NEW CRANE

TECHNICAL FIELD

The present disclosure relates to the field of cranes, and particularly relates to a new type of crane.

BACKGROUND ART

A crawler crane is a type of lifting machinery that travels on crawler tracks for lifting and hoisting, and is capable of hoisting, transporting, loading and unloading, installation of materials, and other operations. With the acceleration of urbanization and the rapid development of economy in China, a scale of national infrastructure is increasingly expanding, and weight and lifting height of objects to be hoisted are accordingly increasing. As a result, crawler cranes have demonstrated their superiority and have developed rapidly.

With the continuous development of large-scale construction projects, a single project or construction site often requires a plurality of cranes or crane models to jointly complete a lifting task due to different weights, dimensions, and other parameters of the equipment or objects involved, as well as different lifting heights. However, from the perspective of operational economy, it is usually desirable to minimize a number of equipment deployed on site, maximize equipment utilization, and reduce idle rate. In addition, construction efficiency is a very critical technical indicator in engineering applications. It is usually expected to adopt standard working conditions with higher installation efficiency to minimize the time spent on dismantling and reassembling a super-lifting system. Under standard operating conditions, the loading capacity of a luffing system is limited. Specifically, it is difficult to raise a long arm, which limits a maximum length of a boom of arm and cannot exert maximum lifting capacity of the whole machine. When the problem is solved solely by improving the capacity of components, it would significantly increase R&D cycle and costs, whether for the development of a new product or modification of existing products.

Conventional crawler cranes are usually divided into two types: box-type and lattice structure. A box-type telescopic boom crane has a box-type boom, with a plurality of sets of telescoping boom sections inside, the sections are extended or retracted using hydraulic cylinder or rope guide, and the like, to adjust a boom length, and an amplitude (boom pitch) of the boom is controlled by a luffing cylinder. A lattice structure boom crane a fixed-length mast, the mast, a

pendant and a boom form a fixed-shaped triangle, and the mast is rotated by the luffing system to achieve changes in boom amplitude.

The lattice structure boom crane offers advantages such as great lifting capacities and long boom combination, and is mainly used in occasions with great lifting capacities and high working heights. However, it is troublesome to adjust the arm length, as it requires adding or removing the boom, while the telescopic boom crane can adjust its boom length without additional sections within a certain range, the lifting capacity and height of the telescopic boom crane are relatively small. The two conventional cranes are suitable for different lifting scenarios according to their respective characteristics.

A luffing system of the lattice structure boom crane includes a mast, a luffing winch, a luffing pulley block, and a luffing steel wire rope. For the luffing system, the luffing pulley block is mounted at a tail of turntable, and is connected to a mast head via the luffing steel wire rope. An important indicator of the luffing system is a luffing moment, that is, the luffing moment = luffing force × arm of force (L). Under the same conditions, the larger arm of force is, the smaller the force is required, such that the capacity of a primary luffing system can be properly reduced, which is conducive to reducing overall costs of the whole machine.

Compared with the boom system, the mast and the boom are connected by a pendant or a cable, and the capacity of lifting the boom system = pendant force × arm of force (A). Under the same conditions, the larger arm of force is, the smaller the force is required, such that dimensions and specifications of the pendant can be properly reduced, which is conducive to reducing overall costs of the whole machine.

It can be seen from the above analysis, a larger arm of force results in stronger lifting capacity when external conditions are constant. Therefore, lengthening the mast is an effective solution to increase the lifting capacity, which is also a conventional practice at present, that is, the mast length should be lengthened to increase the lifting capacity.

From the perspective of overall structure of the two types of crane, only one type can be selected according to the actual working conditions due to their different structural characteristics, and it is impossible to meet all the requirements simultaneously. A large project usually requires the two types of crane at the same time, resulting in higher overall operating costs.

From the perspective of specific structural details, the conventional lattice structure boom crane has a fixed-length mast with an integrated structure. At the outset of design, a mast with a certain length is designed according to overall requirements of the whole machine, resulting in the following problems:

1) Restricted by transportation requirements, a length of the mast cannot be infinitely long:

As the crawler crane is designed for large-scale lifting operations, the whole machine has many components and substantial weight. When being transferred to another construction site, the components of the crawler crane need to be disassembled and transported by trailers, and then reassembled after arriving at the another construction site. Due to road transport regulations and requirements, weights and dimensions of the components cannot be infinite, so the mast length cannot be infinitely long.

2) Fixed-length mast requires a great jacking pressure from a jacking cylinder

A super-large crawler crane has a heavy mast structure, especially after being lengthened, a center of gravity thereof will shift toward the mast head, increasing a jacking pressure of the mast for jacking cylinder, making the mast root structure more severely stressed. In addition, an increase of the jacking pressure results in an increase in a diameter of the jacking cylinder, thereby increasing costs of the cylinder and raising higher space requirement for the turntable.

3) Luffing steel wire rope is lengthened, and dimensions and specifications of the luffing winch are larger:

When connecting the boom pendant or cable, the mast is tilted toward the primary boom as low as possible to facilitate the connection. A longer mast will increase a length of the luffing steel wire rope, which in turn increases dimensions of the luffing winch and other components. The longer the luffing steel wire rope is, the more layers it is wound around a luffing drum are, and the greater the risk of rope entanglement becomes.

Therefore, it is necessary to develop a new type of crane in a targeted manner meet different engineering needs. In addition, one product can be used as a lattice structure boom

crane or a telescopic boom crane (box-type) as needed, and can also have the lifting functions of both the lattice structure boom crane and the telescopic boom crane.

SUMMARY

Objective of the present disclosure: in view of the defects in the prior art, the present disclosure provides a new type of crane, which integrates the advantages of lattice structure boom crane and telescopic boom crane (box-type) and can meet different engineering needs. In addition, one product can be used as a lattice structure boom crane or a telescopic boom crane as needed, and can also have the lifting functions of both the lattice structure boom crane and the telescopic boom crane, improving the lifting capacity of the whole machine, that is, arm of force of the boom is increase when raising the boom, a utilization rate of crane is improved, procurement and operating costs are reduced.

Technical solution: the present disclosure provides a new type of crane, including a lattice structure boom and a box-type telescopic boom, where the box-type telescopic boom serves as a mast; a winch system of the crane includes a first hoisting winch, a luffing winch, and a second hoisting winch, after coming out from the first hoisting winch, a steel wire rope runs toward a top of the lattice structure boom and is wound around a primary hook to serve as a primary lifting system; and after coming out from the second hoisting winch, a steel wire rope runs toward a top of the box-type telescopic boom and is wound around an auxiliary hook to serve as an auxiliary lifting system.

Specifically, the box-type telescopic boom includes a base, a base section and telescopic sections, the box-type telescopic boom is connected to a turntable through the base, and the telescopic sections are telescopic relative to the base section.

Specifically, a luffing pulley block and a lifting pulley block are arranged below an upper part of the telescopic sections; and after coming out from the luffing winch, a luffing steel wire rope passes through the luffing pulley block and is wound around a primary luffing pulley block, and an angle of the box-type telescopic boom can be adjusted by retracting and releasing the luffing steel wire rope.

Specifically, after coming out from the second hoisting winch, the steel wire rope passes over a guiding pulley above a head section of the box-type telescopic boom and is wound between the lifting pulley block and the auxiliary hook to serve as the auxiliary lifting system.

Specifically, one end of a luffing cylinder is connected to the base, and the other end thereof is connected to the base section, such that the angle of the box-type telescopic boom can also be adjusted by retracting the luffing cylinder.

Specifically, the turntable is located above a chassis of the crane.

Specifically, the second hoisting winch adopts an original tower jib luffing winch of the crane.

Specifically, an angle between a triangle formed by the box-type telescopic boom, the primary luffing steel wire rope, and the turntable and a triangle formed by the box-type telescopic boom, a pendant and the lattice structure boom can be adjusted by steplessly adjusting a length of the box-type telescopic boom.

Beneficial effect: Compared with the prior art, the present disclosure has the following obvious advantages: the present disclosure combines the advantages of lattice structure boom crane and box-type telescopic boom crane, such that the crane can perform the functions of the two types of crane simultaneously on the whole, and the costs do not increase much. The multiple-purpose crane features high operating efficiency when operating with two hooks at the same time. The whole machine can be adapted and combined according to actual project requirements, such that a utilization rate of user equipment is improved, equipment models to be managed are reduced, maintenance and operation are simplified, and economic efficiency is improved. The mast length can be adjusted steplessly, force acting on the components, especially the primary luffing system and the pendant, is reduced. In addition, it meets the operational requirements of the whole machine for using a long mast for a large arm of force while using a shorter mast for transportation.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagram of a structure of a lattice structure boom crane in the prior art.

FIG. 2 is a schematic diagram of a force system analysis of a lattice structure boom crane in the prior art;

FIG. 3 is a structural schematic diagram of a fixed-length mast in the prior art.

FIG. 4 is a structural schematic diagram of the present disclosure.

FIG. 5 is a structural schematic diagram of a box-type telescopic boom according to the present disclosure.

FIG. 6 is a diagram showing a state of use of the present disclosure as a lattice structure boom crane.

FIG. 7 is a diagram showing a state of use of the present disclosure as a box-type telescopic boom crane.

Reference numerals in the accompanying drawings: 1. chassis, 2. turntable; 3. lattice structure boom; 4. box-type telescopic boom; 5. pendant; 6. first hoisting winch; 7. luffing winch; 8. second hoisting winch; 9. primary luffing pulley block; 10. primary hook; 11. auxiliary hook; 41. base, 42. base section; 43. telescopic section; 44. luffing pulley block; 45. lifting pulley block; 46. guiding pulley; and 47. luffing cylinder.

DETAILED DESCRIPTION OF THE EMBODIMENTS

The technical solution of the present invention will be further described below with reference to the accompanying drawings and specific embodiments.

In the present disclosure, a crawler crane refers to a truck crane, for which a lifting operation portion is installed on a crawler chassis, and travels by means of a crawler device. A lattice structure boom refers to a structural boom composed of rod systems connected by profile sections or combined cross-sectional rod members. A box-type boom refers to a plate-type structural boom with a closed hollow cross-section, formed or connected by plates. A luffing device refers to a mechanism that provides power to enable the boom to complete a hoisting operation at different working angles, or a mechanism that the crawler crane lifts a primary boom to a working position during the installation process. A luffing pulley block refers to a winding luffing steel wire rope that plays the role of luffing. A cable refers to a component that connects the luffing pulley block to a tail of a turntable, and a component that a primary boom head to a mast head. A luffing steel wire rope is wound between the luffing pulley block and a luffing winch mechanism to transmit pulling force from a winch mechanism. A mast refers to a component that is hinged to the turntable, allowing the primary boom to be luffed through the

luffing pulley block at the mast head. A primary boom refers to a component that is hinged to the turntable and configured to support the load lifting and allows luffing.

As shown in FIG. 4, a chassis 1 and a turntable 2 are similar to those of a conventional crawler crane. However, compared with the conventional crane, the present disclosure further includes a lattice structure boom 3 and a box-type telescopic boom 4, composition and functions of the lattice structure boom 3 are the same as those of a conventional crawler crane, and the box-type telescopic boom 4 serves as a mast. A winch system includes a first hoisting winch 6, a luffing winch 7, and a second hoisting winch 8, after coming out from the first hoisting winch 6, a steel wire rope runs toward a top of the lattice structure boom 3 and is wound around a primary hook 10 to serve as a primary lifting system; and after coming out from the second hoisting winch 8, a steel wire rope runs toward a top of the box-type telescopic boom 4 and is wound around an auxiliary hook 11 to serve as an auxiliary lifting system.

The second hoisting winch 8 does not necessarily need to be added; the crane can be provided with a varying number of winches, depending on actual working conditions, and other winches can be used instead, for example, a tower jib luffing winch (working conditions for the tower jib are the conventional working conditions of the lattice structure boom crane) can be used instead.

As shown in FIG. 5, an overall structure of the mast is a box-type telescopic structure, which includes a base section 42, a plurality of telescopic sections 43, and a base 41, and is connected integrally to the turntable 2 though the base 41, where the telescopic sections 43 are telescoped relative to the base section 42 to achieve a purpose of lengthening the mast, a number of and specific telescopic length the telescopic sections 43 are determined according to a specific product, and telescoping principles are the same as those used in a box-type boom of an existing truck crane. A luffing pulley block 44 and a lifting pulley block 45 are arranged below an upper part of the telescopic sections 43; after coming out from the luffing winch 7, a rope passes through the luffing pulley block 44 and is wound around a primary luffing pulley block 9, and a mast angle can be adjusted by retracting and releasing a luffing steel wire rope; in addition, after coming out from the second hoisting winch 8, the steel wire rope passes over a guiding pulley 46 above a head section of the box-type telescopic boom 4 and is wound between the lifting pulley block 45 and the auxiliary hook 11 to serve as the auxiliary lifting system. One end of a luffing cylinder 47 is arranged on the base 41, and the other end thereof is arranged on the base section 42, such that the mast angle can also be adjusted by retracting the luffing cylinder 47.

During operation (including raising the boom), a mast length can be adjusted steplessly according to actual needs to ensure an appropriate angle between a triangle formed by the mast, the primary luffing steel wire rope, and the turntable and a triangle formed by the mast, the pendant and the lattice structure boom, thereby ensuring that component force of the whole machine falls within an optimal range.

When the whole machine is in operation, a form shown in FIG. 4 can be used to realize simultaneous operation of the primary hook and the auxiliary hook. According to the characteristics of the two types of booms, the primary hook is mainly used for lifting a large, heavy and high object, while the auxiliary hook is mainly used for lifting a smaller object, and the primary hook and the auxiliary hook can also be operated separately. FIG. 6 illustrates operation of the primary hook independently, in which case, an operation form is the same as that of a conventional lattice structure boom crane, the auxiliary hook and the rope can be removed, the telescopic sections can be retracted to a minimum length, thereby reducing a slewing radius of the crane. FIG. 7 illustrates operation of the auxiliary hook independently, in which case, an operation form is the same as that of a conventional box-type telescopic boom crane, and the lattice structure boom and other related components can be removed, thereby reducing weight of the whole machine and lowering costs related to usage and transportation.

The present disclosure combines the advantages of lattice structure boom crane and box-type telescopic boom crane, such that the crane has the functions of the two types of crane simultaneously, but costs of the crane do not increase much. The multiple-purpose crane features high operating efficiency when operating with two hooks at the same time. The whole machine can be adapted and combined according to actual project requirements, such that a utilization rate of equipment is improved, equipment models to be managed are reduced, maintenance and operation are simplified, and economic efficiency is improved. The mast length can be adjusted steplessly, force acting on the components, especially the primary luffing system and the pendant, is reduced. In addition, it meets the operational requirements of the whole machine for using a long mast for a large arm of force while using a shorter mast for transportation.

CLAIMS

1. A crane, comprising a lattice structure boom (3) and a box-type telescopic boom (4), wherein the box-type telescopic boom (4) serves as a mast; a winch system of the crane comprises a first hoisting winch (6), a luffing winch (7), and a second hoisting winch (8), and after coming out from the first hoisting winch (6), a steel wire rope runs toward a top of the lattice structure boom (3) and is wound around a primary hook (10) to serve as a primary lifting system; and after coming out from the second hoisting winch (8), a steel wire rope runs toward a top of the box-type telescopic boom (4) and is wound around an auxiliary hook (11) to serve as an auxiliary lifting system.

2. The crane according to claim 1, wherein the box-type telescopic boom (4) comprises a base (41), a base section (42) and telescopic sections (43), the box-type telescopic boom (4) is connected to a turntable (2) through the base (41), and the telescopic sections (43) are telescopic relative to the base section (42).

3. The crane according to claim 2, wherein a luffing pulley block (44) and a lifting pulley block (45) are arranged below an upper part of the telescopic sections (43); and after coming out from the luffing winch (7), a luffing steel wire rope passes through the luffing pulley block (44) and is wound around a primary luffing pulley block (9), and an angle of the box-type telescopic boom (4) is adjusted by retracting and releasing the luffing steel wire rope.

4. The crane according to claim 3, wherein after coming out from the second hoisting winch (8), the steel wire rope passes over a guiding pulley (46) above a head section of the box-type telescopic boom (4) and is wound between the lifting pulley block (45) and the auxiliary hook (11) to serve as the auxiliary lifting system.

5. The crane according to claim 4, wherein one end of a luffing cylinder (47) is connected to the base (41), the other end of the luffing cylinder (47) is connected to the base section (42), and the angle of the box-type telescopic boom (4) is also adjusted by retracting the luffing cylinder (47).

6. The crane according to claim 2, wherein the turntable (2) is located above a chassis (1) of the crane.

7. The crane according to claim 1, wherein the second hoisting winch (8) adopts an original tower jib luffing winch of the crane.

8. The crane according to any one of claims 2-6, wherein an angle between a triangle formed by the box-type telescopic boom (4), a primary luffing steel wire rope, and the turntable (2) and a triangle formed by the box-type telescopic boom (4), a pendant (5) and the lattice structure boom (3) is adjusted by steplessly adjusting a length of the box-type telescopic boom (4).