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(54) **AUTONOMOUS CARGO LEVELER FOR CRANES ACTIVATED BY RADIOCONTROL**

DURCH FUNKSTEUERUNG AKTIVIERTE UNABHÄNGIGE FRACHTLADEBRÜCKE FÜR KRÄNE
NIVELEUR DE CHARGE AUTONOME POUR GRUES, ACTIONNÉ PAR RADIOCOMMANDE

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(56) References cited:

WO-A1-2006/000919 GB-A- 2 086 841
GB-A- 2 439 133 GB-A- 2 439 133
GB-A- 2 467 149 GB-A- 2 467 149
JP-A- H07 215 666 JP-A- H09 227 070
JP-A- 2004 123 248 JP-A- 2004 224 534
US-A- 3 746 182 US-A- 4 215 851
US-A- 5 800 000

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Description

Field of the Art

[0001] The invention is comprised in the technical field of lifting loads with cranes, including on site tower cranes, derrick cranes or any other type of crane.

State of the Art

[0002] Currently, jobs for leveling a load suspended by a crane are performed manually by shortening or lengthening the chains or slings holding the part to the crane hook. The suspended loads are rested as many times as there are chain or sling shortening or lengthening operations necessary for the purpose of carrying the load with the inclination necessary to its final destination.

[0003] There is no machine on the market which performs these operations mechanically and remotely in a completely autonomous manner and capable of working in special conditions. The document GB 2467 149 A discloses a load leveler according to the preamble of claim 1.

Description of the Invention

[0004] The object of the invention is a machine which, connected to the crane hook, is capable of shortening or lengthening the chains or slings mechanically and remotely, preventing the continuous handling of the suspended load by operators, thus making the load leveling operation a safe and fast operation.

[0005] The object of the invention is to also provide a radio control-operated autonomous load leveler for cranes capable of working in explosive environments, environments with radio interferences, underwater environments, sterilized environments, for the food, hospital, laboratory fields etc. These objects are achieved by the provision of a load leveler according to claim 1.

[0006] The remote control autonomous load leveler is a machine designed or being suspended from a crane hook. Provided with an electric generator and a radio control system which assure complete autonomy and allow operating the blocks and tackles remotely, it thereby achieves that the load suspended from the four hooks is handled at the desired position and at a distance that is safe for operators, all with the suspended load.

[0007] The invention can be used in assembling rebars and inclined column formwork for bridges, viaducts, etc. It can also be used in assembling inclined structures, allowing doing the work of two or three cranes with just one. The load leveler especially further allows the assembly of any part needing beackets having different lengths, since the load leveler allows performing this operation with the suspended load.

[0008] The use of a remote control load leveler in traffic accidents would substantially simplify the tasks of hitching, hoisting and subsequently placing the damaged vehicles in the transport position, equally reducing the time

that the road is closed.

[0009] The present invention can also supply electric power, hydraulic power or both to several crane accessories which up until now were manually operated. For example, it allows supplying electricity to a pump for bailing out water which, suspended from the leveler, prevents having to use electrical extension cords in flooded areas and even an operator having to go to each pumping point to place the pump.

[0010] When building retaining walls, the footings or the walls are often prepared for pouring concrete, and due to rain or the appearance of cracks the batter becomes unstable and dangerous for workers. The leveler can supply electricity to a concrete bucket opened electrically and to an electrovibrator. It can likewise have both suspended, concrete and vibrate the concrete without operators on the formwork, which is not safe due to the proximity of the batter.

[0011] The autonomous load leveler provides another series of advantages:

- It is capable of suspending a part or structure from the transport position to its final destination, being adjusted to the angle of inclination required and thereby preventing the operators from continuous handling the load, lengthening or shortening the anchoring chains as needed.
- Due to its versatility, the load leveler entails optimizing tasks which would have been carried out by more than one crane; the precision necessary for assembling certain structures often makes it necessary to use three or even four cranes. A single crane would be enough with the use of the load leveler.
- It provides considerable savings by reducing both the number of necessary crane and essential personnel hours for the leveling tasks.
- It allows automating instruments which, to date, have been manually operated (concrete bucket, concrete vibrator, water pump, etc.), supplying them the electric and/or hydraulic power necessary to operate, these being handled at a safe distance.

[0012] In terms of on-the-job safety and hygiene, the load leveler also provides a series of advantages:

- At construction sites, one of the jobs to be performed by a tower crane is transferring and turning over the debris containers and boxes. This operation is performed by the crane operator moving to the unloading point, supporting resting the container, to release the two front chains and lift the box again so that it is tipped and unloaded. It is very common in such sites for the unloading point to be very hard for the crane operator to access and even dangerous when providing internal reinforcement for the walls of the site since the chains have to be released at the unloading point with the box supported on the wall. By using the load leveler, not only is the movement of

the crane operator through non-conditioned areas prevented, but also the crane operator or any other operator handling the box for unloading it is prevented.

- When operating a forklift with a safety cage, the cage can be lifted with the leveler, which therefore allows releasing the load without any operator having to go to the unloading point for the purpose of lifting the cage and thus recover the lift.
- In construction sites for building retaining walls, it is very common due to rain for cracks to appear, for the, ground to show little resistance, etc., thereby compromising the stability of the batter. When the formwork is ready for concreting and the batter becomes unstable and dangerous for the operators who are responsible for pouring the concrete (on the formwork) and vibrating it, the load leveler can be used as follows: the electric-driven concrete bucket is suspended from the leveler support, and an electric concrete vibrator is suspended from the block and tackle. The load leveler supplies electricity and drive at a safe distance for both tools, which thereby allows precisely pouring the concrete and then lowering the vibrator to allow it to perform its function. Areas in which safety prevents site personnel from working as it would involve assuming personal risks can thus be concreted.
- When assembling structures, slings are commonly used. Their elasticity causes differences of several centimeters in length from one to the next. This is because some are subjected to a greater load than others, the more weight they support the more they are stretched. In other cases, the sections surrounding slings have different thicknesses, the anchoring points are not symmetrical, the structure is placed with a slight inclination, etc. For this reason, the attempt is usually made to correct these small differences with very rudimentary and dangerous methods, either by operators swinging, prying or handling the load with operators when it is still suspended. The load leveler absorbs any length difference of the slings, giving the structure assembly operation the precision necessary to prevent the suspended part from being handled by the operators in a dangerous situation.

Brief Description of the Drawings

[0013] A series of drawings aiding to better understand the invention and expressly related to an embodiment of said invention presented as a non-limiting example thereof is very briefly described below.

[0014] Figure 1 shows an embodiment of the autonomous load leveler.

Detailed Description of the Invention

[0015] In a first preferred embodiment, the present in-

vention comprises four fundamental parts:

- An electric generator with a radio control start responsible for supplying the electricity necessary for operating the remaining electric parts.
- At least one electric or hydraulic block and tackle and a maximum of as many blocks and tackles as there are leveling points required, a maximum of four blocks and tackles being the most common. This block and tackle or group of blocks and tackles is responsible for placing the suspended part in the desired position.
- An industrial radio control receiver/emitter with dual buttons, one for starting/stopping the electric generator, one for starting/stopping the electrohydraulic pump if there is one, and at least one for each block and tackle installed, the function of which is to operate the electric blocks and tackles or the electrovalves if hydraulic blocks and tackles are installed.
- A structure or support the purpose of which is to house the blocks and tackles, the electric generator, the industrial radio control receiver and the electrohydraulic pump with its electrovalves, there being as many of the latter as there are hydraulic blocks and tackles if there are any installed, allowing the assembly to be suspended from a crane and in turn suspending from such crane the load that must be leveled.

[0016] The generator can thereby be started and the blocks and tackles can be individually operated, all radio control-operated, thereby handling a suspended load, leveling it at the desired position remotely. The load can thereby be handled and included for adapting it to any position by lengthening and shortening the chains of the blocks and tackles from a safe distance with respect to the suspended load.

[0017] In another preferred embodiment, the radio control-operated autonomous load leveler for cranes allows configuring a previous autonomous load leveler so that it can work in different particular working environments. A radio control-operated autonomous load leveler for cranes can be configured so that it can perform its function both underwater, in inside sites without ventilation, in the mining industry, food industry, pharmaceutical industry, etc. It comprises a radio control-operated autonomous load leveler for cranes similar to that of the first embodiment but with one or several of the following modifications:

- A power source replacing the electric generator, said source being able to be solar, wind, batteries, accumulators, a fuel cell or a combination thereof.
- One or several electric, hydraulic or pneumatic chain, steel cable, belt or synthetic cable blocks and tackles which replace the original ones.
- An infrared, Wi-Fi or Bluetooth remote control sys-

tem which replaces the original radio control system as needed.

- One or several electric, hydraulic or pneumatic winches with steel or synthetic cable which replace the original blocks and tackles.
- A fireproof electric system which replaces the original system.
- Leak-tight components for underwater jobs which replace the original components, as needed.

[0018] According to the first, non-limiting preferred embodiment, Figure 1 shows the autonomous load leveler object of the invention. Four blocks and tackles 3, each one operated by a hydraulic motor 4 and placed in an oscillating base 5 which allows oscillating the block and tackle 3 to align the hook of the block and tackle 12 with the hitching point, are installed on a support 1 with a crane hitch 2 (the figure also shows the crane hook 2', which is not part of the load leveler). The oscillating base 5 is particularly useful when using three or more blocks and tackles or winches.

[0019] An electrohydraulic pump 6, the purpose of which is to send the hydraulic oil under pressure from the tank 7 to the distributor 8, formed by at least one electrovalve 9 (electrohydraulic valve) for each block and tackle 3, is also placed on the support 1.

[0020] To operate the electrovalves 9 the support is equipped with an industrial radio control receiver 10 with:

- A channel for starting/stopping the electric generator 11 also installed in the support 1.
- A channel for starting/stopping the electrohydraulic pump 6.
- And a channel for each electrovalve 9.

[0021] The present invention is further illustrated by means of the following examples, which do not intend to limit the scope of said invention.

Example 1

[0022] An autonomous load leveler for cranes operated by basic radio control for a construction tower crane with a maximum load of 2.5 tons, which is intended to be used to both place beams in inclined roofs, such as solar panels, or any other type of inclined structure, even for tasks of unloading debris containers, is formed by:

- An approximately 2000-Watt electric generator with a radio control start.
- A 1000-Watt and 2.5-ton load capacity electric block and tackle.
- A receiver with a channel for starting/stopping the generator and a channel for driving the electric block and tackle.
- An emitter with as many dual buttons as there are channels in the receiver.
- A support or structure housing these parts such that

the load is suspended at two points, one in the structure or support and the other in the hook of the block and tackle.

Example 2

[0023] A radio control-operated autonomous load leveler for cranes intended for a crane the purpose of which is to place a load, the anchoring points of which at the destination are at a different level and have four hitching points and a weight of 5 tons, is formed by:

- A 3500-Watt electric generator with a radio control start.
- An electrohydraulic pump with at least four electrovalves.
- An industrial radio control receiver with a channel for starting/stopping the electric generator, a channel for starting/stopping the electrohydraulic pump and at least one channel for each electrovalve.
- An industrial radio control emitter with as many dual buttons as there are channels in the receiver.
- Four 5.5-ton capacity hydraulic blocks and tackles.
- A support or structure for suspending in the crane housing these parts such that the load is suspended hitched on the four hooks of the blocks and tackles.

Example 3

[0024] A radio control-operated autonomous load leveler for cranes for working in explosive environments formed by a radio control-operated autonomous load leveler for cranes according to the first embodiment but with the following modifications:

- A fireproof electric installation in all the electric components.

Example 4

[0025] A radio control-operated autonomous load leveler for cranes for working in the pharmaceutical or food industry, which requires maintaining a decontaminated atmosphere, is formed by a radio control-operated autonomous load leveler for cranes according to the first embodiment but with the following modifications:

- A non-contaminating power source based on electric accumulators which replaces the original electric generator.
- Belt blocks and tackles or synthetic cable winches which replace the original ones.

Claims

1. A radio control-operated autonomous load leveler for cranes, comprising:

- a support (1) for supporting the elements of the leveler, with a crane hitch (2);
- an electric power generator;
- a remote control system for wirelessly receiving commands;

characterized in that it further comprises:

- load leveling means comprising four winches or four blocks and tackles (3), each one for handling the load at a different leveling point, powered by the power generator and configured for handling the load hitched on four hooks (12) depending on commands received by the remote control system, the four winches or four blocks and tackles (3) being individually radio control-operated;
- an oscillating base (5) which allows oscillating the four winches or four blocks and tackles (3) for aligning their hooks (12) with the respective hitching point of the load.

2. The autonomous load leveler according to claim 1, **characterized in that** the load leveling means comprise four electric blocks and tackles.

3. The autonomous load leveler according to claim 1, **characterized in that** the load leveling means comprise four electric winches.

4. The autonomous load leveler according to claim 1, **characterized in that** the load leveling means comprise:

- four hydraulic winches or blocks and tackles (3,4);
- an electrohydraulic pump (6);
- a hydraulic liquid tank (7);
- a hydraulic distributor (8);
- one electrovalve (9) for each hydraulic winch or block and tackle (3,4), powered by the electric power generator for activating the corresponding hydraulic motor (4) depending on the commands received by the remote control system.

5. The autonomous load leveler according to claim 1, **characterized in that** the load leveling means comprise:

- four pneumatic winches or blocks and tackles;
- a compressed air compressor;
- a compressed air drum;
- one pneumatic electrovalve for each pneumatic winch or block and tackle powered by the electric power generator for activating the corresponding compressed air motor depending on the commands received by the remote control system.

6. The autonomous load leveler according to any of the preceding claims, **characterized in that** the remote control system is one of the following types:

- an industrial radio control receiver (10);
- an infrared remote control system;
- a Wi-Fi remote control system;
- a Bluetooth remote control system.

7. The autonomous load leveler according to any of the preceding claims, **characterized in that** the electric power generator is one of the following types:

- an electric generator (11);
- a solar generator;
- a wind generator;
- batteries;
- accumulators;
- a fuel cell;
- a combination of the above.

8. The autonomous load leveler according to any of the preceding claims, **characterized in that** the electric system of the electric components of the leveler is fireproof.

9. The autonomous load leveler according to any of the preceding claims, **characterized in that** the leveler uses leak-tight components for underwater jobs.

10. The autonomous load leveler according to any of the preceding claims, **characterized in that** it comprises a remote control emitter for remotely and individually operating the four winches or four blocks and tackles (3).

11. The autonomous load leveler according to claim 10, **characterized in that** the remote control emitter is an industrial radio control emitter.

Patentansprüche

1. Durch Funksteuerung betätigte selbstständige Lastausgleichsvorrichtung für Kräne, umfassend:

- einen Träger (1) zum Tragen der Elemente der Ausgleichsvorrichtung, mit einem Krankhaken (2);
- einen Stromgenerator;
- ein Fernsteuerungssystem zum drahtlosen Empfangen von Befehlen;

dadurch gekennzeichnet, dass sie weiterhin Folgendes umfasst:

- Lastausgleichsmittel, welche vier Winden oder vier Flaschenzüge (3) umfassen, von denen je-

- de(r) zur Aufnahme der Ladung an einer unterschiedlichen Ausgleichsstelle dient, welche durch den Stromgenerator angetrieben werden und derart ausgebildet sind, dass sie die auf vier Haken (12) angehängte Last je nach den vom Fernsteuerungssystem empfangenen Befehlen aufnimmt, wobei die vier Winden oder vier Flaschenzüge (3) einzeln durch Fernsteuerung betätigt werden;
- einen Schwenkboden (5), welcher ein Verschwenken der vier Winden oder vier Flaschenzüge (3) ermöglicht, um deren Haken (12) mit der jeweiligen Anhängestelle der Ladung auszurichten.
2. Selbstständige Lastausgleichsvorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Lastausgleichsmittel vier elektrische Flaschenzüge umfassen.
 3. Selbstständige Lastausgleichsvorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Lastausgleichsmittel vier elektrische Winden umfassen.
 4. Selbstständige Lastausgleichsvorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Lastausgleichsmittel Folgendes umfassen:
 - vier hydraulische Winden oder Flaschenzüge (3, 4);
 - eine elektrohydraulische Pumpe (6);
 - einen hydraulischen Flüssigkeitstank (7);
 - einen hydraulischen Verteiler (8);
 - ein Elektroventil (9) für jede hydraulische Winde oder Flaschenzug (3, 4), welches durch den Stromgenerator angetrieben wird, um den entsprechenden Hydraulikmotor (4) je nach den vom Fernsteuerungssystem empfangenen Befehlen zu aktivieren.
 5. Selbstständige Lastausgleichsvorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Lastausgleichsmittel Folgendes umfassen:
 - vier pneumatische Winden oder Flaschenzüge;
 - einen Druckluftkompressor;
 - eine Drucklufttrommel;
 - ein pneumatisches Elektroventil für jede pneumatische Winde oder Flaschenzug, welches durch den Stromgenerator angetrieben wird, um den entsprechenden Druckluftmotor je nach den vom Fernsteuerungssystem empfangenen Befehlen zu aktivieren.
 6. Selbstständige Lastausgleichsvorrichtung nach einem der vorherigen Ansprüche, **dadurch gekennzeichnet, dass** das Fernsteuerungssystem von einer der folgenden Arten ist:
 - ein industrieller Funksteuerungsempfänger (10);
 - ein Infrarot-Fernsteuerungssystem;
 - ein Wi-Fi-Fernsteuerungssystem;
 - ein Bluetooth-Fernsteuerungssystem.
 7. Selbstständige Lastausgleichsvorrichtung nach einem der vorherigen Ansprüche, **dadurch gekennzeichnet, dass** der Stromgenerator von einer der folgenden Arten ist:
 - ein elektrischer Generator (11);
 - ein Solargenerator;
 - ein Windgenerator;
 - Batterien;
 - Akkumulatoren;
 - eine Brennstoffzelle;
 - eine Kombination des Vorherigen.
 8. Selbstständige Lastausgleichsvorrichtung nach einem der vorherigen Ansprüche, **dadurch gekennzeichnet, dass** das elektrische System der elektrischen Komponenten der Ausgleichsvorrichtung feuerfest ist.
 9. Selbstständige Lastausgleichsvorrichtung nach einem der vorherigen Ansprüche, **dadurch gekennzeichnet, dass** die Ausgleichsvorrichtung leckdichte Komponenten für Unterwasserarbeiten verwendet.
 10. Selbstständige Lastausgleichsvorrichtung nach einem der vorherigen Ansprüche, **dadurch gekennzeichnet, dass** sie einen Fernsteuerungssender umfasst, um die vier Winden oder Flaschenzüge (3) aus der Ferne und einzeln zu betätigen.
 11. Selbstständige Lastausgleichsvorrichtung nach Anspruch 10, **dadurch gekennzeichnet, dass** der Fernsteuerungssender ein industrieller Funksteuerungssender ist.

Revendications

1. Niveleur de charge autonome pour grues actionné par radiocommande, comprenant :
 - un support (1) pour supporter les éléments du niveleur, avec un attelage de grue (2) ;
 - un générateur d'énergie électrique ;
 - un système de télécommande pour recevoir des ordres sans fil ;

caractérisé en ce qu'il comprend en outre :

- des moyens de nivellement de charge comprenant quatre treuils ou quatre palans (3), chacun pour manoeuvrer la charge à un point de levage différent, alimentés par le générateur d'énergie et configurés pour manoeuvrer la charge attelée sur quatre crochets (12) en fonction des ordres reçus par le système de télécommande, les quatre treuils ou quatre palans (3) étant individuellement actionnés par radiocommande ;
 - une base d'oscillation (5) qui permet d'osciller les quatre treuils ou quatre palans (3) pour aligner leurs crochets (12) avec le point respectif d'attelage de la charge.
2. Le niveleur de charge autonome selon la revendication 1, **caractérisé en ce que** les moyens de nivellement de charge comprennent quatre palans électriques.
3. Le niveleur de charge autonome selon la revendication 1, **caractérisé en ce que** les moyens de nivellement de charge comprennent quatre treuils électriques.
4. Le niveleur de charge autonome selon la revendication 1, **caractérisé en ce que** les moyens de nivellement de charge comprennent :
- quatre treuils hydrauliques ou palans (3, 4) ;
 - une pompe électrohydraulique (6) ;
 - un réservoir de liquide hydraulique (7) ;
 - un distributeur hydraulique (8) ;
 - une électrovalve (9) pour chaque treuil hydraulique ou palan (3, 4), alimentée par le générateur d'énergie électrique pour activer le moteur hydraulique correspondant (4) en fonction des ordres reçus par le système de télécommande.
5. Le niveleur de charge autonome selon la revendication 1, **caractérisé en ce que** les moyens de nivellement de charge comprennent :
- quatre treuils pneumatiques ou palans ;
 - un compresseur à air comprimé ;
 - un réservoir à air comprimé ;
 - une électrovalve pneumatique pour chaque treuil pneumatique ou palan alimentée par le générateur d'énergie électrique pour activer le moteur à air comprimé correspondant en fonction des ordres reçus par le système de télécommande.
6. Le niveleur de charge autonome selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le système de télécommande est l'un des types suivants :
- un récepteur de radiocommande industriel (10) ;
 - un système de télécommande à infrarouge ;
 - un système de télécommande Wifi ;
 - un système de télécommande Bluetooth.
7. Le niveleur de charge autonome selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le générateur d'énergie électrique est l'un des types suivants :
- un générateur électrique (11) ;
 - un générateur solaire ;
 - une éolienne ;
 - des batteries ;
 - des accumulateurs ;
 - une pile à combustible ;
 - une combinaison de ce qui précède.
8. Le niveleur de charge autonome selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le système électrique des composants électriques du niveleur est ignifuge.
9. Le niveleur de charge autonome selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le niveleur utilise des composants étanches pour des travaux subaquatiques.
10. Le niveleur de charge autonome selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'il** comprend un émetteur de télécommande pour actionner à distance et individuellement les quatre treuils ou quatre palans (3).
11. Le niveleur de charge autonome selon la revendication 10, **caractérisé en ce que** l'émetteur de télécommande est un émetteur de radiocommande industriel.

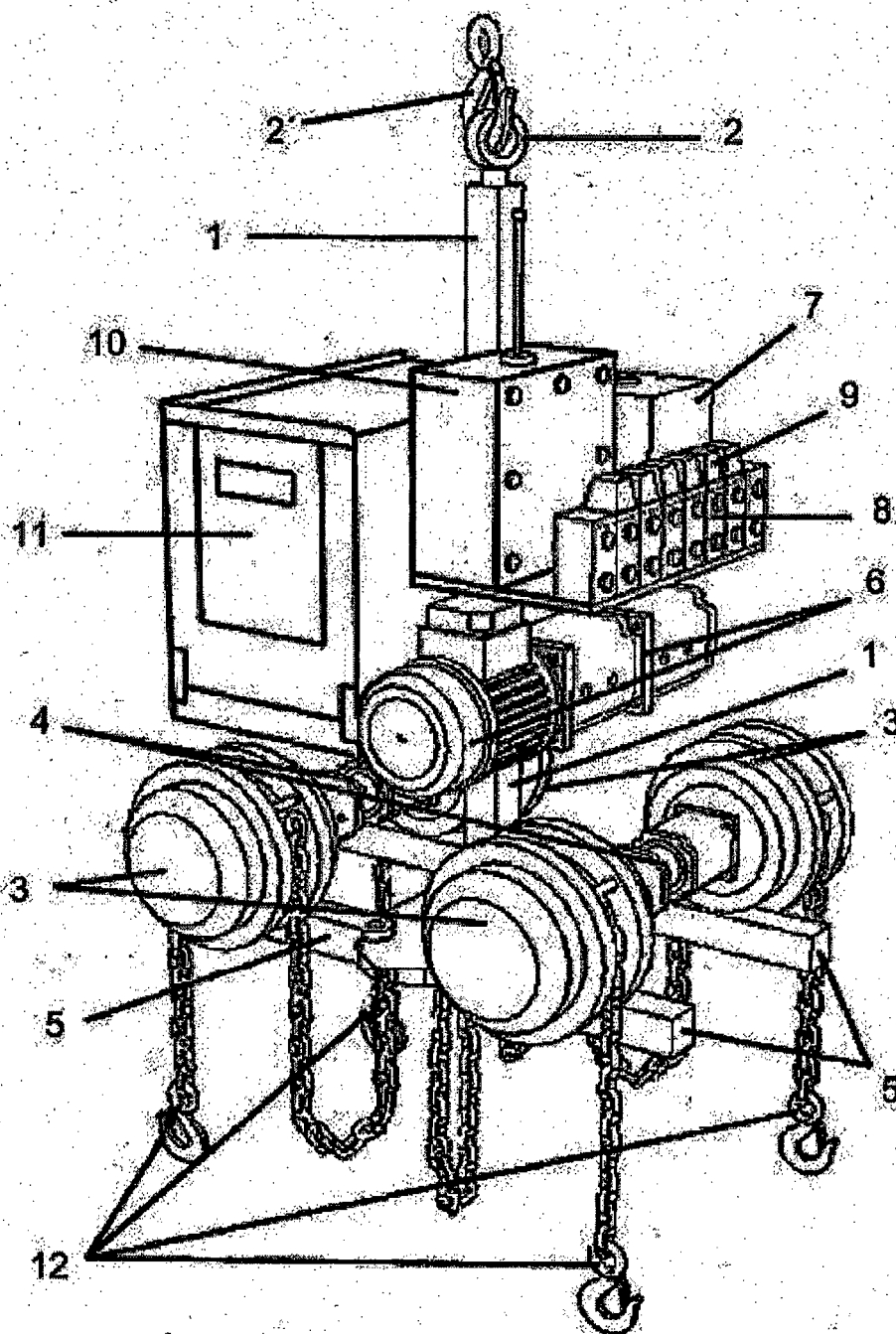


Fig. 1

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- GB 2467149 A [0003]