile houses, containers, etc., without sway, and also can be used as a composite or assembly type bridge structure.

[0005] In addition, wireless transmitting and receiving devices can be optionally assembled respectively on the front and rear ends of the work platform during the transition movement of the work platform. When an obstacle is identified within the predetermined distance, such as a barrier within 1.5m, the wireless transmitting and re-

ceiving device sends a signal to stop the running equipment, thus ensuring the work platform not to collide with the surrounding obstacles or persons during the running of the equipment.

[0006] A new type blocking device with a spring button can be assembled optionally on the equipment. It can prevent a load from sliding down during the work of the equipment. In addition, wheels can be optional on four corners of the base of the framework of the equipment such that the equipment has mobility and can be moved to anywhere. Pickets are arranged inside the four columns and can be used for fixing on loose and soft foundations (such as outdoor sand grounds).

[0007] A touch and stop device can be assembled optionally at each work platform of the inventive equipment on a side opposite to the automatic obstacle monitoring device to ensure the safety when the inventive equipment touches an obstacle and stops at the side of the work platform during operation.

[0008] When operating one or more inventive equipment, the work platforms of every equipment are stayed at or close to the same horizontal position (a certain height difference between the work platforms is permitted) and the equipment are connected from the front to the end, the slope is arranged at both ends, a bridge can be built quickly, as shown in Fig. 11. Of course the inventive equipment can also be combined with the known bridge structure to build a new bridge, as shown in Fig. 11-1. A cushion layer of elastic materials can be laid at the joint to reduce bumping on road surface. A certain height difference between the platforms is permitted. In addition to having a level surface, the platform can also be made in concave-shape or bending-surface platform according to actual needs. By using such a work platform as the bridge structure, both assembly and disassembly of the bridge can be done easily. As the degree of freedom between structures of said equipment is high, the anti-shock performance is good.

[0009] The design scheme of the invention is as follows:

[0010] The load lifting work platform or/and composite bridge structure, comprising a framework, upper and lower work platforms, a platform driving mechanism, driven and driving aided mechanism, an electrical control device, an automatic obstacle monitoring device which can be optional, wheels and pickets which can be optional, and a blocking device and a touch and stop device which can be optional. The load lifting work platform or/and composite bridge structure provides a load lifting equipment with single platform operating or two platforms cooperatively operating. The work platform can run in a curve path around a direct or indirect connection point between one end of pole-shaped structure and the framework, and can stop at any position on the movement path.

[0011] The work platform moves with the aid of driving mechanism and all or part of driven and driving mechanism, so that the work platform run in curve path movement around the direct or indirect connection point be-

tween the pole-shaped structure and the framework.

[0012] The detailed structure of the equipment is described as follows:

(1) The framework is classified into two types: four-column type and two-central-column type according to the number of the columns with fixed pulleys on the top.

1. Four-column type framework ,comprising a base 11 and four columns 12, and crossbeam 13, column provided with a fixed pulley 14 on its top and a guide pulley close to the bottom 15, and an intermediate supporting structure 16 between two crossbeams 13. In this case, the intermediate supporting structure 16 can be optional depending on the actual load. The intermediate supporting structure is designed as a "□" or "∩" shape, as shown in Fig. 1. The four-column type framework has a higher safety effect and a more reasonable stress state than the two-central-column type framework structure.

2. Two-central-column type framework: The difference between two-column-type and four-column-type is that two central columns 121 with two pulleys fixed on its top replace four columns with one pulley fixed at its top, and the rest of the structure is the same as the four-column type framework, as shown in Fig. 11-1 and Fig. 11. This framework structure is the most economical, but load is concentrated on the two central columns, thus higher material strength and structural strength of the central columns are required.

(2) The work platform, comprising the upper layer work platform 21 and the lower layer work platform 22, and the upper and lower layer work platforms can move interactively through the coupling of the driven and driving aided mechanism. When only one platform is required to work with, it is possible to arrange and use one part of the structure of the driven and driving aided mechanism, as shown in Fig. 244 and Fig. 245. The work platform is hinged with the pole-shaped structure and has a curve movement path, and can stop at any position on the movement path. The work platform can be made in different shapes, such as elliptical or circular, and most often in a rectangular shape. The work platform can be one having a level surface or one having a convex-concave non-level surface according to actual requirements, and such a work platform has a certain curve effect. For example, when a ship is to be lifted, the work platform can be made in a platform with arc-shaped internal surface or can be made in a net-structure platform to facilitate berthing, as shown in

Fig. 223 and Fig. 224. Two work platforms provided for the same equipment can be different in size to adapt to special requirements. The platform can be also used as a movable foundation for a mobile house, as shown in Fig. 244 and Fig. 234. When the work platform is used as a stage equipment, the platform can be designed as a long plate shaped structure which is heightened and thickened, as shown in Fig. 7-1, and can be merged into a large stage in array.

[0013] It should be noted that to adapt to the requirements for lifting in some circumstances, the platform can be simplified to the crossbeam, hook, lifting ring or special-purpose fixtures and riggings, as shown in Figs. 225, 226, 227 and 228. If the requirements for the movement stability of a load to be lifted are not strict, which means swaying back and forth of the load during movement is permitted, it is possible to use one or two pole-shaped structures in parallel as the lifting mechanism to lift the load, and the work platform is simplified to the hook, lifting ring or special-purpose fixtures and riggings, as shown in Figs. 228 and 229.

[0014] All of these examples as mentioned above are one part of various forms of the work platform.

(3) The driving mechanism as shown in Fig. 1, comprising a deceleration motor 31, a conveyer belt 32, a wire drum or chain receiving mechanism 33, and the steel wire ropes or chains 34-1 and 34-2 (34-1 and 34-2 can be selected as either the steel wire rope or the chain, conveyer belt or cord) with one end connected with 33 and the other end fixed on the work platform or its end fixed and encircled in the groove of the rim of the semi-circular structure, and 34-1, 34-2 can be configured as multi-strand steel wire ropes or chains for heavy loads; wherein the gear motor 31 drives the roller 33 to rotate through conveyer belt, 43-1, 43-2 rolled on the steel drum is relaxed or tightened, and pull the appropriate platform 21 and 22 to move. Due to some restrict condition or requirement and in addition to being equipped with a driving mechanism for itself, the equipment can also be provided with a corresponding external driving mechanism while the equipment itself is not equipped with a driving mechanism. For example, when used as a bridge structure, the structure itself is very heavy, and the equipment itself needs to move only once or twice while keeping a stationary or stop state for most of the time. In this case, it is neither economical nor sufficient to depend only on the self-equipped driving mechanism of the equipment, and it needs the external large type driving unit.

(4) Driven and driving aided mechanism: the mechanism runs with the platform and drives the movement of the platform. It solves the issues that the

linkage mechanics can not work smoothly in low-speed movement and the possible reversal or failure. The driven and driving aided mechanism can converse and transfer the kinetic energy and potential energy between two work platforms.

[0015] For the different types of the pole-shaped structures, two types of driven and driving aided mechanisms are provided. Any one of two types of the driven and driving aided mechanisms can be used in the inventive equipment independently, and they can also replace each other or be combined together in the equipment, or even be used as one part of the structure of each type in the equipment. If two types of mechanisms are used in combination, more safe transmission guarantee will be provided to improve the work efficiency.

[0016] The pole-shaped structure refers to a stable structure which can be movably connected to the platform with the framework. One end of the pole-shaped structure is hinged with and supports the platform and the other end of the pole-shaped structure is connected with the framework in a movable manner directly or indirectly. The pole-shaped structures are encircled and connected by the wire rope, chain, conveyor belt or cord independently or mutually, achieving the coordinated movements. The pole-shaped structures comprise right-angle pole-shaped structure, semi-circular pole-shaped structure, circular pole-shaped structure, elliptical pole-shaped structure, semi-elliptical pole-shaped structure, drop pole-shaped structure, semi-drop pole-shaped structure, inverted drop pole-shaped structure and inverted semi-drop pole-shaped structure as will be mentioned hereinafter, wherein the semi-elliptical pole-shaped structure and elliptical pole-shaped structure are shown in Figs. 2-20 and 2-21, the drop pole-shaped structure, semi-drop pole-shaped structure, inverted drop pole-shaped structure and inverted semi-drop pole-shaped structure are shown in Figs. 2-22, 2-23, 2-24 and 2-25, which can increase or decrease the starting torque of the equipment. According to the increase of the actual load of the work platform, the pole-shaped structures can also adopt various stressed structure forms in construction engineering or mechanical engineering, such as truss structures, three forms of the truss structures as shown in Figs. 2-16-1, 2-16-2 and 2-16-3. The pole-shaped structures can be made to be different in length to adapt to special applications, such as the work platform required with a slope. Each work platform is supported by at least one pole-shaped structure 41, and generally is supported by four or six pole-shaped structures; and if the actual load is very large, the number of the pole-shaped structures needs to be increased. For example, if six pole-shaped structures are selected to support the work platform, the load can be shared uniformly, thus the cross section area of each pole-shaped structure can be less, as shown in Fig. 2-1.

[0017] Type 1, comprising right-angle pole-shaped structures 41 (briefed as right-angle pole 41), sprocket

42, a bearing box 43 and chains 44. One end of the pole-shaped structure is connected on the framework via the bearing box 43, the sprocket 42 is rigidly connected with one end of the pole-shaped structure 41, and the chain 44 is encircled on the sprocket 42. The assembly relationship of each component is shown in Fig. 3-1. Each work platform is supported by at least one pole-shaped structure 41. The figures here are simplified to illustrate the principles briefly, and in the illustration and description afterwards, the work platform supported by four pole-shaped structures will be provided as an example. The pole-shaped structure can be selected as any form of the right-angle pole-shaped structures as shown in Figs. 2-1, 2-2 and 2-3. The main function of pole-shaped structure bracing 46 is to increase the structural strength. The material strength of Type 1 must be good enough to bear the torque which the sprocket 42 applies to the pole-shaped structure. The function of this mechanism is to transfer the active movement of one work platform to the other work platform and make the other work platform to move cooperatively; the cooperative movement of the other work platform conforms to the principle of the mutual conversion between the potential energy and kinetic energy in physics such that a part of the kinetic energy can be transferred back to the active-movement work platform through the driven and driving aided mechanism. Therefore, the driving mechanism can drive the work platform to move without outputting too much power, thus achieving the objective of energy saving. The schematic diagram for spatial structure arrangement of pole-shaped structures, sprockets, chains, steel wire ropes, and upper and lower layer work platforms is shown in Fig. 4.

[0018] Type 2, comprising non-rectangular pole-shaped structures 41 (in particular comprising semi-circular pole-shaped structure, circular pole-shaped structure, elliptical pole-shaped structure, semi-elliptical pole-shaped structure, drop-shaped pole-shaped structure, semi-drop pole-shaped structure, inverted drop pole-shaped structure, inverted semi-drop pole-shaped structure), steel wire ropes or chains 18, 19 and 20 (18, 19 and 20 can be selected as either steel wire ropes or chains, conveyer belts or cords, wherein, one end of the steel wire ropes or cords needs to be fixed in the grooves of the rim of pole-shaped structure, and the chains and conveyer belts can be selected to circle on the pole-shaped structure or one end to be fixed at the pole-shaped structure), bearing box 43, and a shaft 50. The shaft 50 passes through a shaft hole arranged on the middle part of the pole-shaped structure and is fixed on the framework by the bearing box 43; the steel wire ropes or chains 18, 19 and 20 are encircled in the groove of the rim of the pole-shaped structure. The assembly relationship of the members is shown in Fig. 3-2. Afterwards, the description will be provided for the semi-circular or circular pole-shaped structure as an example. The semi-circular or circular pole-shaped structure can be selected as any form of those shown in Figs. 2-5, 2-6,

2-7, 2-8, 2-18, 2-19, 2-27, 2-28 and 2-29, wherein, Figs. 2-6 and 2-61 are side views for two forms of the pole-shaped structure. The semi-circular or circular pole-shaped structure can be integrally shaped or be formed in a pieces-splicing manner, wherein, Figs. 2-18 and 2-19 illustrate the semi-circular or circular pole-shaped structure with toothed rim and these pole-shaped structures are used with the chains. The steel wire ropes are mounted in the grooves of the semi-circular rims of the semi-circular pole-shaped structures, as shown in Figs. 2-6 and 2-7. The semi-circular pole-shaped structure can save more materials than the circular pole-shaped structure, and is easy to fix with the upper part of the pole-shaped structure. In the appropriate position, the semi-circular pole-shaped structure and the circular pole-shaped structure can replace each other, as shown in Figs. 2-15 and 234. There are various connection manners between the circular and semi-circular pole-shaped structures, and the relatively economical and practical encircling paths and connecting positions are set as follows: the grooves of the rims of the pole-shaped structures 41-1 and 41-2 are connected by the steel wire rope or chain 18, both ends of the steel wire rope or chain 18 are fixed on the groove of the rim of pole-shaped structure, the position of the fixing point is indicated by a small circle painted on the rope, as shown in Figs. 2-9, 291, 292, 293 and Fig. 2-15 illustrating the relevant encircling path and position. The grooves of the rims of the semi-circular pole-shaped structures 41-3 and 41-4 are connected by the steel wire rope or chain 19, and the position of the fixing point is indicated by a small circle painted on the rope, as shown in Figs. 2-10, 211, 212 and 213 and 2-15. The grooves of the rims of the semi-circular pole-shaped structures 41-2 and 41-3 are connected by the steel wire rope or chain 20, and the position of the fixing point is indicated by a small circle painted on the rope, as shown in Figs. 2-12, 266, 267 and 268 and anyone of four types illustrated in Fig. 2-15. When completing above connection measures, the functions of the sprocket 42 and the chain 44 in Type 1 of the inventive equipment can be completely replaced. One of three connection arrangements for 18, 19 and 20 as mentioned above can be independently used as one part of the driven and driving aided mechanism, as shown in Figs. 244 and 245 when only one work platform works, and also can be used with other connection manners in combination, for example when two work platforms work cooperatively.

[0019] Another advantage of selecting the Type 2 is that this type can reduce the mechanical strength requirements of pole-shaped structure, and reduce the sectional area of pole-shaped structure, and save material and cost. The bracing of the pole-shaped structure can be omitted. The disadvantage of Type 2 is that Type 2 is more complicated than Type 1. The figures here are simplified to briefly explain the principles, the parts of the driven and driving aided mechanism are shown only in Fig. 1 (the Type 1 and Type 2 driven and driving aided

mechanisms are used in combination) and Fig. 2-15 (Type 2 driven and driving aided mechanism is independently used), and the driven and driving aided mechanism can be also mounted on corresponding positions of other shown figures.

[0020] In Type 1 and Type 2, there is a combined pattern of pole-shaped structure. That is, a longer pole-shaped structure replaces two adjacent pole-shaped structures in the middle of the framework. This pole-shaped structure has one hole in the middle of the structure for installing, both ends of the pole-shaped structure hinge with two work platforms, as shown in Figs. 2-26, 2-27, 2-28, 2-29 and 233. This combined pattern reduces the number of the pole-shaped structures, but it needs high material strength and structural strength for the pole-shaped structure. The working state is shown in Figs. 233 and 333.

(5) The electrical control device, comprising: a digital circuit central control box 5 including a chip, a relay, a control switch, an adjustable resistor, a transformer, a travel switch and the like. The control switch can control the electric motor to rotate positively and reversely and to stop; the travel switch and the relay can control the work platform to stop on the determined position.

(6) The optional automatic obstacle monitoring device, comprising: wireless transmitting and receiving devices 6 mounted on the front and rear ends of the upper and lower work platforms, as shown in Fig. 7.

[0021] When an obstacle is identified within the predetermined distance, such as 1.5m, a signal is sent to stop the running equipment, thus preventing the work platform from colliding with the surrounding obstacles or persons during the running of the equipment.

(7) The wheels 7 can be assembled optionally on four corners of the base of the framework of the inventive equipment such that the inventive equipment has mobility. When equipped with a car chassis and power, the equipment can be moved to anywhere like a car, to optimize the reasonable allocation of equipment resources, as shown in Fig. 8. Pickets 8 can be optional inside the four columns and are used for the fixing on the loose and soft foundations (such as outdoor sand grounds), as shown in Fig. 8.

(8) The blocking device 9 can be assembled optionally to prevent objects parked on the work platform from sliding down. The blocking device can be also used separately on the ground of a parking lot as a parking bay lock. The blocking device, comprising an inwardly bent angle steel 92 which is provided with a hole 91 on the particular position of the side surface and has a generally inversed "□" shaped

section, a square tube 93, a spring button 95 with a keyhole 94 at its head and an insert tube at its rear, a shaft 97 with a wheel 96, a protective edge 98 having a rotary axis, and a lifting handle 99, as shown in Figs. 9-1 and 9-2.

[0022] In use, the parking bay lock arranged horizontally is lifted up by the lifting handle, and the spring button 95 embedded in the inwardly bent angle steel automatically pops up and locks when encountering the hole 91, thus representing a triangular supporting state, as shown in Figs. 9-3 and 9-4. When the parking bay lock is to be unlocked, the spring button is pressed down with a finger, and under the effect of its gravity, the blocking device automatically slides down to a horizontal position, thus allowing an object to pass by, as shown in Fig. 9-2.

(9) The optional touch and stop device 10: a touch and stop device is mounted at each work platform on a side opposite to the automatic obstacle monitoring device, and is provided with two designs:

Design I: Two metal tubes 10-3 are mounted on two corners at one side of the work platform, as shown in Fig. 10. The pressed emergency stop switch 10-1 is fixed on the top of the metal tube, and a pull 10-2 is connected between the two metal tubes and the pull 10-2 is the one for activating another emergency stop switch. When this side of the work platform collides with an obstacle during the operation, the obstacle compresses the pressed emergency stop switch or the pull is extruded, so the equipment stops timely.

Design II: Elastic brackets 10-5 are mounted on two corners of one side of the work platform. The bracket has many forms, and the basic form is the door-shaped structure. Two legs of the bracket are equipped with elastic materials and thus are flexible; holes are provided in the middle of the elastic materials, and a rod-shaped structure 10-4 on the bracket passes through the middle hole of the elastic materials, and can contact another emergency stop circuit when the elastic materials are compressed, thus sending a signal to stop the equipment.

Brief Description of the Drawings

[0023] In the drawings, 11 represents a base, 12 represents a column, 121 represents a central column, 13 represents a crossbeam, 14 represents a fixed pulley, 15 represents a guide pulley, 16 represents an intermediate support structure, 2 generally represents a work platform which is subdivided into 21 representing an upper work platform and 22 representing a lower work platform, 23 represents a slope, 31 represents a gear motor,

32 represents a conveyer belt, 33 represents a wire drum, 34 generally represents a steel wire rope or chain having one end connected with the wire drum and the other end connected with the work platform or semi-circular or circular structure, wherein 34-1 represents a steel wire rope or chain related to one work platform and 34-2 represents a steel wire rope or chain related to the other work platform; 36 represents a rotating chassis, 41 represents the pole-shaped structures, wherein 41-1, 41-2, 41-3 and 41-4 represent optional semi-circular or circular pole-shaped structure, 42 represents a sprocket, 43 represents a bearing box, 44 represents a chain, 45 represents an anti-chain-disengaging device, 46 represents a pole-shaped structure bracing, 47 represents a semi-circular wheel, 48 represents a shaft hole of pin, 49 represents a pin, 50 represents a shaft, 5 represents a central control box, 6 represents a wireless obstacle monitoring device, 7 represents a wheel (optional), 8 represents a picket for fixing on the soft foundation (optional), 9 represents the whole blocking device, 91 represents a hole, 92 represents the inwardly crimped angle steel strut, 93 represents a square tube strut, 94 represents a keyhole, 95 represents a spring button, 96 represents a wheel, 97 represents a shaft, 98 represents a protective edge with a rotating axis, and 99 represents a lifting handle. 10-1 represents a pressed type emergency stop switch, 10-2 represents a pull for activating the emergency stop switch, 10-3 represents a metal tube, 10-4 represents a rod-shaped structure, and 10-5 represents an elastic bracket. 18, 19 and 20 represent steel wire ropes, chains or conveyer belts which are individually set to connect with the circular or semi-circular strut at the particular positions separately. 24 represents a crossbeam connected between the columns, and 25 represents a slope and cushion layer.

Fig. 1 is an overall structure schematic diagram.

Fig. 2-1 is a view of one work platform supported by six pole-shaped structures, with three pole-shaped structures arranged in parallel on each side of the crossbeam.

Figs. 2-2, 2-3, 2-4, 2-5, 2-6, 2-61, 2-7, 2-8, 2-16-1, 2-16-2, 2-16-3, 2-18, 2-19, 2-20, 2-21, 2-22, 2-23, 2-24, 2-25, 2-26, 2-27, 2-28 and 2-29 are schematic diagrams of various forms for the pole-shaped structures, wherein Figs. 2-6 and 2-61 are side views of the non-right-angle pole-shaped structures.

Figs. 2-9, 291, 292, 293, 2-10, 211, 212, 213, 2-12, 266, 267 and 268 illustrate the connection path, manner and position of the steel wire rope, chain, conveyer belt or cord 18, 19 and 20 in the groove of the rim of the semi-circular or circular pole-shaped structure, and the small circle painted on the rope indicates the position of the fixing point.

Figs. 2-15 and 234 are schematic diagrams of the driven and driving aided mechanism of Type 2 where the steel wire rope or chain 18, 19 and 20 are connected completely; wherein one end of 34 is connected with the particular position of the rim of the pole-shaped structure and the other end of 34 is connected with the wire drum.

Figs. 244 and 245 are overall structure diagrams with a single work platform in operation.

Figs. 2-16-1, 2-16-2 and 2-16-3 illustrate some truss structure forms employed by the pole-shaped structures under a heavy load.

Figs. 223 and 224 illustrate the work platforms with arc-shaped internal surfaces when lifting ships.

Figs. 225, 226, 227, 228, 229 and 230 illustrate various change forms of the work platform which is simplified as the crossbeam, hook, hoisting ring, special-purpose fixtures and rigging.

Fig. 3-1 is a partially enlarged structural schematic diagram of the Type 1 driven and driving aided mechanism, and the pole-shaped structure, chain, sprocket, shaft and bearing box are assembled together; Fig. 3-2 is a partially enlarged structural schematic diagram of the Type 2 driven and driving aided mechanism, and the semi-circular or circular pole-shaped structure, steel wire rope or chain, shaft and bearing box or shaft sleeve are assembled together.

Fig. 4 is a spatial layout diagram of the pole-shaped structure, sprocket, chain, steel wire rope, and the upper and lower work platforms. Fig. 41 is a schematic diagram to illustrate the connection of the pole-shaped structure and the platform when two work platforms move.

Fig. 5 is a working state diagram with one work platform running up and the other work platform running down while selecting right-angle pole-shaped structure to assembly on the equipment.

Fig. 6 is a working state diagram with one work platform running up and the other work platform running down while selecting semi-circular pole-shaped structure to assembly on the equipment.

Fig. 7 is a working state diagram to illustrate how the automatic obstacle monitoring device works. Fig. 7-1 illustrates the structural form of the work platform when it is used as stage equipment.

Fig. 8 is an installed position diagram of the wheels and pickets on the soft foundation.

Fig. 9-1 is an internal structural diagram for the blocking device, and here the spring button is compressed by an external force. Fig. 9-2 is a side view of the blocking device placed horizontally. Fig. 9-3 is a top view of the blocking device when it is lifted up and locked, and Fig. 9-4 is a side view of the blocking device when it is lifted up and locked.

Fig. 10-1 is a schematic diagram as Design 1 for the touch and stop device; 10-1 represents the pressed stop switch, 10-2 represents the pull for activating the stop switch, and 10-3 represents two metal pole-shaped structures. Fig. 10-2 is a schematic diagram as Design 2 of the touch and stop device; 10-4 represents rod-shaped structure and 10-5 represent the door-shaped structure.

Fig. 11-1 illustrates two middle columns with two fixed pulleys on the top, and Fig. 11 is an overview diagram of two-central-column type framework, wherein the steel wire ropes or chains 34-1, 34-2 are connected with the circular pole-shaped structure 41-2, 41-3 respectively. The small circle painted on the rope indicates the position of the fixing point.

Fig. 12 is a schematic diagram of two-central-column type framework, wherein the steel wire rope or chain 34-1 or 43-2 is connected with pole-shaped structure 41-1 or 41-4, respectively. The small circle painted on the rope indicates the position of the fixing point.

Fig. 233 is an overview diagram of the combined pole-shaped structure arranged with four-column type framework, and Fig. 333 is an overview structural diagram of two-central-column type framework.

Fig. 13 is a side elevation view of operating one or more work platforms of the equipment to build a bridge, and the view is simplified by omitting the driven and driving aided mechanism. Fig. 13-1 is a schematic diagram wherein the inventive equipment is combined and arranged with the existing prior bridge structure to build a new bridge. Fig. 13-2 illustrates a method for multiple parallel work platforms lifting synchronously.

Fig. 14 is a schematic perspective view, and multiple work platforms are combined to build a bridge, and the framework is two-central-column type and four-column type framework, and the view is simplified by omitting the driven and driving aided mechanism and only drawing some cables at a few columns, wherein 23 represents the crossbeam between the columns, and the shadowed areas represent the filling and cushion layer arranged for the flat-surface road of the lower channel.

Fig. 15 is a schematic diagram for bridge surface

shape when multiple work platforms are combined to build a bridge. The work platform can be a horizontal surface platform or curve surface platform, wherein 2 are various shapes of the work platform, 25 is the slope and expansion joint device.

Detailed Description

[0024] Hereinafter, the invention will be further described in combination with drawings and examples. The framework is selected as a four-column type framework with pulleys at its top, and the load is exemplified as vehicle. Due to different types of the pole-shaped structures selected, the driving mode of the equipment is different, which is embodied in the different position for connection of the steel wire rope or chain 34. Now the description will be provided according to two types:

[0025] Type 1: when the right-angle pole-shaped structures shown in Figs. 2-1, 2-2 and 2-3 are selected, the steel wire rope or chain 34 are fixed on the work platform, as shown in Figs. 5, and 34 can be selected as steel wire rope or chain, or be selected as cord or conveyor belt. Hereinafter, in order to simplify the description, 34 will be exemplified as the steel wire rope throughout the description. When a vehicle is parked on the work platform 22 and the work platform 22 is moved to the upper level, the parking equipment is in the status shown in Fig. 5. When starting the switch, the gear motor 31 rotates positively to drive the wire drum 33 and the steel wire rope 34 to move via the conveyor belt 32, the steel wire rope 34-1 fixed on the work platform 22 is tightened while the steel wire rope 34-2 connected with another work platform 21 is loosened. Under the pulling of the steel wire rope 34-1, the work platform 22 runs up actively to drive the driven and driving aided mechanism (including four pole-shaped structures 41, four sprockets 42 and chains 43) hinged with the work platform 22 to rotate. With the aid of the chain transmission, the rotation of these four sprockets drives other four sprockets and pole-shaped structures hinged with another work platform 21 to rotate, thus driving the work platform 21 to run down correspondingly. Two work platforms 21 and 22 can move simultaneously and transmit the power via the chain and sprocket, thus it can save the output of electrical power from the motor. When the work platform 22 runs up to the predetermined location, the other work platform 21 must run down to the predetermined location. When the work platform 22 approaches to the predetermined location, the travel switch will be touched, then the equipment stops, shown in Fig. 5.

[0026] Upon taking the vehicle from the work platform, the gear motor reverse run is controlled by switch, so that the drum and the wire rope are driven to reverse, and the wire rope 34-1 is relaxed, and the work platform 22 runs down, and the steel wire rope 34-2 hinged with the other work platform 21 is tightened to drive the other work platform 21 to run up actively. With the transmission by the sprockets and chains, the work platform 22 runs ac-

cordingly from a high level to the ground, thus completing the procedure for taking a vehicle.

[0027] The process of parking or taking a vehicle at the work platform 21 is opposite to the process of parking or taking a vehicle at work platform 22.

[0028] Type 2: when the semi-circular or circular pole-shaped structures is selected, the steel wire rope or chain or conveyor belt 34 is fixed on the particular position of the semi-circular or circular pole-shaped structure at the end of the groove of the rim, as shown in Figs. 6 and 234; or the steel wire rope or chain or conveyor belt 34 can also be fixed on a particular position of the work platform, as shown in Fig. 1. When a car is parked on the work platform 22 and the work platform 22 is moved to the upper level, the parking equipment is in the status shown in Fig. 6. When starting the switch, gear motor 31 runs and drives the drum 33 and the wire rope 34 via the transmission belt 32, the wire rope or chain 34-1 which is fixed in the groove of semi-circular pole-shaped structure is tightened, and the wire rope or chain 34-2 which is fixed in the groove of semi-circular pole-shaped structure for the hinge with the work platform 21 is relaxed. Under the pulling by the steel wire rope or chain 34-1, the pole-shaped structure 41 is rotated around the shaft, and driving the work platform 22 to run up actively and thus driving the four pole-shaped structures 41 hinged with the work platform 22 to rotate. The rotation of these four pole-shaped structures, with the aid of the transmission of the steel wire rope or chain 18, 19 and 20 in the groove of the rim, then drives another four pole-shaped structures 41 hinged with the work platform 21 to rotate, thus driving the other work platform 21 to run down correspondingly. The two work platforms transmit power to each other through the steel wire rope or chain 18, 19 and 20, thus ensuring the cooperative synchronous movement and also saving the power output of the electric motor. When the work platform 22 runs up to the predetermined position, the other work platform 21 runs down to the predetermined position simultaneously. When the work platform 22 approaches the predetermined rising position, it contacts the travel switch, and thus the running equipment stops, as shown in Fig. 6.

[0029] Upon taking the vehicle from the work platform, the gear motor reverse run is controlled by switch, so that the drum and wire rope are driven to reverse, and the wire rope rounded in the groove of semi-circular pole-shaped structure is relaxed, and the work platform 22 runs down, and the wire rope 34-2 rounded in the groove of semi-circular pole-shaped structure is tightened to drive another work platform 21 to run up.

[0030] With the transmission by the steel wire rope or chain 18, 19 and 20, the work platform 22 runs accordingly from a higher level to the ground, thus completing the procedure for taking a vehicle.

[0031] The process of parking or taking a vehicle at the work platform 21 is opposite to that of the work platform 22.

[0032] When the two-central-column type framework

is selected for the inventive equipment, the arrangement position of the driving mechanism and the driven and driving aided mechanism are different from those mentioned above, but the mode of movement is substantially the same. Specifically, the steel wire rope or chain 34-1 and 34-2 is connected with the circular pole-shaped structure 41-2 and 41-3 respectively, as shown in Fig. 11; wherein, one end of 34-1 is connected to the circular pole-shaped structure 41-2, and the other end of 34-1 is passed through a fixed pulley on a central column 121, and runs downwards to connect with the wire drum or chain receiving device (the central column 121 is provided with two fixed pulleys in parallel on its top); one end of 34-2 is connected with the circular pole-shaped structure 41-3, and the other end of 34-2 is passed through the other fixed pulley on the central column 121, and runs downwards to connect with the wire drum or chain receiving device. Alternatively, 34-1 and 34-2 can also be connected with the circular pole-shaped structure 41-1 and 41-4, but the steel wire rope or chain needs to be longer, as shown in Fig. 12.

[0033] When a longer pole-shaped structure is used to replace two adjacent pole-shaped structures between two work platforms, in case of the combined pattern of pole-shaped structure, one end of the steel wire rope 34-1 and 34-2 turns around a fixed pulley on the central column 121 respectively in opposite direction and runs downwards and then turns around a deflection pulley to be connected with the wire drum, and the other end thereof is fixed on the particular position of the work platform or the circular or semi-circular pole-shaped structure, as shown in Fig. 333.

[0034] The working movement manner of the inventive equipment using the two-central-column type framework is in accordance with that of the inventive equipment using the four-column type framework.

[0035] To increase the lifting capacity, the method of synchronous lifting for multiple parallel platforms can be applied, as shown in Fig. 13-2. For example, in bridge construction, multiple parallel platforms can increase the width of the bridge deck and the bearing capacity of the bridge.

[0036] In addition, the wireless transmitting and receiving device is mounted respectively on the front and rear ends of the upper and lower work platforms during the movement of the upper and lower work platforms, as shown in Fig. 7. When an obstacle is identified within the predetermined distance, such as 1.5m, a signal is sent out to stop the running equipment, thus preventing the work platform from colliding with the surrounding moving or stationary obstacles or persons during the running of the equipment.

[0037] When the blocking device is used, the horizontally arranged parking lock is lifted up with the handle, and the spring button 95 embedded in the inwardly bent angle steel automatically pops up and locks when encountering the hole 91, as shown in Figs. 9-3 and 9-4; when the blocking device is to be opened, the spring

button is pressed down with a finger, and under the effect of the gravity, the blocking device automatically slides down to a horizontal position, as shown in Fig. 9-2.

[0038] Wheel 7 can be optional on the four corners of the base of the framework of the inventive equipment, and the inventive equipment can be moved to anywhere when it is equipped with a car chassis, or can be towed by a truck to anywhere to optimize the allocation of equipment resources, as shown in Fig. 8. Pickets 8 can be optional inside the four columns, for fixing on the loose and soft foundation (such as outdoor sand ground), as shown in Fig. 1 and Fig. 8. For the standard hard land, it is only necessary to connect the base with the ground by anchor bolts.

[0039] Finally, the touch and stop device 10 can ensure that the equipment will stop emergently when the side of the work platform with the touch and stop device touches the obstacle during operation. The inventive equipment can load and unload different loads, and can replace some functions of load lift and crane under appropriate conditions. Further, a single or more equipment can be operated to rapidly build a bridge for vehicles and pedestrians, which can also provide an access with two upper and lower channels, and this is very useful in some emergencies or in case of natural disasters. Hereinafter, the application of the inventive equipment as a bridge composite structure will be specifically explained:

[0040] When operating one or more inventive equipment, the work platform of every equipment is stayed at or closed to the same horizontal position (a certain height difference between the work platforms is permitted) and all work platforms are connected from the front to the end, and slopes are arranged at both ends, so that a bridge can be built quickly. Of course, the inventive equipment can also be combined with the existing bridge structure to build a new bridge, as shown in Figs. 13 and 13-1. It is not necessary for the two work platforms of each equipment or the platforms of multiple equipments to stay at an absolutely same horizontal level, and a certain height difference is permitted, as shown in Fig. 13. Thus, an appropriate sloping can be formed, and rubber cushion layers and slopes can be arranged at joints to reduce the bumping from road surface. In this case, it is very convenient to dock the platforms, namely dock the bridge deck structures without strict requirements. In the traditional methods of docking the deck of bridge, the weight of the section of bridge is concentrated at the column in the junction, and the bridge machine or crane is needed to lift the heavy structure of bridge to the precise position. While using the work platforms of this equipment to build one bridge, it is not necessary to set the column to support the weight of bridge structure at the junction of the structure of bridge. It reduces the difficulty of building a bridge and saves time. The reason is that the whole weight of the structure of bridge is supported by the wire rope or chain 34, the hinged pole-shaped structure, and the column of the framework. With the help of driven and driving aided device, it regulates the force balance of two work

platforms of the equipment. Of course, increasing the number of columns to support the weight of the bridge at the junction of the structure of the bridge can improve the capacity of the overall force for the structure of the bridge.

[0041] Also, the work platform and column can be designed with different heights according to the changes of topography, as shown in Fig. 13.

[0042] In a manner of synchronous lifting with multiple parallel work platforms, as shown in Fig. 13-2, for example, in bridge construction, multiple parallel work platforms are arranged to increase the width of the bridge deck and the bearing capacity of the bridge.

[0043] In addition, according to the increase of actual load of the work platform, and referring to the arrangement of the stayed-cable bridge or suspension bridge in construction engineering, the number of the steel wire ropes or chains connected between the work platforms and the columns can be increased, and the number of the pole-shaped structures can be increased, and the number of crossbeams 24 connected between two columns can be increased when necessary, as shown in Fig. 14. According to the amount of the actual load of the work platform, the pole-shaped structures can also have many stressed structure forms in construction engineering or mechanical engineering, such as reinforcing bar and truss structure. The shadowed areas in Fig. 14 represent the filling and cushion layers arranged for a flat surface of the road of the lower channel.

[0044] The work platform can be made into a concave-shape or bending-surface platform according to the actual need. Such a work platform has special usage in some aspects, for example, it will be very helpful to bridging, as shown in Fig. 15; wherein 25 refers to the slope and the extensible joint device.

[0045] When dismantling the bridge, the equipment can be operated to automatically "shrink" into the upper and lower platforms automatically. Then it will be towed away by the construction party. If a certain section of the work platform fails or is damaged, a new equipment can replace such section of equipment, or the equipment can be controlled to lower the failure or damage section of platform for maintenance and replacement at low altitudes or near the level of ground or sea. Such a method reduces the difficulty in maintenance and saves maintenance time.

[0046] It should be noted that in order to meet the requirements for lifting in some circumstances, the platform can be simplified as a crossbeam shown in Figs. 225 and 226; or it is even possible to directly use the hook or lifting ring linked with the pole-shaped structure for lifting, as shown in Figs. 227 and 228. When a container is lifted, the pole-shaped structure of the equipment can be directly placed at the two sides of the container, herein the platform is simplified as the crossbeam, and then can be connected with the top corner parts or bottom corner parts of the container by pins through the clamps and riggings of the crossbeam; or the bottom of the load is

directly upheld by a net-shaped part hung and connected to two crossbeams. Fig. 225 illustrates a lifting along the direction of the length of the container. Alternatively, it is possible for lifting along the direction of the width of the container, as shown in Figs. 226 and 229.

[0047] If the requirement of horizontal stability for lifting a load is not high, which means swaying back and forth of the load is permitted, it is possible to use one or two pole-shaped structures in parallel as the lifting mechanism for lifting the load, and herein the work platform is simplified as the hook, lifting ring or special-purpose fixture and riggings, as shown in Figs. 228 and 229. In Fig. 229, only one pole-shaped structure is used and the work platform is simplified as a special-purpose fixture for container, and the container can be rotated at an angle close to 360 degree in the vertical plane. Fig. 230 illustrates how two pole-shaped structures in parallel are used. The work platform is simplified as a special-purpose fixture for container and the container can be rotated at an angle close to 360 degree in the vertical plane.

[0048] The above describes the specific cases of the implementation of the patent. The patent is not limited to the above icon or description of the specific structure, but also covers all changes of the essence spirit and scope from the patent.

Claims

1. A multi-purpose load lifting work platform or/and composite bridge structure comprising a framework, at least one work platform, a drive mechanism, and an electrical control devices, **characterized in that** one end of a pole-shaped structure (41) is connected with the framework in a movable manner, and the other end of the pole-shaped structure (41) is connected with the work platform in a movable manner, the work platform can run with the pole-shaped structure together; the work platform can run in curve track relative to the framework by power, and can stop at any position in running track.
2. A multi-purpose load lifting work platform or/and composite bridge structure according to claim 1, **characterized in that** the forms of said pole-shaped structure (41) include: the semi-circular pole-shaped structure, the circular pole-shaped structure, the right-angle pole-shaped structure, the elliptical pole-shaped structure, the semi-elliptical pole-shaped structure, the drop pole-shaped structure, the semi-drop pole-shaped structure, the inverted drop pole-shaped structure, the inverted semi-drop pole-shaped structure.
3. A multi-purpose load lifting work platform or/and composite bridge structure according to claim 1, **characterized in that** the driven and driving aided mechanism is assembled, it solves the issues that

the linkage mechanics can not work smoothly in low-speed movement and the possible reversal or failure; the driven and driving aided mechanism can converse and transfer the kinetic energy and potential energy between two work platforms;

the driven and driving aided mechanism has two types, any one of two types of the driven and driving aided mechanisms can be used in the inventive equipment independently, and they can also replace each other or be combined together in the equipment with a manner of all structure or one part of the structure of each type, even can be used one part of the structure of each type in the equipment; in addition, two types can be used in the equipment, and can also be used in the other equipment requiring coordination-movement as one method and principle.

4. A multi-purpose load lifting work platform or/and composite bridge structure according to claim 1 or claim 2, **characterized in that** the driven and driving aided mechanism comprises the pole-shaped structure (41), a sprocket (42), a bearing box (43) and a chain (44), wherein, one end of pole-shaped structure is connected with framework through the bearing box (43), the sprocket (42) is connected with one end of pole-shaped structure (41), the chain (44) is encircled on the sprockets (42).
5. A multi-purpose load lifting work platform or/and composite bridge structure according to claim 1 or claim 2, **characterized in that** the driven and driving aided mechanism comprises the pole-shaped structure (41), the wire rope, chain, belt or rope encircled in the grooves of rim for pole-shaped structure, the bearing box (43), a shaft (50); the shaft (50) passes through the pole-shaped structure, and is fixed at the framework through the bearing box (43); the wire rope, chain, conveyor belt or cord is encircled in the groove of the rim for pole-shaped structure, wherein one end of steel wire rope and rope needs to be fixed in the grooves of the rim for pole-shaped structure.
6. A multi-purpose load lifting work platform or/and composite bridge structure according to claim 1, **characterized in that** the pole-shaped structures (41) are encircled and connected by the wire rope, chain, conveyor belt or cord independently or mutually, achieving the coordinated movements.
7. A multi-purpose load lifting work platform or/and composite bridge structure according to claim 1, **characterized in that** a obstacle monitoring device (6) can be assembled optionally at the front and rear side of work platform, which can avoid the colliding between the work platform and surrounding obstacles or people; the work platform is furnished with a blocking devices (9), which is equipped with a spring button (95) with a keyhole (94), a pulling handle (99),

an axis (97) with a pulley (96), the blocking device is more convenient for using, the blocking device can also be used independently on the ground of car park as a parking lock; a touch and stop device (10) is fixed at one side of work platform, it can stop the equipment quickly while the work platform contacts surrounding obstacles or people; a wheel (7) can be installed the base of the framework of the equipment optionally to provide mobility and thus optimize the reasonable allocation of equipment resources.

8. A building-bridge method for using a multi-purpose load lifting work platform or/ and composite bridge structure as a bridge structure, comprising: operating one or more equipment as **characterized in** claims 1 to 7 to allow the work platforms of each equipment to stay at the same horizontal position or close to the same horizontal position, and connecting all work platforms from the front to the end, so the bridge can be built quickly; building the bridge by combining the composite bridge structure with the known structures of bridge can achieve the same effect.
9. A multi-purpose load lifting work platform or/and composite bridge structure according to claim 8, **characterized in that** when dismantling the bridge, the equipment can be operated to "shrink" into the upper and lower platforms automatically, then it will be towed away by the construction party; if a certain section of work platform is failed or damaged, a new equipment can replace such section of equipment, or the equipment can be controlled to lower the failure or damage section of platform for maintenance and replacement at low altitudes or near the level of ground or sea.
10. A multi-purpose load lifting work platform or/and composite bridge structure according to claim 8, **characterized in that** when the composite bridge structure is used to build a bridge, a certain altitude difference between the platforms is allowed, the work platform can be made in the horizontal platform, and can also be made in concave-shape or bending-surface platform according to actual needs.

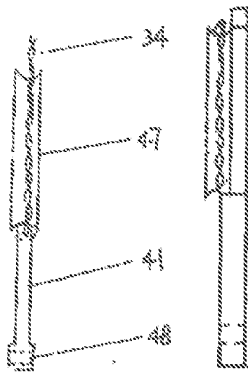


FIG. 2-6



FIG. 2-61

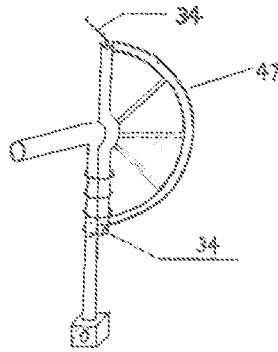


FIG. 2-7

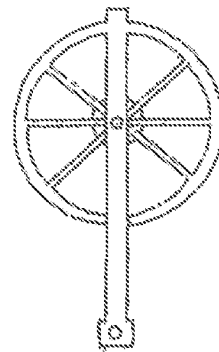


FIG. 2-8

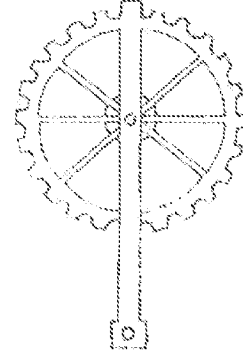


FIG. 2-18

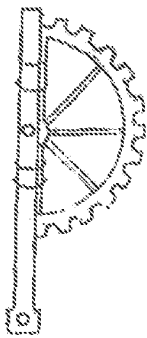


FIG. 2-19

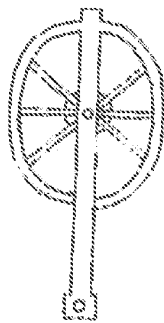


FIG. 2-20

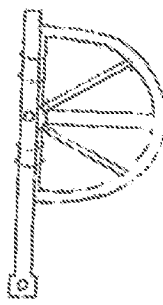


FIG. 2-21

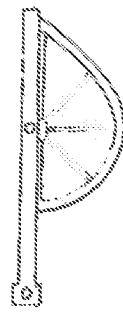


FIG. 2-22

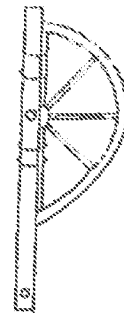


FIG. 2-23

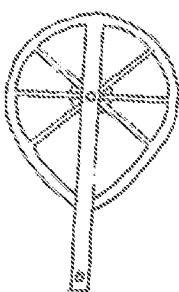


FIG. 2-24

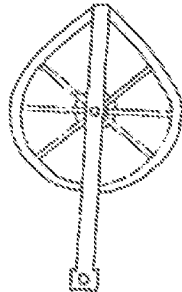


FIG. 2-25

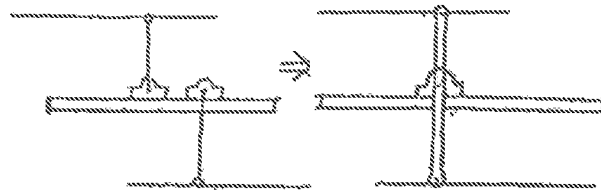


FIG. 2-26



FIG. 2-27

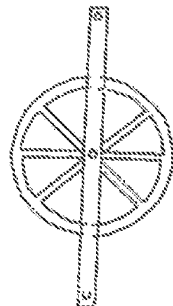


FIG. 2-28

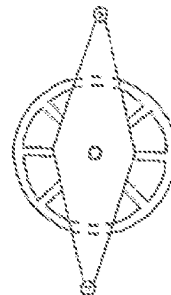


FIG. 2-29

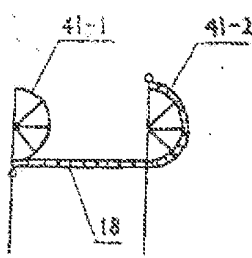


FIG. 2-9

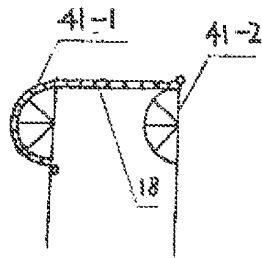


FIG. 291

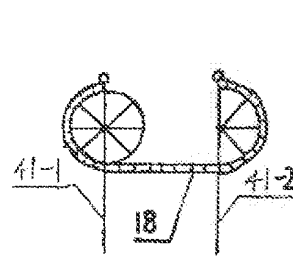


FIG. 292

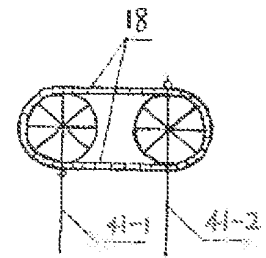


FIG. 293

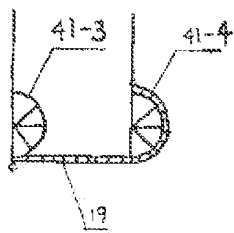


FIG. 2-10

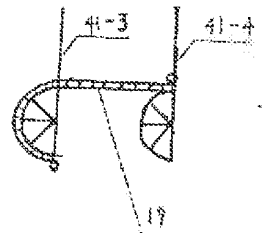


FIG. 211

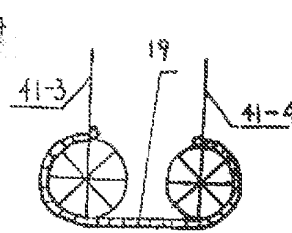


FIG. 212

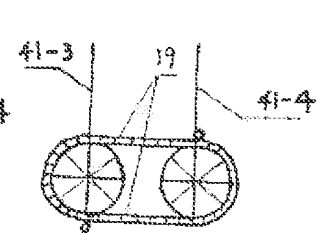


FIG. 213

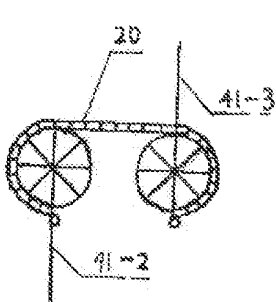


FIG. 2-12

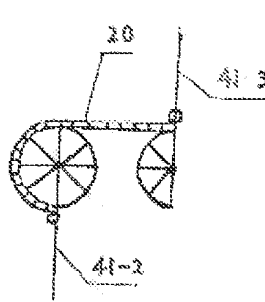


FIG. 266

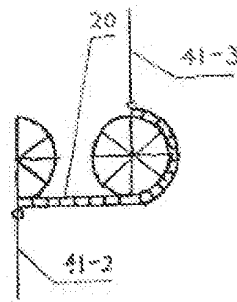


FIG. 267

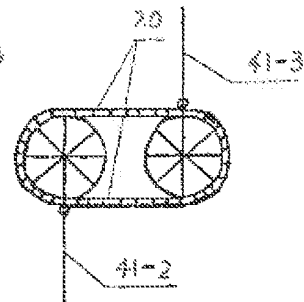


FIG. 268

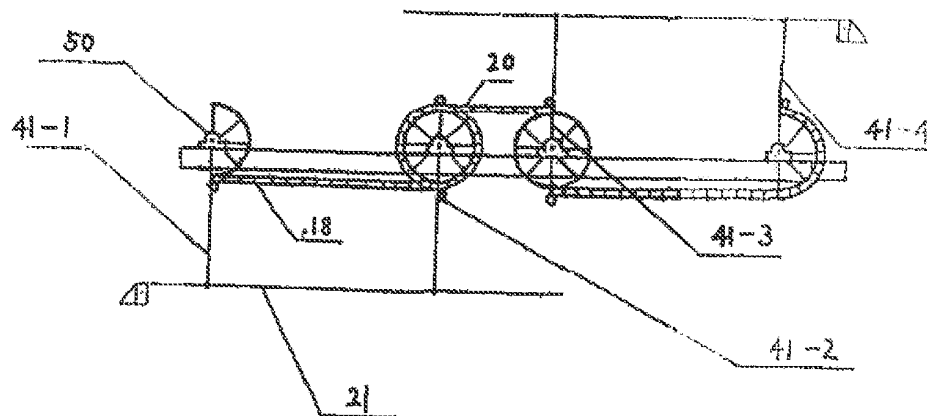


FIG. 2-15

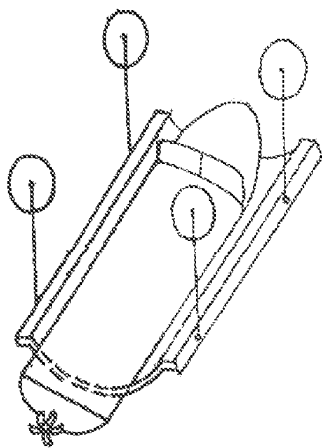


FIG. 223

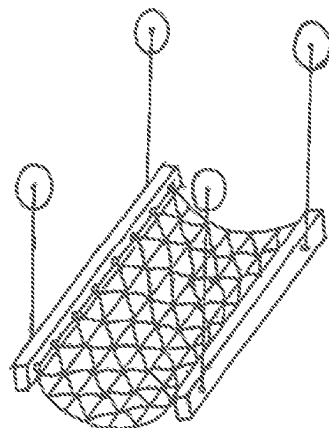


FIG. 224

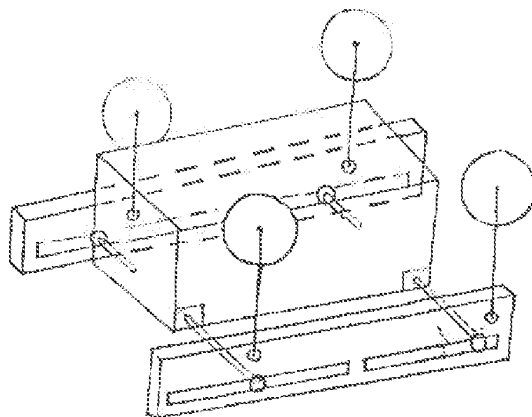


FIG. 225

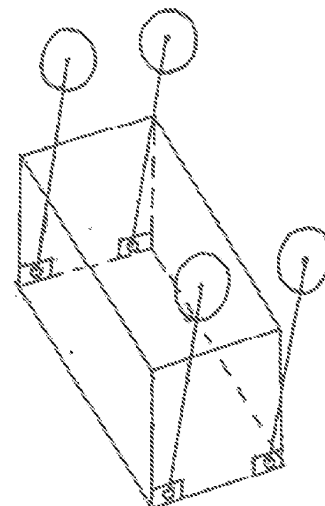


FIG. 226

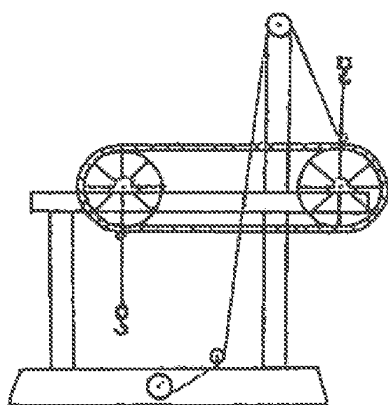


FIG. 227

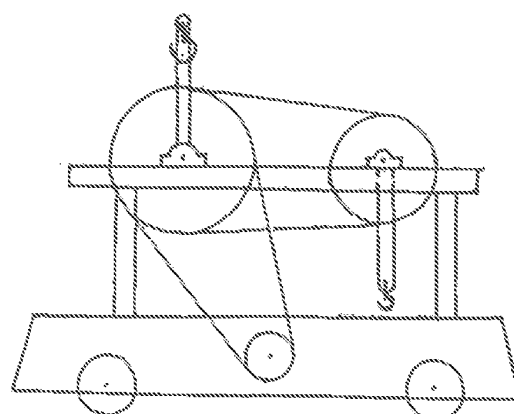


FIG. 228

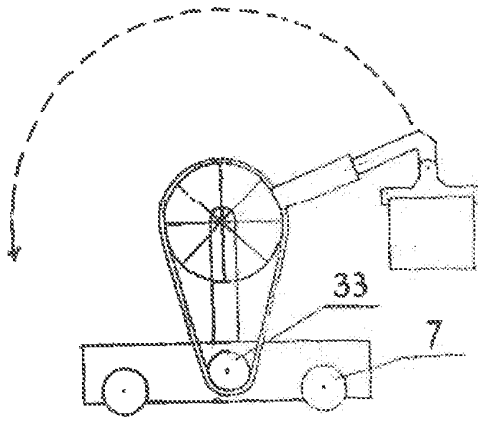


FIG. 229

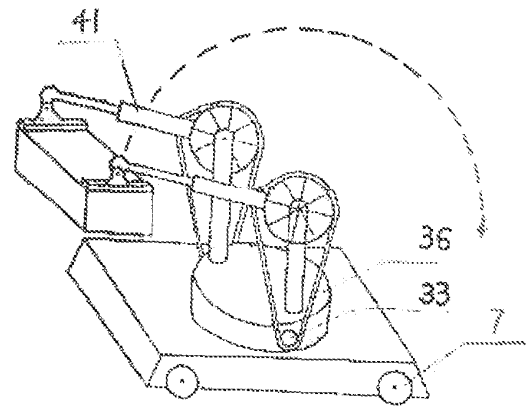


FIG. 230

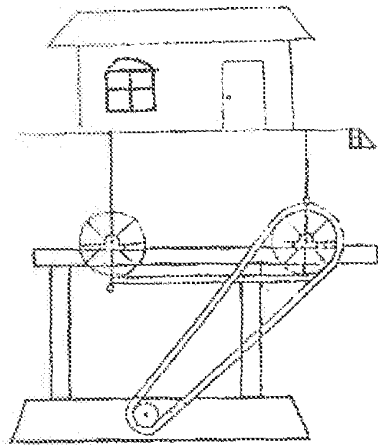


FIG. 244

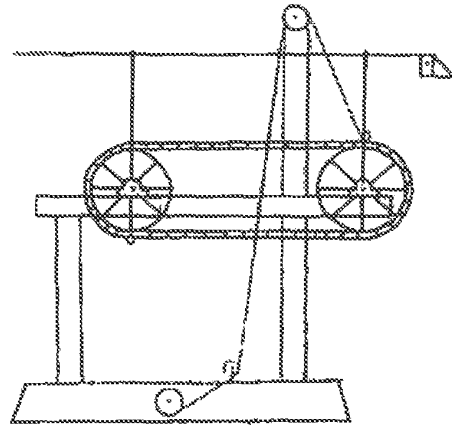


FIG. 245

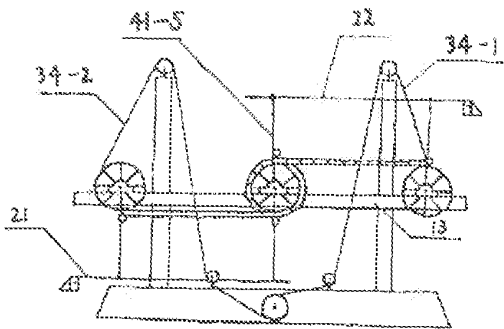


FIG. 233

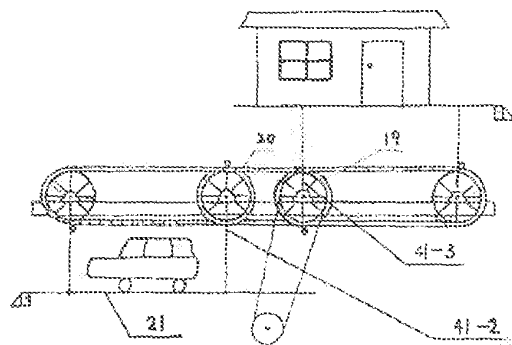


FIG. 234

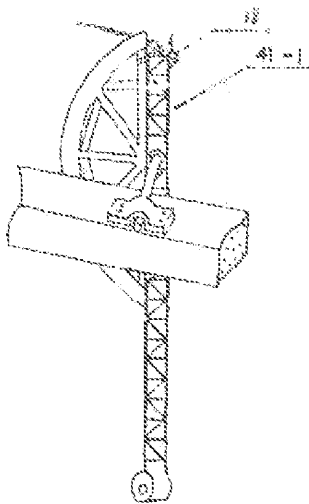


FIG. 2-16-1

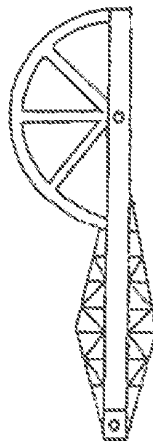


FIG. 2-16-2

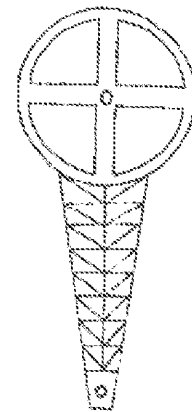


FIG. 2-16-3

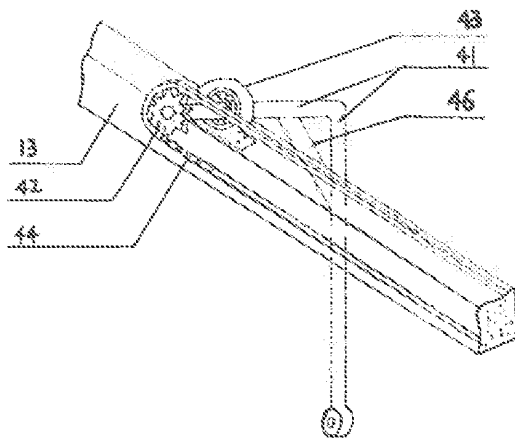


FIG. 3-1

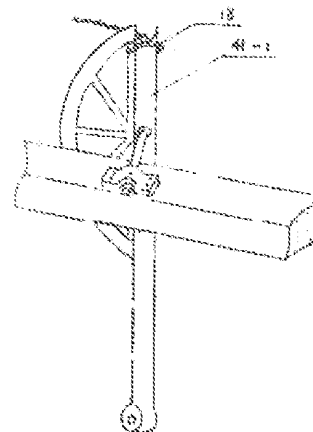
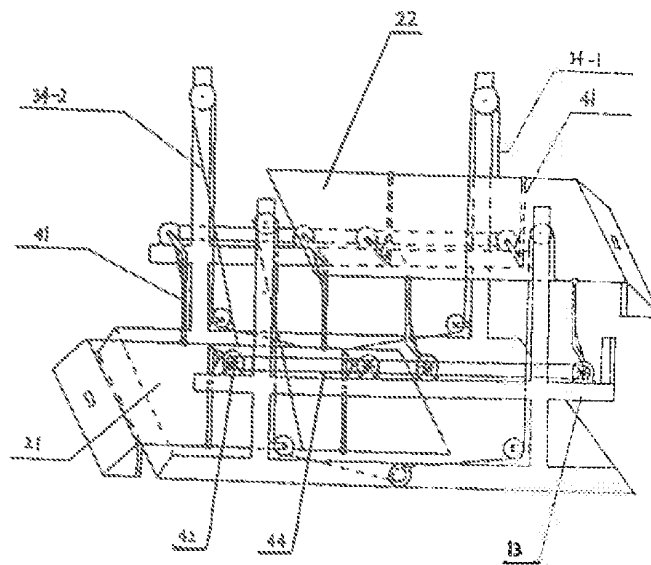


FIG. 3-2



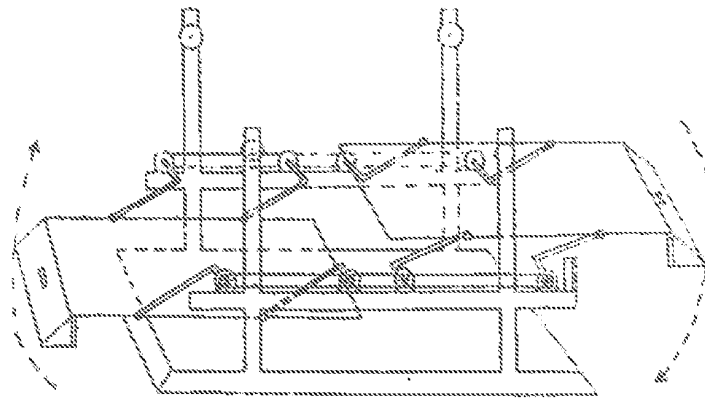


FIG. 41

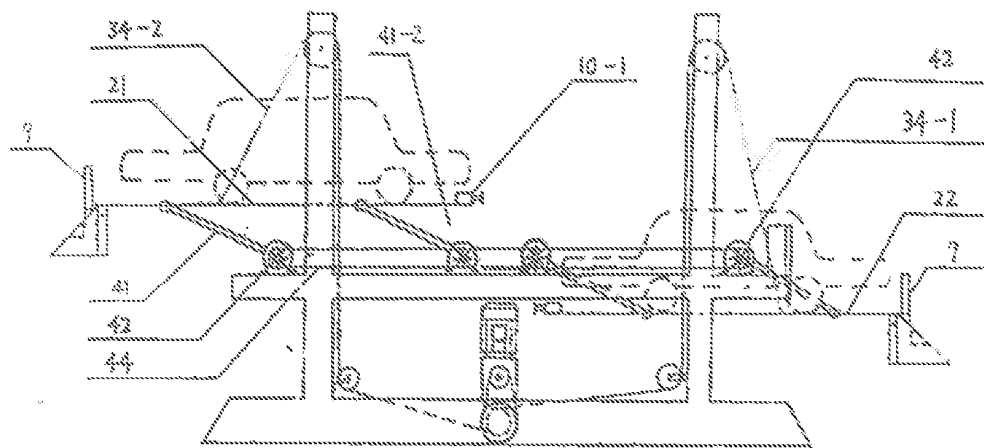


FIG. 5

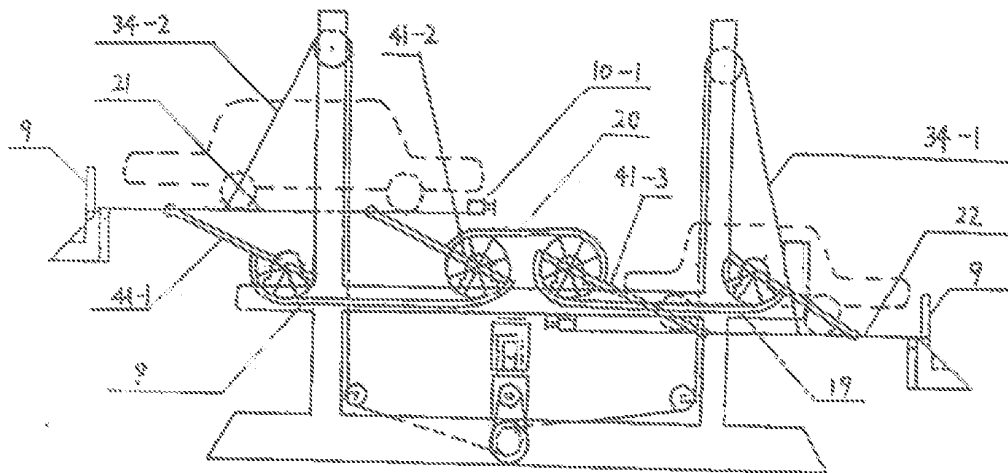


FIG. 6

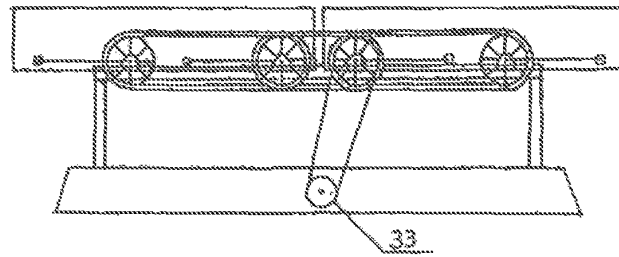


FIG. 7-1

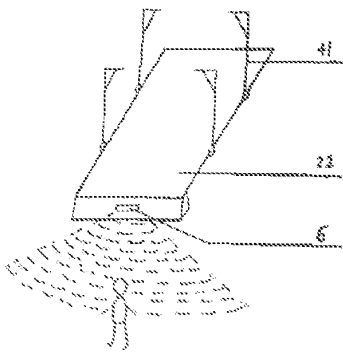


FIG. 7

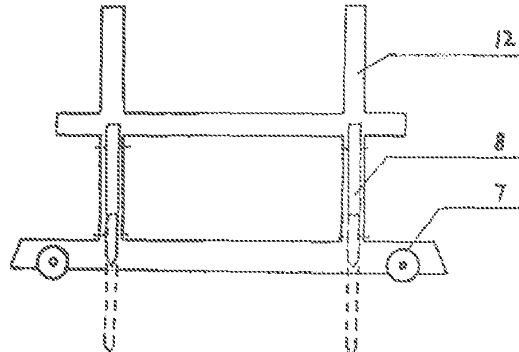


FIG. 8

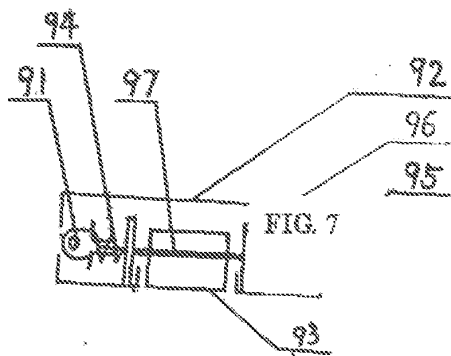


FIG. 9-1

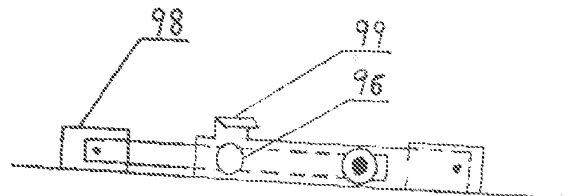


FIG. 9-2

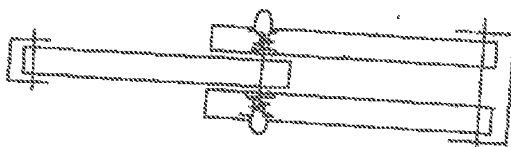


FIG. 9-3

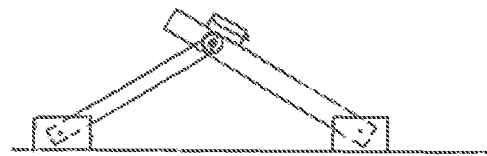


FIG. 9-4

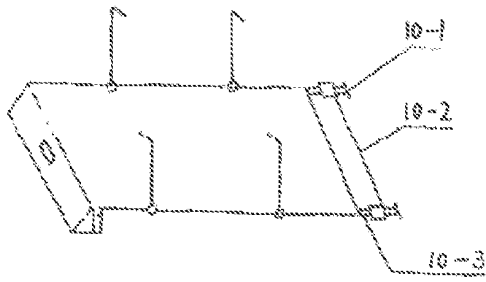


FIG.10-1

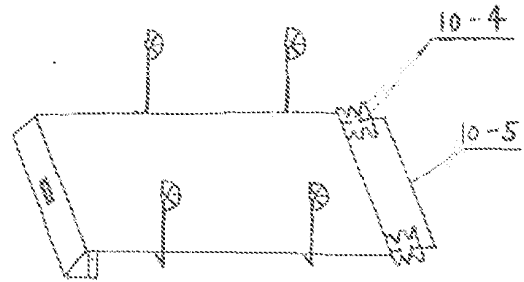


FIG.10-2

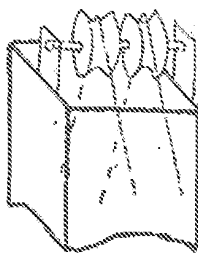


FIG.11-1

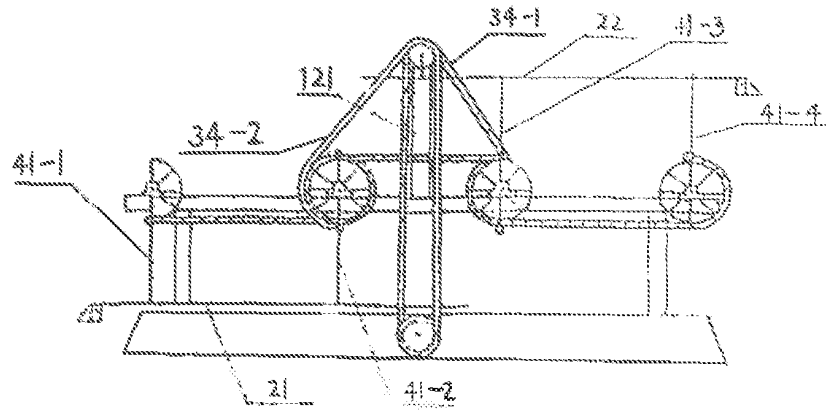


FIG.11

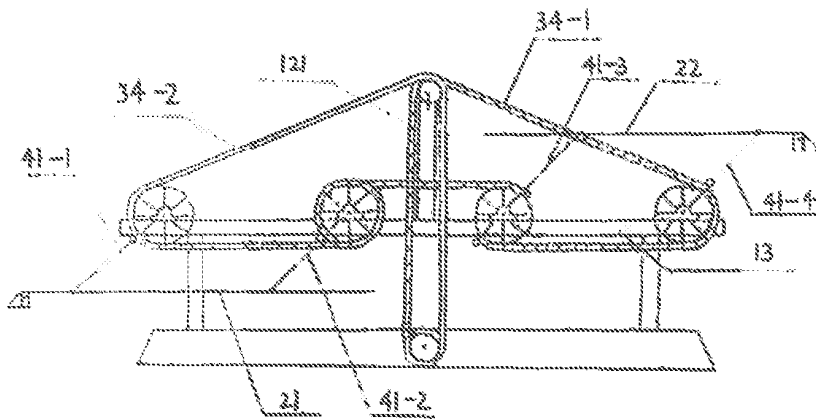


FIG.12

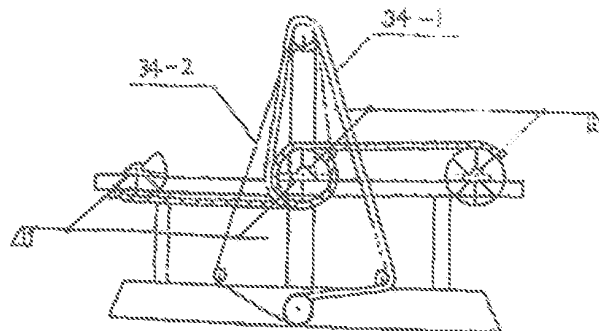


FIG.333

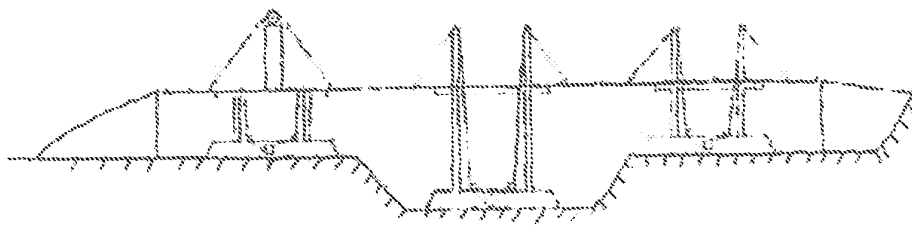


FIG.13

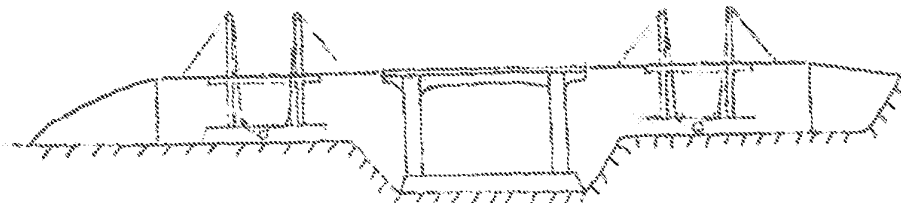


FIG.13-1

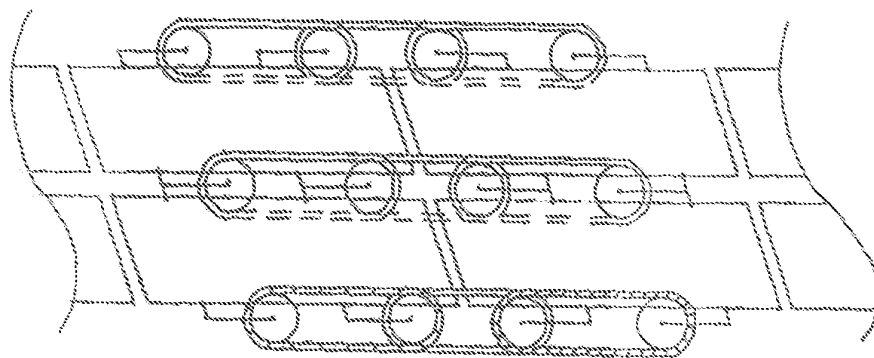


FIG.13-2

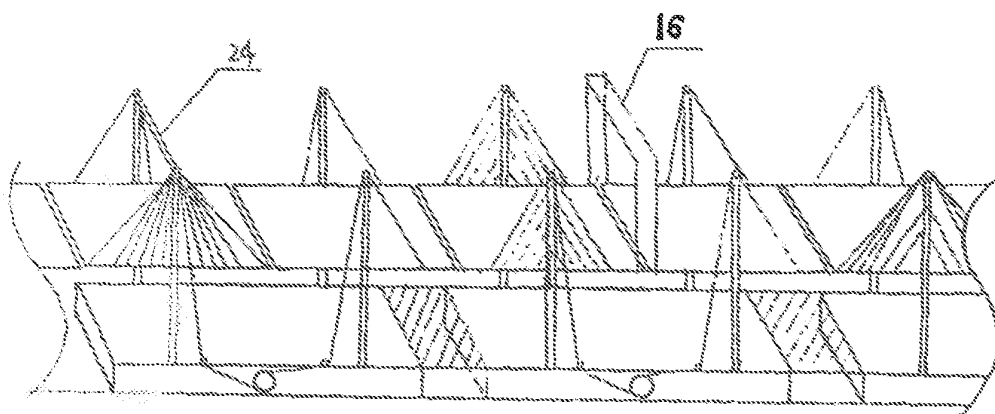


FIG.14



FIG.15

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2009/070597

A. CLASSIFICATION OF SUBJECT MATTER

E04H6/18 (2006.01) i

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)

IPC: E04H6/00, E04H6/06, E04H6/12, E04H6/14, E04H6/16, E04H6/18, E04H6/20, E01D21/-

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

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

CNPAT, CNKI, WPI, EPODOC, PAJ: car, vehicle, garage, lift+, rotat+, platform?, position?, mov+, chain?, cable?

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim
PX	CN201047182Y(SUN, Meng) 16 Apr. 2008(16.04.2008) page 3 of description, figures 1-6	1-7
X	JP7-4099A(KUDO Hirakazu)10 Jan. 1995(10.01.1995) column 2, figures 1-2	1-3
X	JP6-341242A(SHIN MEIWA IND. CO. LTD.)13 Dec. 1994(13.12.1994) columns 4-6, figure 1	1-3
A	CN2340836Y(LI, Guanfeng)29 Sep. 1999(29.09.1999) the whole document	1-10
A	CN2890245Y(WANG, Yidao)18 Apr. 2007(18.04.2007) the whole document	1-10
A	JP 9-291716A(GIKEN SEISAKUSHO K.K.)11 Nov. 1997(11.11.1997) the whole document	1-10
A	FR2721292A1(ROCHER, Robert)22 Dec. 1995(12.12.1995) the whole document	1-10

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

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“A” document defining the general state of the art which is not considered to be of particular relevance	“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
“E” earlier application or patent but published on or after the international filing date	“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
“L” document which may throw doubts on priority claim (S) or which is cited to establish the publication date of another citation or other special reason (as specified)	“&” document member of the same patent family
“O” document referring to an oral disclosure, use, exhibition or other means	
“P” document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
31 May 2009 (31.05.2009)Date of mailing of the international search report
11 Jun. 2009 (11.06.2009)Name and mailing address of the ISA/CN
The State Intellectual Property Office, the P.R.China
6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China
100088
Facsimile No. 86-10-62019451Authorized officer
CHEN, Yaofeng
Telephone No. (86-10)62412882

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2009/070597

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN201047182Y	16.04.2008	NONE	
JP7-4099A	10.01.1995	NONE	
JP6-341242A	13.12.1994	NONE	
CN2340836Y	29.09.1999	NONE	
CN2890245Y	18.04.2007	NONE	
JP9-291716A	11.11.1997	EP0735215A1	02.10.1996
		DE69619009T	19.09.2002
		JP2872962B2	24.03.1999
		SG44731A	19.12.1997
		KR970065931A	13.10.1997
FR2721292A1	22.12.1995	NONE	

Form PCT/ISA/210 (patent family annex) (April 2007)