Mechanical Structure and Working Principle
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Chapter 1 Summary of Crawler Crane

1.1 Summary of Crawler Crane

A crawler crane is a mobile crane that the lifting mechanism is mounted on a crawler chassis, it’s movement depends on the crawler mechanism and is used for material lifting, transporting, loading, unloading and installing, etc.

A crawler crane travels with loads and works with multiple combinations of boom & jib length, excellent lifting performance, high lifting height and large luffing range. Because of these unparalleled advantages, it cannot be replaced by any other hosting machine.
1.2 Applicability

The crawler crane is a key type of engineering crane, and is widely used in the construction of large stadium and other buildings, bridges, metro, shipbuilding, wind power, thermal power and petrochemical industries, etc.
1.3 Advantages

- The unit pressure of ground of crawler is small, and thus the crane is suitable for some bad ground condition.
- Small turning radius
- Large gradeability
- Excellent lifting performance
- Outriggers are unnecessary for lifting operation.
- It can travel with the load.
- Multiple combinations of boom & jib length
- High lifting height and large luffing range
Chapter 2 Structure of Sany Crawler Crane

Series SCC Crawler Crane has a compact structure and reasonably layout of components and parts. It mainly consists of: crawler travelling device, slewing mechanism, upperworks, working device and hook, etc.
Structure and Functions

Working device and hook

Upperworks
Slewing mechanism
Crawler travelling mechanism

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Structure and Functions

2.1 Crawler travelling mechanism

- Chassis
- Outrigger oil cylinder (4 pcs) (Withdrawn after crawler are installed)
- Crawler
- Track shoe
- Drive wheel
- Support roller
- Track roller
- Tensioning mechanism
- Guide wheel

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Crawler travelling mechanism: 4 wheels + 1 crawler + crawler frame + hydraulic travelling system

(1) 4 wheels: guide wheel, track roller, upper guide wheel, drive wheel
- Drive wheel: the track wheel on the track shoe, driven by the hydraulic motor
- Track roller: the roller rolling on the track shoe and supporting the whole crane
- Guide wheel: the wheel symmetrical to the driving wheel but only used for guiding
- Upper guide wheel: (support roller) the wheel supporting the upper track

(2) 1 crawler: crawler
crawler: a group of track shoes linked via track shoe pins and mounted on the crawler frame
(3) Hydraulic travelling system: the hydraulic system driving the travelling motor

- Telescopic oil cylinder: the oil cylinder used for adjusting the distance between the tracks during working and transporting

- Outrigger oil cylinder: the oil cylinder used for supporting the whole crane by the extending outriggers when tracks are not installed
2.2 Slewing mechanism

The slewing mechanism consists of the slewing support, slewing motor, slewing reducer and so on; the slewing support is connected to the base via high-strength bolts, the slewing reducer’s small gear is meshed with the slewing support, and thus the upperworks and working device can be rotating against the lowerworks within 360°.

1-slewing motor; 2-slewing reducer; 3-drive gear of reducer; 4-connecting bolt; 5-slewing support; 6-base

SCC4000 Crawler crane slewing mechanism (external meshing)
Structure and Functions

Slewing motor

Slewing mechanism
2.3 Upperworks

The upperworks mainly consists of the working mechanism, platform, cover assembly, mechanical & power device, hydraulic system, electrical system, cab, air-conditioning system, counterweight system and so on.
2.4 Working mechanism

The working mechanism consists of: main hoist mechanism, auxiliary hoist mechanism, and (main) luffing mechanism; the working mechanism of a crawler crane with an luffing jib (tower condition) further consists of auxiliary luffing mechanism; the working mechanism of a crawler crane with a superlift further consists of luffing mechanism for superlift.
- Small tonnage

- Luffing rope
- Main hoist rope
- Aux. hoist rope
- Aux. lifting hoist
- Main lifting hoist

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• Large ton

- Main lifting rope 1
- Aux. luffing hoist
- Aux. hoisting hoist
- Main lifting hoist 2
- Main lifting hoist 1

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Structure and Functions

Luffing hoist

Main lifting hoist 1

Main lifting hoist 2
2.5 Platform and covering assembly

- Large tonnage
  - main back counterweight
  - slewing mechanism
  - cover
  - platform
  - left platform
  - main platform
  - right platform

- Small tonnage
  - main back counterweight
  - slewing mechanism
  - cover

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2.6 Mechanical & power device, hydraulic system and electrical system

- Mechanical & power device: including the engine body, air inlet system, exhausting system, fuel system, cooling system, transfer case and pump group, etc; the mechanical & power device is the power source of crawler crane.

- Hydraulic system: including the hydraulic hoisting system, hydraulic travelling system, hydraulic slewing system, hydraulic luffing system, hydraulic servo system, hydraulic anti-collapse system, driver’s cab pitching system, hydraulic cooling system, hydraulic superlift counterweight lifting system and the hydraulic subsystems including the auxiliary oil cylinder and self-loading/unloading oil cylinder, etc.

- Electrical system: mainly including the control system, torque limit system and closed-circuit monitor system.
Structure and Functions

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2.7 Driver’s cab and air-conditioning system
**2.8 Counterweight system**

Counterweight system: mainly including the center counterweight, back counterweight and additional counterweight.

- **Back counterweight**: including the counterweight tray, left and right counterweights
- **Additional counterweight**: optional for some models
2.9 Working device

The working device includes the primary working device, auxiliary working device, boom luffing mast, superlift luffing mast, jib fixing mast, jib luffing mast and hooks for different tonnages, etc.
(1) **Boom:** including the boom, jib, extending boom and masts, etc

Boom: it is hinged with the main platform via a pin and can be used for hoisting independently.

Jib: it is hinged with the top of the boom and used for hoisting together with the boom.

Mast: it is used for bearing the press from the wire rope.

Extending boom: it is used for connecting and supporting the pulley block on the top of the primary or auxiliary boom.
### Structure and Functions

- **Top section of the fixed jib**
- **Middle section of the fixed jib**
- **Lower section of the fixed jib**
- **Tie rope of the fixed jib**
- **Mast rod of the fixed jib**

The image illustrates the different sections of the fixed jib, including the tie rope, mast rod, and various sections ranging from 6.1m to 15.25m and 22m to 43m.
- Superlift mast: it cooperates with the tie rope or tie rod to bear the press from the super-hoisted load.
- Primary (auxiliary) luffing mast: it is used to bear the press from the wire rope during luffing of the boom (jib).
- Anti-inclination mast: it is used to prevent the boom from inclining backwards.
- Mast rod: it is used for bearing the wire rope press but is not as large as the mast.

Superlift device: for a small crawler crane, the torque from the counterweight to the collapsing line is balanced by the torque from the load to the collapsing line. If a special device is equipped: the hoisting capacity can be improved by adding a counterweight far away from the collapsing line to balance a larger load torque. This special device is called the superlift device.
Structure and Functions

- superlift mast
- superlift luffing
- winding
- superlift counterweight
- lifting oil cylinder
- superlift counterweight
(2) Tie device: including the tie rope and tie rod, etc

1-luffing jib upper arm; 2-luffing jib middle 6m-12m arm; 3-luffing jib lower arm; 4-luffing jib front mast; 5- luffing jib back mast
(3) Hook
Chapter 3 Working Principle

Load

Counterweight

Counterweight

L1

L2

P

L1

L2

E
The working principle of a crawler crane

The working principle of a crawler crane is lever principle, i.e. torques at both sides of the overturning line are balanced, simply illustrated as below:

Ma-Total of the anti-overturning torques (stabilizing torque)
Mt-Overturning torque

Theoretically, when Ma>Mt, the lifted load will not overturned, i.e. the load can be lifted.
Chapter 4 Major Products of Sany Crawler Crane

- SCC500E
- SCC700
- SCC800C
- SCC1000D
- SCC1250
- SCC1500D
- SCC1800
- SCC2500D
- SCC3200
- SCC3600
- SCC4000C
- SCC6300
- SCC7500
- SCC10000
- SCC16000
- SCC8300
- SCC3000WE
- SCC6500WE
- SCC1000HD
- SQH400

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Chapter 5 Working Conditions

H: boom
H_L: light boom
HD (HDB): boom with superlift mast (and superlift counterweight)
HJ: section varying boom
HJD (HJDB): section varying boom with superlift mast (and superlift counterweight)
FJ: fixed jib
LJ: luffing jib
LJD (LJDB): luffing jib with superlift mast (and superlift counterweight)
SF: fixed short jib
SF_L: light fixed short jib
SF_LD (SF_LDB) light fixed short jib with superlift mast (and superlift counterweight)
SF_H: heavy fixed short jib
SF_HD (SF_HDB): heavy fixed short jib with superlift mast (and superlift counterweight)
Working Conditions

Boom working condition
Mixed boom working condition

**Boom**: basic service condition of a crawler crane

**Features**: the hoisting capacity is large at a small pitch, and will sharply decrease with pitch increasing.

**Section varying boom (mixed boom)**: additional service condition for a large tonnage crane

**Features**: it is suitable for a high hoisting elevation and small load
Boom with extending boom
Boom with superlift device
Mixed boom with superlift device
Luffing jib working condition

- Working condition: special for large tonnage crane
- Features: large pitch, large hoisting capacity at high hoisting elevation

LJ working condition

<table>
<thead>
<tr>
<th>Boom</th>
<th>Luffing jib back mast</th>
<th>Luffing jib front mast</th>
<th>Luffing jib</th>
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Luffing jib with superlift working condition

LJDB working-condition
Fixed jib working condition
Fixed (short) jib with superlift device

Fixed short jib:
Special working condition
Features: it is suitable for small pitch, high hoisting elevation and large load, such as the hoisting and installing of various reactor towers in chemical industry and wind power device, etc.
Chapter 6 Products Features

6.1 High reliability

- The integrated control system based on CAN bus and independently developed by Sany is equipped with the functions of control and monitor, high generality and low fault rate, and is suitable for various bad environmental conditions.

- The hydraulic system independently developed by Sany has advanced performance and delicate design in details.

- Based on the globalized purchase platform, main outsourcing parts of the crawler crane are made by internationally famous manufacturers.
6.2 High adaptability

- Complete types and extensive applicability make Sany crawler cranes satisfy various requirements for hoisting; the small tonnage crawler crane can be optionally equipped with the third winch and free hook lowering for further application.

- Suitable for high temperature, extremely cold, high altitude and strong sand wind conditions.
6.3 Low transportation cost

- Some small tonnage products can be transported by 3m width and 45t single piece weight at maximum; large tonnage products can be transported by separating into single pieces of 50t below.

- The counterweights for similar tonnages can be universally used, and thus the transportation amount for several devices in field working is effectively reduced.

- Some booms can be transported together, and thus the number of transporting trucks is effectively reduced.
6.4 Quick and simple mounting and dismounting

- Time for part matching and installing is reduced by modularized transporting units.

- The primary luffing mast can be operated by only a switch, and thus the mast can be effectively mounted or dismounted, and the safety accident caused by man-made disoperation is avoided. The auxiliary rope winding can be finished by one operator.

- The plug-socket electrical system is design to prevent errors, no field wiring is necessary, the time for wiring is shortened, and errors in field wiring are eliminated.

- Most of the products can be self-mounted or dismounted, and some of the products can be self-mounted or dismounted as a whole set.
6.5 Low service and maintenance cost

- The large volume oil tank reduces the oiling frequency and improves the working efficiency;

- The optimized design of hydraulic, electrical and engine system brings the engine capacity fully into play, it provides the maximum driving power and also reduces the oil consumption effectively;

- The centralized lubricating system, maintenance-free winding and the design of supporting wheel simplify the regular maintenance.

- The cleaning procedures for the installing process of the hydraulic system can effectively reduce the system pollution and the frequency for replacing the hydraulic oil.
6.6 Outstanding performance

- The hosting performance at any working condition can challenge any product of the same level in the market, and the performance at some special conditions is distinctly advantageous.
- Powerful travelling driving and flexible turning
- Stable and fine operating
6.7 Comfortable operating and environmentally-friendly

- Novel and advanced shape, wide visual field; luxury internal decoration, comfortable, large and bright; Convenient control assembly, human-engineering design; comfortable seat, strong adjustability and powerful functions;

- Reasonably distributed air-conditioning system, favorable cooling effect;

- Initially designed and unique door opening mode, convenient for the driver to get in and out;

- Globalized standard for environmental protection: the engine emission is complying with EU-US Non-highway Standard (Tier 3); the noise control is complying with 2000/14/EC outdoor device noise control; and the vibration control is complying with ISO2631 related code;