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(54) METHOD FOR DISPOSING ROCKER ARM ROLLING FRICTION-BASED EXTENDABLE AND RETRACTABLE ROLLING STROKE SECTIONS IN PARALLEL, EXCAVATOR OR LOADER HAVING ROCKER ARM ROLLING STROKE SECTIONS DISPOSED IN PARALLEL

(57) The present invention relates to the field of excavations or loadings, and in particular, to a method for arranging rolling-friction stretching and retraction based rolling stroke sections of a rocker arm in parallel, and an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel. The excavator or loader comprises a rocker arm, a machine body, and a work head, wherein the rocker arm comprises a front roller, a rear roller, a front roller raceway, a rear roller raceway, a telescopic arm, a telescopic support arm, and the like; the front roller raceway and the rear roller raceway are arranged in parallel; the front roller rolls within the front roller raceway; the rear roller rolls within the rear roller raceway; the front roller coordinates with the rear roller to support the telescopic arm to perform the rolling-friction stretching and retraction on the telescopic support arm by means of rolling friction; the work head is connected with the telescopic arm which drives the work head to stretch or retract; and the telescopic support arm is connected with the machine body.

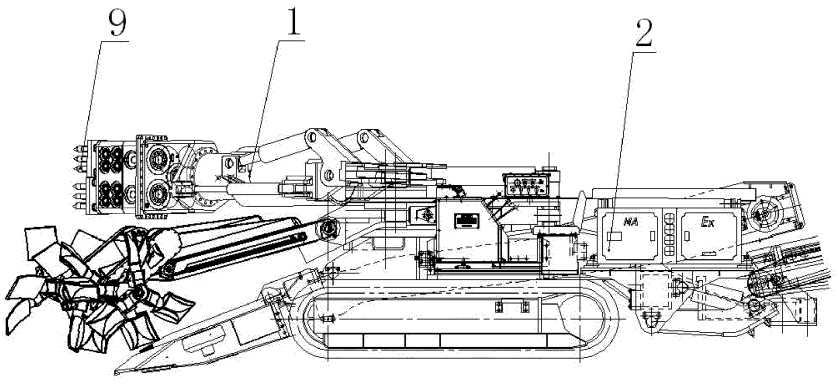

Fig.1

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Description

Technical field

[0001] The present invention relates to the field of excavators or loaders, and in particular, to a method for arranging rolling-friction stretching and retraction based rolling stroke sections of a rocker arm in parallel, and an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel.

Background

[0002] The rocker arms of commonly used equipment such as heading machines or coal mining machines or loading machines, for example, the rocker arms of reciprocating impact heading machines or the rocker arms of reciprocating impact coal mining machines or the rolling harrow support rocker arms of rolling-harrow loading machines, all stretch and retract relative to the machine bodies by means of sliding friction, resulting in high sliding friction resistance and strong twisting force. In order to improve work efficiency and applicability, the work heads of the heading machine, the coal mining machine, the loading machine and the like are designed to have large volume and great weight. The work heads having large volume and great height produce great twisting gravity and serious reciprocating wear onto the telescopic sliding guide rail; moreover, in operation, crawling jitters are easy to occur, and in serious cases, bonding burn may appear in the sliding friction surface. The most critical thing is that the adjustment to the movement fails because it is difficult to form a uniform lubricating oil film on the friction surface thereof to generate heat by friction owing to the particularity of working environment. In order to avoid stretching/retracting and sliding friction faults of the rocker arms, many manufacturers do not use telescopic rocker arms. However, service efficiency and adaptability are seriously reduced by forbidding the rocker arm to stretch or retract relative to the machine body. In some cases, the slide rail is shortened in order to reduce sliding frictional resistance, but this would result in problems such as short rocker arm stretching/retracting distance, small excavation or loading range, bad adaptability, and low operating efficiency, etc. Furthermore, the service efficiency and adaptability will be more seriously reduced if the rocker arm is forbidden to stretch or retract relative to the machine body. In order to solve the above problems, rolling friction is used in the present invention to reduce wear and frictional resistance, and more especially, the rolling stroke sections of the rollers are arranged in parallel. Therefore, the present invention provides a method for arranging rolling-friction stretching and retraction based rolling stroke sections of a rocker arm in parallel, and an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel.

Summary of the invention

[0003] The present invention is realized by adopting the following technical solution: the excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel comprises a rocker arm, a machine body, a work head, etc.; the rocker arm comprises a front roller, a rear roller, a front roller raceway, a rear roller raceway, a telescopic arm, and a telescopic support arm, etc.; the front roller raceway is disposed on the telescopic arm or the telescopic support arm, or the like; the rear roller raceway is disposed on the telescopic support arm or the telescopic arm or the machine body or the like; the front roller is disposed on the telescopic support arm or the telescopic arm or the like; the rear roller is disposed on the telescopic arm or the telescopic support arm or the like; the front roller raceway and the rear roller raceway are arranged in parallel; the front roller rolls within the front roller raceway; the rear roller rolls within the rear roller raceway; the front roller coordinates with the rear roller to support the telescopic arm to perform rolling-friction stretching and retraction on the telescopic support arm by means of rolling friction; the work head is connected with the telescopic arm which drives the work head to stretch and retract; and the telescopic support arm is connected with the machine body.

[0004] The present invention further comprises the following method for arranging rolling-friction stretching and retraction based rolling stroke sections of a rocker arm in parallel, which is specifically as follows.

Method 1:

[0005] Step 1: providing a front roller, a rear roller, a front roller raceway, a rear roller raceway, a telescopic arm, a telescopic support arm, etc.; disposing the front roller raceway on the telescopic arm or the telescopic support arm or the like; disposing the rear roller raceway on the telescopic support arm or the telescopic arm or the machine body or the like; disposing the front roller on the telescopic support arm or the telescopic arm or the like; disposing the rear roller on the telescopic arm or the telescopic support arm or the like; arranging the front roller raceway and the rear roller raceway in parallel; rolling the front roller within the front roller raceway; rolling the rear roller within the rear roller raceway; and coordinating the front roller with the rear roller to support the telescopic arm to perform rolling-friction stretching and retraction on the telescopic support arm by means of rolling friction.

Step 2: providing a work head, and connecting the work head with the telescopic arm so that the telescopic arm drives the work head to stretch and retract.

Step 3: connecting the telescopic support arm with a machine body, and providing a traveling gear on the lower part of the machine body so that the

traveling gear drives the machine body to travel.

Method 2:

[0006] Configuring a front roller as a fixed wheel; configuring a rear roller as a traveling wheel; configuring a front roller raceway as a fixed wheel raceway; configuring a rear roller raceway as a traveling wheel raceway; arranging the fixed wheel raceway and the traveling wheel raceway in parallel; disposing the fixed wheel raceway along the direction of the traveling wheel raceway, and clipping the fixed wheel raceway onto the fixed wheel to partially or completely overlap the travelling wheel raceway and the fixed wheel raceway; and overlapping the fixed wheel and some or all of the rolling stroke sections of the traveling wheel, thereby shortening a length between the fixed wheel raceway and the traveling wheel raceway arranged one behind the other, reducing the length of the rocker arm under the condition of equal stretching and retracting distances, and shortening the force arm of the work head that twists a machine body.

[0007] The work head comprises a rolling harrow, or a reciprocating impact head, or a bucket, or a scraper box, or a cutting drum, or a crushing head, or a combination of a reciprocating impact head and a bucket, or a combination of a rolling harrow and a scraper box, or a combination of a rolling harrow with a reciprocating impact head, or the like.

[0008] The rocker arm comprises a rolling harrow rocker arm, or a reciprocating impact head rocker arm, or an excavation/loading rocker arm, or a combination of a rolling harrow rocker arm and a reciprocating impact head rocker arm, or a combination of a reciprocating impact head rocker arm and a scraper box rocker arm, or the like.

[0009] The front roller comprises a fixed wheel; the rear roller comprises a traveling wheel; the front roller raceway comprises a fixed wheel raceway; the rear roller raceway comprises a traveling wheel raceway; the fixed wheel raceway and the telescopic arm are separately connected or integrated; the traveling wheel raceway and the telescopic support arm are separately connected or integrated; the fixed wheel is disposed on the front end of the telescopic support arm and rolls within the fixed wheel raceway; the traveling wheel rolls within the traveling wheel raceway and is fixed to the back of the telescopic arm; the fixed wheel raceway and the traveling wheel raceway are arranged in parallel; and the fixed wheel overlaps some or all of the rolling stroke sections of the traveling wheel, thereby shortening a length between the fixed wheel raceway and the traveling wheel raceway arranged one behind the other, reducing the length of the rocker arm under equal stretching and retracting distances, reducing the volume height of the rocker arm, and shortening a force arm that damages the machine body through twisting.

[0010] The fixed wheel raceway comprises a fixed wheel groove; the telescopic arm comprises a rolling harrow telescopic arm; the retractable support arm comprises a rolling harrow telescopic support arm; the fixed wheel groove and the rolling harrow telescopic arm are separately connected and integrated; the traveling wheel raceway is disposed on the telescopic support arm; the rear roller comprises a slide opening roller; the traveling wheel raceway comprises a slide opening roller groove; the slide opening roller rolls within the slide opening roller groove and is fixed to the back of the rolling harrow telescopic arm; the fixed wheel groove and the slide opening roller groove are arranged in parallel; when the rolling harrow telescopic arm is lifted up by bulk materials, the fixed wheel groove hoists the fixed wheel to pull up the rolling harrow telescopic support arm; the slide opening roller and fixed wheel support and pull the rolling harrow telescopic arm to stretch/retract and ascend/descend.

[0011] The outer surface of the rear roller is provided with a convex surface or a concave surface; if the outer surface of the rear roller is provided with a concave surface, the rear roller raceway is correspondingly provided with a convex surface clipped to the concave surface of the rear roller to conduct rolling guide for the telescopic arm; and if the outer surface of the rear roller is provided with a convex surface, the rear roller raceway is correspondingly provided with a concave surface clipped to the convex surface of the rear roller to conduct rolling guide for the telescopic arm.

[0012] The front roller and rear roller are arranged between the telescopic arm and telescopic support arm to form a rolling guide device; the rolling guide device comprises a protector for preventing mud, water, dust, or material or the like from entering the rolling guide device. The protector and the fixed wheel roller groove are separately clipped or integrated.

[0013] The front roller rollaway comprises a U-shaped raceway or a square raceway or a circular raceway or a C-shaped raceway or a [-shaped raceway or an H-shaped raceway or the like.

[0014] The rocker arm is hingedly connected with a machine body via a rotary limiting hinge shaft or is connected with the machine body via a rotary structure; a rotation-stopping limiting structure is disposed at the hinge joint and rotary joint of the rocker arm and the machine body; the rotation-stopping limiting structure comprises a rotary limiting platform, a machine body rotation stopping platform, and the like; the rotary limiting platform rotates about the rotary structure or the limiting hinge shaft; when the rotary limiting platform rotates to an angle where the telescopic support arm and the work head are about to be in collision with a shovel plate, the machine body rotation stopping platform is pressed against the rotary limiting platform, so that the machine body rotation stopping platform stops the rotary limiting platform from continuing rotating; the rocker arm is limited to continue descending by limiting the rotation angle thereof, a reasonable safety gap is maintained between each of the rocker arm and the work head and the shovel plate.

[0015] The machine body comprises a shovel plate frame, a machine body frame, a shovel plate controllers,

and the like; the shovel plate frame is hingedly connected with the machine body frame or the shovel plate frame is connected with the machine body frame via a rotary structure; one end of the shovel plate controller is disposed on the machine body frame, and the other end is disposed on the shovel plate frame; the shovel plate controller drives the shovel plate to ascend/descend in the way of unidirectional rotation or multidirectional rotation.

[0016] The machine body and/or the rocker arm comprises a discharging stopping device; the discharging stopping device comprises a plate type discharging device or a fork type discharging device or a brush type discharging device or a tooth-type discharging device, or the like.

[0017] The front roller comprises a pin roller or a waist drum wheel or a multidirectional wheel or the like.

[0018] The rear roller comprises an alloy steel roller or an ordinary steel roller or a polymer roller or a rubber roller or a ceramic roller or the like.

[0019] The shovel plate controller is disposed on the upper part of the machine body; the machine body comprises a shovel plate controller support; one end of the shovel plate controller is hingedly connected to the shovel plate controller support or is connected with the shovel plate controller support via a rotary structure, and the other end is connected with the shovel plate frame; the joint of the shovel plate frame and the machine body frame is disposed on the lower part of the machine body; a distance from the shovel plate controller support on the upper part of the machine body to the force arm at the joint of the shovel plate frame and the machine body frame is greater than a distance, in the event that the shovel plate controller is disposed on the lower part of the machine body, from the shovel plate controller support to the force arm at the joint of the shovel plate frame and the machine body frame; the shovel plate controller drives the shovel plate frame which drives the shovel plate to ascent/descend, thereby reducing power consumption and the number of the shovel plate controllers.

[0020] The rear roller rollaway comprises an anti-swing roller groove; the rear roller comprises an anti-swing roller; the anti-swing roller groove and the machine body are separately or fixedly connected; the anti-swing roller performs linear reciprocating rolling in the anti-swing roller groove to support the rolling-friction stretching and retraction of the telescopic arm; the telescopic arm is limited to swing from side to side by the anti-swing roller.

[0021] The rear roller rollaway comprises an anti-swing roller groove; the front roller rollaway comprises an ascending/descending roller groove; the anti-swing roller groove and the ascending/descending roller groove are arranged separately in parallel or are arranged into one piece; the front roller is an ascending/descending roller; the rear roller is an anti-swing roller; the ascending/descending roller rolls within the ascending/descending roller groove; the anti-swing roller rolls within the anti-swing roller groove; the rocker arm is hingedly connected with the machine body or is connected to the machine body via the rotary structure; the telescopic arm is limited to swing non-directionally from side to side by the anti-swing roller and the telescopic support arm is driven to ascend/descend by the ascending/descending roller, to reduce a height between the anti-swing roller groove and the ascending/descending roller groove arranged one below the other, as well as the volume height of the rocker arm; the ascending/descending roller and/or the ascending/descending roller groove guides the rocker arm.

[0022] The rotation-stopping limiting structure enables the rocker arm to form a tilt angle relative to the ground; the tilt angle enables the work head not to be in collision with the shovel plate; owing to the tilt angle, the rocker arm enables the work head to be lower than the shovel plate when stretching out of the upper part of the shovel plate and to excavate, mill, load or crush materials in the front of the shovel plate.

[0023] The machine body comprises a shovel plate frame; a shovel platform frame limiting gantry is disposed on the shovel plate frame at the lower part of the rocker arm; the shovel platform frame limiting gantry lifts up the telescopic support arm when the rocker and the work head descend to be about to collide with the shovel plate, thereby preventing the rocker arm and the work head from descending to be in collision with the shovel.

[0024] A buffer is disposed on the shovel platform frame limiting gantry; the buffer absorbs the impact caused by the rocker arm during descending.

[0025] The buffer comprises a rubber buffer cushion or a spring buffer cushion or a polyurethane buffer cushion or a nylon buffer cushion or a polymeric material buffer cushion or the like.

[0026] The work head comprises a rolling harrow which comprises harrow teeth, a tooth cylinder, and the like; the length from the tip of each harrow tooth to the center line of the tooth cylinder is greater than the radius of the tooth cylinder.

[0027] The harrow teeth are shovel heads or pick heads or ivory teeth or hammers or axes or hoes or a combination or multiple shapes or the like.

[0028] The rotary structure comprises a ball-head ball-groove type, an arc-shaped catching groove type, a flexible universal joint coupling head, a universal joint bearing coupling head, a universal coupler coupling head, a joint bearing coupling head or a spherical hinge mechanism, or the like.

[0029] The machine body comprises a rotary disk which comprises a rotary inner disk, a rotary outer disk, etc.; the rotary inner disk and the rotary outer disk rotates relatively; when the rotary inner disk is fixed on the machine body, the rotary outer disk rotates relative to the rotary inner disk; when the rotary outer disk is fixed on the machine body, the rotary inner disk rotates relative to the rotary outer disk; one end of the rocker arm is connected to the rotary inner disk under rotation or the rotary outer disk under rotation; the machine body comprises a rotary disk rotation controller which drives the rotary inner disk to rotate or the rotary outer disk to rotate;

one end of the telescopic arm controller is connected with the rotary inner disk under rotation or the rotary outer disk under rotation, and the other end is connected with the telescopic arm; the rocker arm rotates with the rotary disk, to expand the excavation and/or loading range.

[0030] The rocker arm or the machine body comprises a side-to-side movement controller; the telescopic arm comprises a telescopic section and a support work head section; the telescopic section is hingedly connected with the support work head section; a hinge shaped is disposed perpendicularly to the ground; one end of a stretching and retraction controller is connected with the machine body via a rotary structure or is connected with the telescopic support arm, and the other end is connected with the telescopic section; one end of the side-to-side movement controller is connected with the machine body via a rotary structure or is connected with the telescopic support arm or the telescopic section, and the other end is connected with support head section; the side-to-side movement controller drives the support work head section to move from side to side; and the side-to-side movement controller drives the support work head section to move from side to side.

[0031] The rocker arm and/or the machine body comprises a rolling harrow driving device; the rolling harrow comprises harrow teeth, a tooth cylinder, etc.; the rolling harrow driving device comprises an electrical machine or a motor or the like; the electrical machine or motor or the like is disposed inside or outside the tooth cylinder.

[0032] The rolling harrow driving device comprises a transmission which comprises a gear transmission or a belt transmission or a sprocket transmission or a rope sheave transmission or the like.

[0033] The front roller comprises a fixed wheel felly and a fixed wheel shaft; the fixed wheel felly and the fixed wheel shaft are connected separately or integrated.

[0034] The telescopic support arm is hingedly connected with the machine body or is connected with the machine body via a rotary structure or is fixedly connected with the machine body.

[0035] The rotary disk rotation controller comprises a telescopic oil cylinder, or a gear and a rack, or a rope and a rope winder, or a telescopic air cylinder, or a sprocket and a chain, or the like.

[0036] The machine body comprises a rocker arm ascending/descending controller which controls the rocker arm to ascend and descend; the ascending/descending controller comprises an ascending/descending oil cylinder, or a gear and a rack, or a rope and a rope winder, or an ascending/descending air cylinder, or a sprocket and a chain, or the like.

[0037] The rotary disk comprises a multilayer rotary disk which comprise a lower-layer rotary disk, an upper-layer rotary disk, and the like.

[0038] A rolling harrow rocker arm is provided on the lower-layer rotary disk; a reciprocating impact head rocker arm is provided on the upper-layer rotary disk; the lower-layer rotary disk drives the rolling harrow rocker arm to rotate horizontally and/or vertically; the upper-layer rotary disk drives the reciprocating impact head rocker arm to rotate horizontally and/or vertically; the rolling harrow rocker arm coordinates with the reciprocating impact head rocker arm to excavate and load materials in multiple azimuths and angles.

[0039] The present invention has the beneficial effects below:

The present invention provides a method for arranging rolling-friction stretching and retraction based rolling stroke sections of a rocker arm in parallel, and an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel, which have the following advantages:

1. For the rocker arm of an excavator or loader having rolling stroke sections arranged in parallel, the front roller raceway and the rear roller raceway are arranged in parallel; the front roller rolls within the front roller raceway; the rear roller rolls within the rear roller raceway; and the front roller coordinates with the rear roller to support the rocker arm to stretch and retract by means of rolling friction, to improve moving efficiency and flexibility of the rocker arm in adapting to excavating and/or loading various materials, and expand the excavating and/or loading range, thereby enabling the rocker arm to flexibly excavate and/or load materials, etc.
2. The fixed wheel raceway and the traveling wheel raceway are arranged in parallel; and the fixed wheel overlaps some or all of the rolling stroke sections of the traveling wheel, to shorten the length between the fixed wheel raceway and the traveling wheel raceway arranged one behind the other, reduce the length of the rocker arm under equal stretching and retracting distances, decrease the volume height of the rocker arm, and shorten a force arm that damages the machine body through twisting, thereby reducing the use of raw materials, and making the whole machine more reasonable and compact in design and more safe, reliable and flexible in operation.
3. The slide opening roller rolls within a slide opening roller groove; the slide opening roller is fixed to the back of the rolling harrow telescopic arm; the fixed wheel groove and the slide opening roller groove are arranged in parallel; when the rolling harrow telescopic arm is lifted up by bulk materials, the fixed wheel groove hoists the fixed wheel to pull up the rolling harrow telescopic support arm; the slide opening roller and the fixed wheel support and pull the rolling harrow telescopic arm to stretch/retract and ascend/descend.
4. The outer surface of the front roller is provided

with a concave surface or a convex surface; if the outer surface of the front roller is provided with a concave surface, the front roller raceway is correspondingly provided with a convex surface clipped to the concave surface of the front roller to conduct rolling guide for the telescopic arm; if the outer surface of the front roller is provided with a convex surface, the front roller raceway is correspondingly provided with a concave surface clipped to the convex surface of the front roller to conduct rolling guide for the telescopic arm; the outer surface of the rear roller is provided with a concave surface or a convex surface; if the outer surface of the rear roller is provided with a convex surface, the rear roller raceway is correspondingly provided with a convex surface clipped to the concave surface of the rear roller to conduct rolling guide for the telescopic arm; if the outer surface of the rear roller is provided with a convex surface, the rear roller raceway is correspondingly provided with a concave surface clipped to the convex surface of the rear roller to conduct rolling guide for the telescopic arm, so that the rollers roll within corresponding raceways, thereby effectively limiting the rolling directions of the rollers, and controlling the stretching/retracting direction of the telescopic arm.

5. The rocker arm is hingedly connected with a machine body via a rotary limiting hinge shaft or is connected with the machine body via a rotary structure; a rotation-stopping limiting structure is disposed at the hinge joint and a rotary joint of the rocker arm and the machine body; the rotary limiting platform rotates about the rotary structure or rotates about the limiting hinge shaft; when the rotary limiting platform rotates to an angle where the telescopic support arm and the work head are about to be in collision with a shovel plate, the machine body rotation stopping platform is pressed against the rotary limiting platform, so that the machine body rotation stopping platform stops the rotary limiting platform from continuing rotating; the rocker arm is limited to continue descending by limiting the rotation angle thereof, a reasonable safety gap is maintained between each of the rocker arm and the work head and the shovel plate.

6. When the rocker arm stretches out of a position to separate the work head from the upper part of the shovel plate, the rear-end raceway of the front roller raceway rotates about the front roller to enable the work head to be lower than the shovel plate for excavation and/or loading.

7. The shovel plate frame is hingedly connected with the machine body frame or the shovel plate frame is connected with the machine body frame via a rotary structure; one end of a shovel plate controller is disposed on the machine body frame, and the other end is disposed on the shovel plate frame; the shovel plate controller drives the shovel plate to ascend/descend in the way of unidirectional rotation or multidirectional rotation, thereby further improving the applicability of the excavator or loader to excavate and/or load materials at differing heights.

8. The shovel plate controller drives the shovel plate connected with the shovel plate frame to move up and down and/or move from side to side; the shovel plate frame drives the rocker arm to move up and down and/or move from side to side synchronously with the shovel plate, thereby preventing the shovel plate from being locked or in collision with the rocker arm and the work head when the movements of the shovel plate or the rocker arm and the work head are controlled respectively.

9. The discharge stopping device avoids the fault that the rolling harrow throws the materials to the machine body and the console and the like when harrowing the materials quickly.

10. One end of the shovel plate controller is hingedly connected to the shovel plate controller support or is connected with the shovel plate controller support via the rotary structure, and the other end is connected with the shovel plate frame; the joint of the shovel plate frame and the machine body frame is disposed on the lower part of the machine body; a distance from the shovel plate controller support on the upper part of the machine body to the force arm at the joint of the shovel plate frame and the machine body frame is greater than a distance, in the event that the shovel plate controller is disposed on the lower part of the machine body, from the shovel plate controller support to the force arm at the joint of the shovel plate frame and the machine body frame, so that the force arm that pulls the shovel plate to ascend and descend is lengthened; the shovel plate controller drives the shovel plate frame which drives the shovel plate to ascent/descend, thereby reducing power consumption and the number of the shovel plate controllers.

11. The anti-swing roller groove and the machine body are separately or fixedly connected; the anti-swing roller on the telescopic arm is clipped to the anti-swing roller groove to roll therein; the anti-swing roller performs linear reciprocating rolling in the anti-swing roller groove to support the rolling-friction stretching and retraction of the telescopic arm; the telescopic arm is limited to swing from side to side by the anti-swing roller, so that the telescopic arm ascends and descends more stably.

12. The ascending/descending roller groove is

clipped to the anti-swing roller groove; the ascending/descending roller rolls within the ascending/descending roller groove; the anti-swing roller rolls within the anti-swing roller groove; the rocker arm is hingedly connected with the machine body or is connected with the machine body via the rotary structure; the telescopic arm is limited to swing non-directionally from side to side by the anti-swing roller and the telescopic support arm is driven to ascend/descend by the ascending/descending roller, to reduce a height between the anti-swing roller groove and the ascending/descending roller groove arranged one below the other, as well as the volume height of the rocker arm; the anti-swing roller also drives the rocker arm to ascend/descend; the ascending/descending roller groove and/or the anti-swing roller groove guides the rocker arm; and the ascending/descending roller coordinates with the anti-swing roller, thereby enhancing the control over the rolling and stretching/retraction of the rocker arm.

13. The rotation-stopping limiting structure enables the rocker arm to form an tilt angle relative to the ground; the tilt angle enables the work head not to be in collision with the shovel plate; owing to the tilt angle, the rocker arm enables the work head to be lower than the shovel plate when stretching out of the upper part of the shovel plate and to excavate, mill, load or crush the materials in the front of the shovel plate.

14. A shovel plate frame limiting gantry is disposed on the shovel plate frame at the lower part of the rocker arm; the shovel platform frame limiting gantry lifts up the telescopic support arm when the rocker and the work head descend to be about to collide with the shovel plate, thereby preventing the rocker arm and the work head from descending to be in collision with the shovel.

15. The shovel plate frame limiting gantry is provided with a buffer, etc.; the buffer absorbs the impact caused by the rocker arm during descending, thereby decreasing the impact damage caused by the descending of the rocker arm to the shovel plate frame limiting gantry, etc., thereby reducing impact noise and improving work environment.

16. The length from the tip of each harrow tooth to the center line of the tooth cylinder is greater than the radius of the tooth cylinder, so that the harrow teeth are easier to harrow and shift materials.

17. The harrow teeth are like shovel heads, etc., thereby bringing benefit to harrowing the materials of different grain sizes into a conveying device, and improving the capability of the rolling harrow for harrowing and shifting scattered materials.

18. One end of a telescopic arm controller is connected with the rotary inner disk under rotation or the rotary outer disk under rotation, and the other end is connected with the telescopic arm; and the rocker arm rotates along with the rotary disk, thereby expanding the excavating and/or loading range, and increasing the material excavating, harrowing and loading efficiency.

19. The telescopic section is hingedly connected with the support work head section; the hinge shaft is disposed perpendicularly to the ground; one end of the stretching and retraction controller is connected with the machine body via a rotary structure or is connected with the telescopic support arm, and the other end is connected with the telescopic section; one end of the side-to-side movement controller is connected with the machine body via a rotary structure or is connected with the telescopic support arm or is connected with the telescopic section, and the other end is connected with the support work head section; the side-to-side movement controller drives the support work head section to move left and right, and the side-to-side movement controller drives the support work head section to move from side to side.

20. An electrical machine or motor is disposed in the tooth cylinder, so that the roller harrow has a simple and compact structure, thereby bringing benefit to protecting the electrical machine or motor with the tooth cylinder.

21. The fixed wheel felly and the fixed wheel shaft are an integrated structure having larger strength and less maintenance.

22. The combination of a rolling harrow rocker arm and a reciprocating impact head rocker arm or the combination of a reciprocating impact head rocker arm and a scraper box rocker arm has a higher working efficiency than the rolling harrow rocker arm or the reciprocating impact head rocker arm or an excavation/loading rocker arm used alone.

23. The rotary disk is configured as a multilayer rotary disk which comprises a lower-layer rotary disk, an upper-layer rotary disk; the rolling harrow rocker arm is disposed on the lower-layer rotary disk; the reciprocating impact head rocker arm is disposed on the upper-layer rotary disk; the lower-layer rotary disk drives the rolling harrow rocker arm to rotate vertically and/or horizontally; the upper-layer rotary disk drives the reciprocating impact head rocker arm to rotate vertically and/or horizontally; and the rolling harrow rocker arm coordinates with the reciprocating impact head rocker arm excavation/loading

to excavate and load materials in multiple azimuths and angles; the work heads on the multilayer rotary disk work simultaneously to significantly improve the working efficiency of the apparatus in comprehensive operations.

24. The front roller and the rear roller are arranged between the telescopic arm and the telescopic support arm to form a rolling guide device which is provided with a protector; the protector prevents mud, water, dust or material, or the like from entering the rolling guide device, such that the rolling guide device operates more reliably and stably.

Brief Description of the Drawings

[0040]

FIG. 1 is a structural schematic diagram of an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel in embodiment 1;
FIG. 2 is a structural schematic diagram of an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel in embodiment 1;
FIG. 3 is a structural schematic diagram of a rocker arm of an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel in embodiment 1;
FIG. 4 is a front view of a reciprocating impact head of an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel in embodiment 2;
FIG. 5 is a front view of a rolling harrow of an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel in embodiment 2;
FIG. 6 is a structural schematic diagram of a rocker arm of an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel in embodiment 3;
FIG. 7 is a structural schematic diagram of a rocker arm of an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel in embodiment 3.
FIG. 8 is a structural schematic diagram of an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel in embodiment 4.
FIG. 9 is a sectional view of A-A in FIG. 8 in embodiment 4;
FIG. 10 is another structural schematic diagram of an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel in embodiment 5.
FIG. 11 is a sectional view of B-B in FIG. 10 in embodiment 5;
FIG. 12 is a structural schematic diagram of an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel in embodiment 6;
FIG. 13 is a sectional view of A-A in FIG 12 in embodiment 6;
FIG. 14 is a front view of an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel in embodiment 7;
FIG. 15 is a front view of an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel in embodiment 8;
FIG. 16 is a schematic diagram of a discharge stopper of an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel in embodiment 9;
FIG. 17 is a front view of an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel in embodiment 10;
FIG. 18 is a structure diagram of an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel in embodiment 11;
FIG. 19 is a structural schematic diagram of an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel in embodiment 12.
FIG. 20 is a schematic view of a shovel plate frame limiting gantry of an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel in embodiment 13.
FIG. 21 a schematic view of a rolling harrow of an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel in embodiment 14.
FIG. 22 is another schematic view of a rolling harrow of an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel in embodiment 14.
FIG. 23 is a structural schematic diagram of a rotary disk of an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel in embodiment 15.
FIG. 24 is a structural schematic diagram of a rotary disk of an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel in embodiment 15.
FIG. 25 is a structural schematic diagram of an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel in embodiment 16.
FIG. 26 is a schematic view of a multilayer rotary disk of an excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel in embodiment 17.

[0041] In the figures: 1, rocker arm; 2, machine body; 3, front roller; 4, rear roller; 5, front roller rollaway; 6, rear roller rollaway; 7, telescopic arm; 8, telescopic support arm; 9, work head; 10, reciprocating impact head; 11, rolling harrow; 12, rolling harrow rocker arm; 13, reciprocating impact head rocker arm; 14, excavation/loading rocker arm; 15, fixed wheel; 16, traveling wheel; 17, fixed

wheel raceway; 18, traveling wheel raceway; 19, fixed wheel groove; 20, rolling harrow telescopic arm; 21, rolling harrow telescopic support arm; 22, slide opening roller; 23, slide opening roller groove; 24, concave surface; 25, convex surface; 26, rolling guide device; 27, protector; 28, fixed wheel felly; 29, fixed wheel shaft; 30, limiting hinge shaft; 31, rotation-stopping limiting structure; 32, rotary limiting platform; 33, machine body rotation stopping platform; 34, shovel plate; 35, rotary structure; 36, shovel plate frame; 37, machine body frame; 38, shovel plate controller; 39, discharging device; 40, shovel plate controller support; 41, anti-swing roller groove; 42, anti-swing roller; 43, ascending/descending roller groove; 44, ascending/descending roller; 45, shovel plate frame limiting gantry; 46, buffer; 47, harrow tooth; 48, tooth cylinder; 49, rolling harrow driving device; 50, transmission; 51, rotary disk; 52, rotary inner disk; 53, rotary outer disk; 54, rotary disk rotation controller; 55" telescopic arm controller; 56, telescopic section; 57, support work head section; 58, stretching/retraction controller; 59, hinge shaft; 60, side-to-side movement controller; 61, ascending/descending controller; 62, multilayer rotary disk; 63, lower-layer rotary disk; 64, upper-layer rotary disk; 65, hammer; 66, pick.

[0042] The present invention is further described below with reference to the accompanying drawings.

Embodiment 1

[0043] An excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel, as shown in FIGs. 1-3, is characterized in that: the excavator or loader having rolling stroke sections arranged in parallel comprises a rocker arm 1, a machine body 2, a work head 9, etc.; the rocker arm 1 is mainly composed of a front roller 3, a rear roller 4, a front roller rollaway 5, a rear roller rollaway 6, a telescopic arm 7, a telescopic support arm 8, etc.; the front roller rollaway 5 is disposed on the telescopic arm 7; the rear roller rollaway 6 is disposed on the telescopic support arm 8; the front roller 3 is disposed on the telescopic support arm 8; the rear roller 4 is disposed on the telescopic arm 7; the front roller rollaway 5 and the rear roller rollaway 6 are arranged in parallel; the front roller 3 rolls in the front roller rollaway 5, and the rear roller 4 rolls in the rear roller rollaway 6; the front roller 3 coordinates with the rear roller 4 to support the telescopic arm 7 to perform rolling-friction stretching and retraction on the telescopic support arm 8 by means of rolling friction; the work head 9 is connected with the telescopic arm 7, so that the telescopic arm 7 drives the work head 9 to stretch and retract; the telescopic support arm 8 is connected with the machine body 2; a traveling device on the lower part of the machine body drives the rocker arm and the work head to operate continuously.

[0044] The front roller rollaway 5 may also be disposed on the telescopic support arm 8, etc.

[0045] The rear roller rollaway 6 may also be disposed on the telescopic arm 7 or the machine body 2 or the like.

[0046] The front roller 3 may also be disposed on the telescopic arm 7, etc.

[0047] The rear roller 4 may also be disposed on the telescopic support arm 8, etc.

[0048] The front roller 3 comprises a pin roller or a waist drum wheel or a multidirectional roller or the like.

[0049] The rear roller 4 is made of steel alloy or ordinary steel or high polymer material or rubber or ceramic or the like.

[0050] The telescopic support arm 8 is hingedly connected with the machine body 2 or is connected with the machine body 2 via a rotary structure or is fixedly connected with the machine body 2.

[0051] The front roller rollaway 5 a U-shaped raceway or a square raceway or a circular raceway or a C-shaped raceway or [-shaped raceway or an H-shaped raceway or the like.

[0052] The present invention provides a method for arranging rolling stroke sections of a rocker arm in parallel, which is specifically as follows:

Method 1:

[0053]

Step 1: providing a front roller 3, a rear roller 4, a front roller raceway 5, a rear roller raceway 6, a telescopic arm 7, a telescopic support arm 8, etc.; disposing the front roller raceway 5 on the telescopic arm 7 or the telescopic support arm 8; disposing the rear roller raceway 6 on the telescopic support arm 8 or the telescopic arm 7 or the machine body 2; disposing the front roller 3 on the telescopic support arm 8 or the telescopic arm 7; disposing the rear roller 4 on the telescopic arm 7 or the telescopic support arm 8; arranging the front roller raceway 5 and the rear roller raceway 6 in parallel; rolling the front roller 3 within the front roller raceway 5; rolling the rear roller 4 within the rear roller raceway 6; and coordinating the front roller 3 with the rear roller 4 to support the telescopic arm 7 to perform rolling-friction stretching and retraction on the telescopic support arm 8 by means of rolling friction.

Step 2: providing a work head 9, and connecting the work head 9 with the telescopic arm 7, so that the telescopic arm 7 drives the work head 9 to stretch and retract.

Step 3: connecting the telescopic support arm 8 with the machine body 2, and disposing a traveling device on the lower part of the machine body 2 so that the traveling device drive the machine body 2 to travel.

Method 2:

[0054] Configuring a front roller 3 as a fixed wheel 15; configuring a rear roller 4 as a traveling wheel 16; configuring a front roller raceway 5 as a fixed wheel raceway

17; configuring a rear roller raceway 6 as a traveling wheel raceway 17 that is arranged in parallel with the traveling wheel raceway 18; disposing the fixed wheel raceway 17 along the direction of the traveling wheel raceway 18, and clipping the fixed wheel raceway 17 onto the fixed wheel 15 to partially or completely overlap the travelling wheel raceway and the fixed wheel raceway; and overlapping the fixed wheel 15 and some or all of the rolling stroke sections of the traveling wheel 16, thereby shortening the length between the fixed wheel raceway 17 and the traveling wheel raceway 18 arranged one behind the other, reducing the length of the rocker arm 1 under the condition of equal stretching and retracting distances, and shortening the force arm of the work head 9 that twists a machine body 2.

[0055] The others are the same as those in method 1.

Embodiment 2

[0056] As shown in FIG. 4 and FIG. 5, the excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel shown in embodiment 2 is different from that in embodiment 1 in that: the work head 9 comprises a rolling harrow 11, or a reciprocating impact head 10, or a bucket, or a scraper box, or a cutting drum, or a crushing head, or a combination of the reciprocating impact head 10 and the bucket, or a combination of the rolling harrow 11 and the scraper box, or a combination of the rolling harrow 11 and the reciprocating impact head 10, or the like.

[0057] The others are the same as those in embodiment 1.

Embodiment 3

[0058] As shown in FIG. 6 and FIG. 7, the excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel shown in embodiment 3 is different from that in embodiment 1 in that: the rocker arm 1 comprises a rolling harrow rocker arm 12, or a reciprocating impact head rocker arm 13, or an excavating/loading rocker arm 14, or a combination of the rolling harrow rocker arm 12 and the reciprocating impact head rocker arm 12, or a combination of the reciprocating impact head rocker arm 13 and the scraper box rocker arm, or the like.

[0059] The others are the same as those in embodiment 1.

Embodiment 4

[0060] As shown in FIG. 8 and FIG. 9, the excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel shown in embodiment 4 is different from that in embodiment 1 in that the front roller 3 comprises a fixed wheel 15; the rear roller 4 comprises a traveling wheel 16; the front roller raceway 5 comprises a fixed wheel raceway 17; the rear roller raceway 6 comprises a traveling wheel raceway 18; the fixed wheel raceway 17 is separately connected with a telescopic arm 7; the traveling wheel raceway 18 is separately connected with a telescopic support arm 8; the front end of the telescopic support arm 8 is provided with the fixed wheel 15 that rolls within the fixed wheel raceway 17; the traveling wheel 16 rolls within the roll wheel raceway 18 and is fixed to the back of the telescopic arm 7; the fixed wheel raceway 17 is arranged in parallel with the traveling wheel raceway 18; the fixed wheel 15 overlaps some or all of the rolling stroke sections of the roll wheel 16, thereby shortening the length between the fixed wheel raceway 17 and the traveling wheel raceway 18 arranged on behind the other, decreasing the length of the rocker arm 1 under equal stretching and retracting distances, reducing the volume height of the rocker arm 1, and shortening the force that twists and damages the machine body 2.

[0061] The fixed wheel raceway 17 and the telescopic arm 7 may also be integrated.

[0062] The traveling wheel raceway 18 and the telescopic support arm 8 may also be integrated.

[0063] The others are the same as those in embodiment 1.

Embodiment 5

[0064] As shown in FIGs. 10 and 11, the excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel shown in embodiment 5 is different from that embodiment 1 in that: the fixed wheel raceway 17 comprises a fixed wheel groove 19; the telescopic arm 7 comprises a rolling harrow telescopic arm 20; the telescopic support arm 8 comprises a rolling harrow telescopic support arm 21; the fixed wheel groove 19 is separately connected with the rolling harrow telescopic arm 20; a traveling wheel raceway 18 is provided on the telescopic support arm 8; the rear roller 4 comprises a slide opening roller 22; the traveling wheel raceway 18 comprises a slide opening roller groove 23; the slide opening roller 22 rolls within the slide opening roller groove 23; the slide opening roller 22 is fixed to the back of the rolling harrow telescopic arm 20; the fixed wheel groove 19 is arranged in parallel with the slide opening roller groove 23; when the rolling harrow telescopic arm 20 is lifted up by bulk materials, the fixed wheel groove 19 hoists the fixed wheel 15 to pull up the rolling harrow telescopic support arm 21; the slide opening roller 22 and the fixed wheel 15 support and pull the rolling harrow telescopic arm 20 to stretch/retract and ascend/descend.

[0065] The outer surface of the rear roller 4 is provided with a concave surface 24 and a convex surface 25; if the outer surface of the rear roller 4 is provided with a concave surface 24, the rear roller raceway 6 is correspondingly provided with a convex surface 25 clipped to the concave surface 24 of the rear roller 4 to conduct rolling guide for the telescopic arm 7; if the outer surface 25 of the rear roller 4 is provided with a convex surface 25, the rear roller raceway 6 is correspondingly provided

with a concave surface 24 clipped to the convex surface 25 of the rear roller 4 to conduct rolling guide for the telescopic arm 7.

[0066] The fixed wheel groove 19 and the rolling harrow telescopic arm 20 may also be integrated.

[0067] The others are the same as those in embodiment 1.

Embodiment 6

[0068] As shown in FIG. 12 and FIG. 13, the excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel shown in embodiment 6 is different from that in embodiment 1 in that: the front roller 3 and the rear roller 4 are disposed between the telescopic arm 7 and the telescopic support arm 8 to form a rolling guide device 26 which comprises a protector 27 for preventing mud, water, dust or materials or the like from entering the rolling guide device 26.

[0069] The front roller 3 comprises a fixed wheel felly 28 and a fixed wheel shaft 29; the fixed wheel felly 28 and the fixed wheel shaft 29 are separately connected.

[0070] The fixed wheel felly 28 and the fixed wheel shaft 29 may also be integrated.

[0071] The others are the same as those in embodiment 1.

Embodiment 7

[0072] As shown in FIG. 14, The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel shown in embodiment 7 differs from that in embodiment 1 in that: the rocker arm 1 is hingedly connected with the machine body 2 via a rotary limiting hinge shaft 30, a rotation-stopping limiting structure 31 is disposed at the hinge joint or rotary joint of the rocker arm and the machine body; the rotation-stopping limiting structure 31 comprises a rotary limiting platform 32, a machine body rotation stopping platform 33 and the like; the rotary limiting platform 32 rotates about the limiting hinge shaft 30; when the rotary limiting platform 32 rotates to an angle where the telescopic support arm 8 and the work head 9 are about to be in collision with a shovel plate 34, the machine body rotation stopping platform 33 is pressed against the rotary limiting platform 32 so that the machine body rotation stopping platform 33 stops the rotary limiting platform 32 from continuing rotating; the rocker arm 1 is limited to continue descending by limiting the rotation angle thereof, a reasonable safety gap is maintained between each of the rocker arm 1 and the work head 9 and the shovel plate 34.

[0073] The rotation-stopping limiting structure 31 enables the rocker arm 1 to form an tilt angle relative to the ground; the tilt angle enables the work head 9 not to be in collision with shovel plate 34; owing to the tilt angle, the rocker arm 1 enables the work head 9 to be lower than the shovel plate 34 when stretching out of the upper part of the shovel plate 34 and to excavate, mill, load or crush the materials in the front of the shovel plate 34.

[0074] The others are the same as those in embodiment 1.

Embodiment 8

[0075] As shown in FIG. 15, the excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel shown in embodiment 8 differs from that in embodiment 1 in that: the machine body 2 comprises a shovel plate frame 36, a machine body frame 37, a shovel plate controller 38 and the like; the shovel plate frame 36 is hingedly connected with the machine body frame 37; one end of the shovel plate controller 38 is disposed on the machine body frame 37 while the other end is disposed on the shovel plate frame 36; the shovel plate controller 38 drives the shovel plate 34 to ascend/descend in the way of unidirectional rotation or multidirectional rotation.

[0076] The others are the same as those in embodiment 1.

Embodiment 9

[0077] As shown in FIG. 16, the excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel shown in example 9 differs from that in embodiment 1 in that: the machine body 2 and /or the rocker arm 1 comprises a discharge stopper 39; and the discharge stopper 39 comprises a plate type discharging device 39 or a fork type discharging device 39 or a brush type discharging device 39 or a tooth type discharging device 39 or the like.

[0078] The others are the same as those in embodiment 1.

Embodiment 10

[0079] As shown in FIG. 17, the excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel shown in embodiment 10 differs from that in embodiment 1 in that: the shovel plate controller 38 is disposed on the upper part of the machine body 2 which is provided with a shovel plate controller support 40; one end of the shovel plate controller 38 is hingedly connected to the shovel plate controller support 40, and the other end is connected with the shovel plate frame 36; the joint of the shovel plate frame 36 and the machine body frame 37 is disposed on the lower part of the machine body 2; ta distance from the shovel plate controller support 40 on the upper part of the machine body 2 to the force arm at the joint of the shovel plate frame 36 and the machine body frame 37 is greater than a distance, in the event that the shovel plate controller is disposed on the lower part of the machine body, from the shovel plate controller support to the force arm at the joint of the shovel plate frame and the machine body frame; the shovel plate controller 38 drives the shovel plate frame 36; and the

shovel plate frame 36 drives the shovel plate 34 to ascent/descend, thereby reducing power consumption and the number of the shovel plate controllers 38.

[0080] One end of said shovel plate controller 38 may also be connected to blade controller support 40 via a rotary structure.

[0081] The others are the same as those in embodiment 1.

Embodiment 11

[0082] As shown in FIG. 18, the excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel shown in embodiment 11 differs from that in embodiment 1 in that: said rear roller raceway 6 comprises an anti-swing roller groove 41; the rear roller 4 comprises an anti-swing roller 42; the anti-swing roller groove 41 is separately connected to the machine body 2; the anti-swing roller 42 performs linear reciprocating rolling in the anti-swing roller groove 41 to support the rolling-friction stretching and retraction of the telescopic arm 7; the telescopic arm 7 is limited to swing from side to side by the anti-swing roller 42.

[0083] Said anti-swing roller groove 41 may also be fixedly connected with machine body 2.

[0084] The others are the same as those in embodiment 1.

Embodiment 12

[0085] As shown in FIG. 19, the excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel shown in embodiment 12 differs from that in embodiment 1 in that: the rear roller raceway 6 comprises an anti-swing roller groove 41; the front roller raceway 5 comprises a ascending/descending roller groove 43; the anti-swing roller groove 41 and the ascending/descending roller groove 43 are arranged into one piece; the front roller 3 is an ascending/descending roller 44; the rear roller 4 is an anti-swing roller 42; the ascending/descending roller 44 rolls within the ascending/descending roller groove 43; the anti-swing roller 42 rolls within the anti-swing roller groove 41; the rocker arm 1 is hingedly connected with the machine body 2 or the rocker arm 1 is connected to the machine body 2 via a rotary structure 35; the telescopic arm 7 is limited to swing non-directionally from side to side by the anti-swing roller 42 and the telescopic support arm 8 is driven to ascend/descend by the ascending/descending roller 44, to reduce a height between the anti-swing roller groove 41 and the ascending/descending roller groove 43 arranged one below the other, as well as the volume height of the rocker arm 1; the ascending/descending roller 43 and/or the anti-swing roller 41 guides the rocker arm 1.

[0086] The anti-swing roller groove 41 and the ascending/descending roller groove 43 may also be separately arranged in parallel.

[0087] The others are the same as those in embodiment 1.

Embodiment 13

[0088] As shown in FIG. 20, the excavator or loader comprising a rocker arm having roller stroke sections arranged in parallel shown in embodiment 13 differs from that in embodiment 1 in that: the machine body 2 comprises a shovel plate frame 36; a shovel plate frame limiting gantry 45 is disposed on the shovel plate frame 36 on the lower part of the rocker arm 1; the shovel plate frame limiting gantry 45 lifts up the telescopic support arm 8 when the rocker arm 1 and the work head 9 descend to be about to collide with the shovel plate 34, thereby preventing the rocker arm 1 and the work head 9 from descending to be in collision with the shovel plate 34.

[0089] The shovel plate frame limiting gantry 45 is provided thereon with a buffer 46 which absorbs the impact caused by the rocker arm 1 during descending.

[0090] The buffer 46 comprises a rubber buffer cushion or a spring buffer cushion or a polyurethane buffer cushion or a nylon buffer cushion or a polymer buffer cushion or the like.

[0091] The others are the same as those in embodiment 1.

Embodiment 14

[0092] As shown in FIG. 21 and FIG. 22, the excavator or loader comprising a rocker arm having roller stroke sections arranged in parallel shown in embodiment 14 differs from that in embodiment 1 in that: the rocker arm 1 comprises a rolling harrow 11; the work head 9 comprises harrow teeth 47 and a tooth cylinder 48; the length from the tip of each of the harrow teeth 47 to a center line of the tooth cylinder 48 is greater than the radius of the tooth cylinder 48.

[0093] The harrow teeth 47 are shovel heads or pick heads 66 or ivory teeth or hammers 65 or axes or hoes or a combination thereof, etc.

[0094] The rocker arm 1 and/or the machine body 2 comprises a rolling harrow driving device 49; the rolling harrow 11 comprises harrow teeth and a tooth cylinder 48; the rolling harrow driving device 49 comprises an electrical machine or a motor or the like;, the electrical machine or motor are disposed inside or outside the tooth cylinder 48.28

[0095] The rolling harrow driving device 49 comprises a transmission 50; the transmission 50 comprises a gear transmission 50 or a belt transmission 50 or a sprocket transmission 50 or a rope sheave transmission 50 or the like.

[0096] The others are the same as those in embodiment 1.

Embodiment 15

[0097] As shown in FIG. 23 and FIG. 24, the excavator or loader comprising a rocker arm having roller stroke sections arranged in parallel shown in embodiment 15 differs from that in embodiment 1 in that: the machine body 2 comprises a rotary disk 51; the rotary disk 51 comprises a rotary inner disk 52 and a rotary outer disk 53; the rotary inner disk 52 and the rotary outer disk 53 rotate relative to each other; when the rotary inner disk 52 is fixed on the machine body 2, the rotary outer disk 53 rotates relative to the rotary inner disk 52; when the rotary outer disk 53 is fixed on the machine body 2, the rotary inner disk 52 rotates relative to the rotary outer disk 53; one end of the rocker arm 1 is connected to the rotary inner disk 52 under rotation; the machine body 2 comprises a rotary disk rotation controller 54 which drives the rotary inner disk 52 to rotate; one end of the telescopic arm controller 55 is connected with the rotating rotary inner disk 52, while the other end is connected with the telescopic arm 7; the rocker arm 1 rotates along with the rotary disk 51, thereby expanding the excavation and/or loading range; the telescopic arm controller 55 controls the telescopic arm 7 to stretch and retract by means of rolling friction.

[0098] One end of the rocker arm 1 may further be connected with the rotary outer disk 53 under rotation; the machine body 2 comprises a rotary disk rotation controller 54 which drives the rotary outer disk 53 to rotate; one end of telescopic arm controller 55 is connected with the rotary outer disk 53 under rotation.

[0099] The rotary disk rotation controller 54 comprises a telescopic oil cylinder, or a gear and a rack, or a rope and a rope winder, or a telescopic air cylinder, or a sprocket and chain, or the like.

[0100] The others are the same as those in embodiment 1.

Embodiment 16

[0101] As shown in FIG. 25, the excavator or loader comprising a rocker arm having roller stroke sections arranged in parallel shown in embodiment 16 differs from that in embodiment 1 in that: the rocker arm 1 or the machine body 2 comprises a side-to-side movement controller 60; the telescopic arm 7 comprises a telescopic section 56 and a support work head section 57; the telescopic section 56 is hingedly connected with the support work head section 57; the hinge 59 is disposed perpendicularly to the ground; one end of the telescopic control part 58 is connected with the machine body 2 via a rotary structure or is connected with the telescopic support arm 8, and the other end is connected with the telescopic section 57; one end of the side-to-side movement controller 60 is connected with the machine body 2 via a rotary structure or is connected with the telescopic support arm 8 or the telescopic section 56, and the other end is connected with the support work head section 57; the side-to-side movement controller 60 drives the support work head section 57 to move from side to side; and the side-to-side movement controller 60 drives the support work head section 57 to move from side to side.

[0102] The rotary structure 35 comprises a ball-head ball-groove type, an arc-shaped catching groove type, a flexible universal joint coupling head, a universal joint bearing coupling head, a universal coupler coupling head, a joint bearing coupling head or a spherical hinge mechanism or the like.

[0103] The others are the same as those in embodiment 1.

Embodiment 17

[0104] As shown in FIG. 26, the excavator or loader comprising a rocker arm having roller stroke sections arranged in parallel shown in embodiment 17 differs from that in embodiment 1 in that: the rotary disk 51 comprises a multilayer rotary disk 62 which comprise a lower-layer rotary disk 63, an upper-layer rotary disk 64, etc.

[0105] A rolling harrow rocker arm 12 is provided on the lower-layer rotary disk 63; a reciprocating impact head rocker arm 13 is provided on the upper-layer rotary disk 64; the lower-layer rotary disk 63 drives the rolling harrow rocker arm 12 to rotate horizontally and/or vertically; the upper-layer rotary disk 64 drives the reciprocating impact head rocker arm 13 to rotate horizontally and/or vertically; the rolling harrow rocker 12 coordinates with the reciprocating impact head rocker arm 13 to excavate and load materials in multiple azimuths and angles.

[0106] The machine body 2 comprises a rocker arm ascending/descending controller 61 which controls the rocker arm 1 to ascend and descend; the ascending/descending controller 61 comprises an ascending/descending oil cylinder, or a gear and a rack, or a rope and a rope winder, or an ascending/descending air cylinder, or a sprocket and a chain, or the like.

[0107] The others are the same as those in embodiment 1.

Claims

1. A method for arranging rolling-friction stretching and retraction based rolling stroke sections of a rocker arm in parallel, which is implemented by the following steps:

   step 1: providing a front roller, a rear roller, a front roller raceway, a rear roller raceway, a telescopic arm, and a telescopic support arm; disposing the front roller raceway on the telescopic arm or the telescopic support arm; disposing the rear roller raceway on the telescopic support arm or the telescopic arm or the machine body; disposing the front roller on the telescopic sup-

port arm or the telescopic arm; disposing the rear roller on the telescopic arm or the telescopic support arm; arranging the front roller raceway and the rear roller raceway in parallel; rolling the front roller within the front roller raceway; rolling the rear roller within the rear roller raceway; and coordinating the front roller with the rear roller to support the telescopic arm to perform rolling-friction stretching and retraction on the telescopic support arm by means of rolling friction;

step 2: providing a work head, and connecting the work head with the telescopic arm so that the telescopic arm drives the work head to stretch and retract; and

step 3: connecting the telescopic support arm with a machine body, and providing a traveling gear on the lower part of the machine body so that the traveling gear drives the machine body to travel.

2. A method for arranging rolling-friction stretching and retraction based rolling stroke sections of a rocker arm in parallel, which is implemented by the following steps: configuring a front roller as a fixed wheel; configuring a rear roller as a traveling wheel; configuring a front roller raceway as a fixed wheel raceway; configuring a rear roller raceway as a traveling wheel raceway; arranging the fixed wheel raceway and the traveling wheel raceway in parallel; disposing the fixed wheel raceway along the direction of the traveling wheel raceway, and clipping the fixed wheel raceway onto the fixed wheel to partially or completely overlap the travelling wheel raceway and the fixed wheel raceway; and overlapping the fixed wheel and some or all of the rolling stroke sections of the traveling wheel, thereby shortening the length between the fixed wheel raceway and the traveling wheel raceway arranged one behind the other, reducing the length of the rocker arm under the condition of equal stretching and retracting distances, and shortening the force arm of the work head that twists a machine body.

3. An excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel for implementing the method for arranging rolling-friction stretching and retraction based rolling stroke sections of a rocker arm in parallel according to claim 1, **characterized in that** the excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel comprises a rocker arm, a machine body, and a work head, wherein the rocker arm comprises a front roller, a rear roller, a front roller raceway, a rear roller raceway, a telescopic arm, and a telescopic support arm; the front roller raceway is disposed on the telescopic arm or the telescopic support arm; the rear roller raceway is disposed on the telescopic support arm or the telescopic arm or the machine body; the front roller is disposed on the telescopic support arm or the telescopic arm; the rear roller is disposed on the telescopic arm or the telescopic support arm; the front roller raceway and the rear roller raceway are arranged in parallel; the front roller rolls within the front roller raceway; the rear roller rolls within the rear roller raceway; the front roller coordinates with the rear roller to support the telescopic arm to perform rolling-friction stretching and retraction on the telescopic support arm by means of rolling friction; the work head is connected with the telescopic arm which drivesthe work head to stretch and retract; and the telescopic support arm is connected with the machine body.

4. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 3, **characterized in that** the work head comprises a rolling harrow, or a reciprocating impact head, or a bucket, or a scraper box, or a cutting drum, or a crushing head, or a combination of the reciprocating impact head and the bucket, or a combination of the rolling harrow and the scraper box, or a combination of the rolling harrow and the reciprocating impact head.

5. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 3, **characterized in that** the rocker arm comprises a rolling harrow rocker arm, or a reciprocating impact head rocker arm, or an excavation/loading rocker arm, or a combination of the rolling harrow rocker arm and the reciprocating impact head rocker arm, or a combination of the reciprocating impact head rocker arm and a scraper box rocker arm.

6. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 3, **characterized in that** the front roller comprises a fixed wheel; the rear roller comprises a traveling wheel; the front roller raceway comprises a fixed wheel raceway; the rear roller raceway comprises a traveling wheel raceway; the fixed roller raceway and the telescopic arm are separately connected or integrated; the traveling wheel raceway and the telescopic support arm are separately connected or integrated; the fixed wheel is disposed on the front end of the telescopic support arm and rolls within the fixed wheel raceway; the traveling wheel rolls within the traveling wheel raceway and is fixed at the rear part of the telescopic support arm; the fixed wheel raceway and the traveling wheel raceway are arranged in parallel; and the fixed wheel overlaps to some or all of the rolling stroke sections of the traveling wheel, thereby shortening the length between the fixed wheel raceway and the traveling wheel raceway arranged one behind the other, re-

ducing the length of the rocker arm under equal stretching and retracting distances, reducing the volume height of the rocker arm, and shortening a force arm that damages the machine body through twisting.

7. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 6, **characterized in that** the fixed wheel raceway comprises a fixed wheel groove; the telescopic arm comprises a rolling harrow telescopic arm; the telescopic support arm comprises a rolling harrow telescopic support arm; the fixed wheel groove and the rolling harrow telescopic arm are separately connected or integrated; the traveling wheel raceway is disposed on the telescopic support arm; the rear roller comprises a slide opening roller; the traveling wheel raceway comprises a slide opening roller groove, whichrolls within the slide opening roller groove and is fixed at the rear part of the rolling harrow telescopic arm; the fixed wheel groove and the slide opening roller groove are arranged in parallel; when the rolling harrow telescopic arm is lifted up by bulk materials, the fixed wheel groove hoists the fixed wheel to pull up the rolling harrow telescopic support arm; and the slide opening roller and the fixed wheel support and pull the rolling harrow telescopic arm to stretch/retract and ascend/descend.

8. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 3, **characterized in that** the outer surface of the rear roller is provided with a concave surface or a convex surface; if the outer surface of the rear roller is provided with a concave surface, the rear roller raceway is correspondingly provided with a convex surface clipped to the concave surface of the rear roller to conduct rolling guide for the telescopic arm; and if the outer surface of the rear roller is provided with a convex surface, the rear roller raceway is correspondingly provided with a concave surface clipped to the convex surface of the rear roller to conduct rolling guide for the telescopic arm.

9. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 3, **characterized in that** the front roller and the rear roller are disposed between the telescopic arm and the telescopic support arm to form a rolling guide device; the rolling guide device comprises a protector for preventing mud, water, dust or material from entering the rolling guide device.

10. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 3, **characterized in that** the front roller raceway comprises a U-shaped raceway, or a square raceway, or a circular raceway, or a C-shaped raceway, or a [-shaped raceway, or anH-shaped raceway.

11. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 3, **characterized in that** the rocker arm is hingedly connected with the machine body via a rotary limiting hinge shaft or is connected with the machine body via a rotary structure; a rotation-stopping limiting structure is disposed at the hinge joint or rotary joint of the rocker arm and the machine body; the rotation-stopping limiting structure comprises a rotary limiting platform and a machine body rotation-stopping platform; the rotary limiting platform rotates about the rotary structure or the limiting hinge shaft; when the rotary limiting platform rotates to an angle where the telescopic support arm and the work head are about to be in collision with a shovel plate, the machine body rotation-stopping platform is pressed against the rotary limiting platform so that the machine body rotation-stopping platform stops the rotary limiting platform from continuing rotating;the rocker arm is limited to continue descending by limiting the rotation angle thereof,so that a reasonable safety gapis maintained between each of the rocker arm and the work head and the shovel plate.

12. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 3, **characterized in that** the machine body comprises a shovel plate frame, a machine body frame, and a shovel plate controller, wherein the shovel plate frame is hingedly connected with the machine body frame or the shovel plate frame is connected with the machine body frame via a rotary structure; one end of the shovel plate controller is disposed on the machine body frame, and the other end thereof is disposed on the shovel plate frame;and the shovel plate controller drives the shove plate to ascend/descend in the way of unidirectional rotation or multidirectional rotation.

13. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 3, **characterized in that** the machine body and/or the rocker arm comprises a discharge stopper, which comprises a plate type discharging device, or a fork type discharging device, or a brush type discharging device, or a toothtype discharging device.

14. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 3, **characterized in that** the front roller comprises a pin roller, or a waist drum wheel or a multidirectional wheel.

15. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 3, **characterized in that** the rear roller comprises an alloy steel roller, or an ordinary steel roller, or a polymer roller, or a rubber roller, or a ceramic roller.

16. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 12, **characterized in that** the shovel plate controller is disposed on the upper part of the machine body; the machine body comprises a shovel plate controller support; one end of the shovel plate controller is hingedly connected to the shovel plate controller support or is connected with the shovel plate controller support via a rotary structure, and the other end thereof is connected with the shovel plate frame; the joint of the shovel plate frame and the machine body frame is disposed on the lower part of the machine body; a distance from the shovel plate controller support on the upper part of the machine body to the force arm at the joint of the shovel plate frame and the machine body frame is greater than a distance, in the event that the shovel plate controller is disposed on the lower part of the machine body, from the shovel plate controller support to the force arm at the joint of the shovel plate frame and the machine body frame; the shovel plate controller drives the shovel plate frame; and the shovel plate frame drives the shovel plate to ascent/descend, thereby reducing power consumption and the number of the shovel plate controllers.

17. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 3, **characterized in that** the rear roller raceway comprises an anti-swing roller groove; the rear roller comprises an anti-swing roller; the anti-swing roller groove and the machine body are separately or fixedly connected; the anti-swing roller performs linear reciprocating rolling in the anti-swing roller groove to support the rolling-friction stretching and retraction of the telescopic arm; and the telescopic arm is limited to swing from side to side by the anti-swing roller.

18. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 3, **characterized in that** the rear roller raceway comprises an anti-swing roller groove; the front roller raceway comprises an ascending/descending roller groove; the anti-swing roller groove and the ascending/descending roller groove are arranged separately in parallel or are arranged into one piece; the front roller is an ascending/descending roller; the rear roller is an anti-swing roller; the ascending/descending roller rolls within the ascending/descending roller groove; the anti-swing roller rolls within the anti-swing roller groove; the rocker arm is hingedly connected with the machine body or is connected with the machine body via a rotary structure; the telescopic arm is limited to swing non-directionally from side to side by the anti-swing roller and the telescopic support arm is driven to ascend/descend by the ascending/descending roller, to reduce a height between the anti-swing roller groove and the ascending/descending roller groove arranged one below the other, as well as the volume height of the rocker arm;and the ascending/descending roller groove and/or the anti-swing roller grooveguides the rocker arm.

19. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 11, **characterized in that** the rotation-stopping limiting structure enables the rocker arm to form a tilt angle relative to the ground; the tilt angle enables the work head not to be in collision with shovel plate; due to the tilt angle, the rocker arm enables the work head to be lower than the shovel plate when stretching out of the upper part of the shovel plate and to excavate, mill, load or crush the materials in the front of the shovel plate.

20. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 12 or 16, **characterized in that** the machine body comprises a shovel plate frame; a shovel plate frame limiting gantry is disposed on the shovel plate frame at the lower part of the rocker arm; the shovel platform frame limiting gantry lifts up the telescopic support arm when the rocker arm and the work head descend to be about to collide with the shovel plate, thereby preventing the rocker arm and the work head from descending to be in collision with the shovel plate.

21. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 20, **characterized in that** a buffer is disposed on the shovel platform frame limiting gantry; the buffer absorbs the impact caused by the rocker arm during descending.

22. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 21, **characterized in that** the buffer comprises a rubber buffer cushion, or a spring buffer cushion, or a polyurethane buffer cushion, or a nylon buffer cushion, or a polymer buffer cushion.

23. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 3, **characterized in that** the work head comprises a rolling harrow which comprises harrow teeth and a tooth cylinder; the length from

the tip of each harrow tooth to the center line of the tooth cylinder is greater than the radius of the tooth cylinder.

24. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 23, **characterized in that** the harrow teethare shovel heads, or pick heads, or ivory teeth, or hammers, or axes, or hoes or combinations of multiple shapes.

25. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 11, 12, 16 or 18, **characterized in that** the rotary structure comprises a ball-head ball-groove type, arc-shaped catching groove type, and flexible universal joint coupling head, a universal joint bearing coupling head, a universal coupler coupling head, a joint bearing coupling head, or a spherical hinge mechanism.

26. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 3, **characterized in that** the machine body comprises a rotary disk which comprises a rotary inner disk and a rotary outer disk, wherein the rotary inner disk and the rotary outer diskoppositely rotate; when the rotary inner disk is fixed on the machine body, the rotary outer disk rotates relative to the rotary inner disk; when the rotary outer disk is fixed on the machine body, the rotary inner disk rotates relative to the rotary outer disk; one end of the rocker arm is connected to the rotary inner disk under rotation or the rotary outer disk under rotation; the machine body comprises a rotary disk rotation controller which drives the rotary inner disk or the rotary outer disk to rotate; one end of the telescopic arm controller is connected with the rotary inner disk under rotation or the rotary outer disk under rotation, and the other end thereof is connected with the telescopic arm;and the rocker arm rotates with the rotary disk, to expand the excavation and/or loading range.

27. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 3, **characterized in that** the rocker arm or the machine body comprises a side-to-side movement controller; the telescopic arm comprises a telescopic section and a support work head section; the telescopic section is hingedly connected with the support work head section; a hinge shaft is disposed perpendicularly to the ground; one end of a stretching and retraction controller is connected with the machine body via a rotary structure or is connected with the telescopic support arm, and the other end thereof is connected with the telescopic section; one end of the side-to-side movement controller is connected with the machine body via a rotary structure or is connected with the telescopic support arm or the telescopic section, and the other end thereof is connected with support work head section; the side-to-side movement controller drives the support work head section to move from side to side; and the side-to-side movement controller leads the support work head section to move from side to side.

28. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 3, **characterized in that** the rocker arm and/or the machine body comprises a rolling harrow driving device; the rolling harrow comprises harrow teeth and a tooth cylinder;and the rolling harrow driving device comprises an electrical machine or a motor, whichis disposed inside or outside the tooth cylinder.

29. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 28, **characterized in that** the rolling harrow driving device comprises a transmission which comprises a gear transmission, or a belt transmission, or a sprocket transmission,or a rope sheave transmission.

30. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 3, **characterized in that** the front roller comprises a fixed wheel felly and a fixed wheel shaft; the fixed wheel felly and the fixed wheel shaft are separately connected or integrated.

31. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 3, **characterized in that** the telescopic support arm is hingedly connected with the machine body or is connected with the machine body via a rotary structure or is fixedly connected with the machine body.

32. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 26, **characterized in that** the rotary disk rotation controller comprises a telescopic oil cylinder, or a gear and a rack, or a rope and a rope winder, or a telescopic air cylinder, or a sprocket and a chain.

33. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 3, **characterized in that** the machine body comprises a rocker arm ascending/descending controller, wherein theascending/descending controller controls the rocker arm to ascend and descend and comprises an ascending/descending oil cylinder, or a gear and a rack, or a rope and

a rope winder, or an ascending/descending air cylinder, or a sprocket and a chain.

34. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 26, **characterized in that** the rotary disk comprises a multilayer rotary disk which comprises a lower-layer rotary disk and an upper-layer rotary disk.

35. The excavator or loader comprising a rocker arm having rolling stroke sections arranged in parallel according to claim 34, **characterized in that** a rolling harrow rocker arm is disposed on the lower-layer rotary disk; a reciprocating impact head rocker arm is disposed on the upper-layer rotary disk; the lower-layer rotary disk drives the rolling harrow rocker arm to rotate horizontally and/or vertically; the upper-layer rotary disk drives the reciprocating impact head rocker arm to rotate horizontally and/or vertically; and the rolling harrow rocker arm coordinates with the reciprocating impact head rocker arm to excavate and load materials in multiple azimuths and angles.

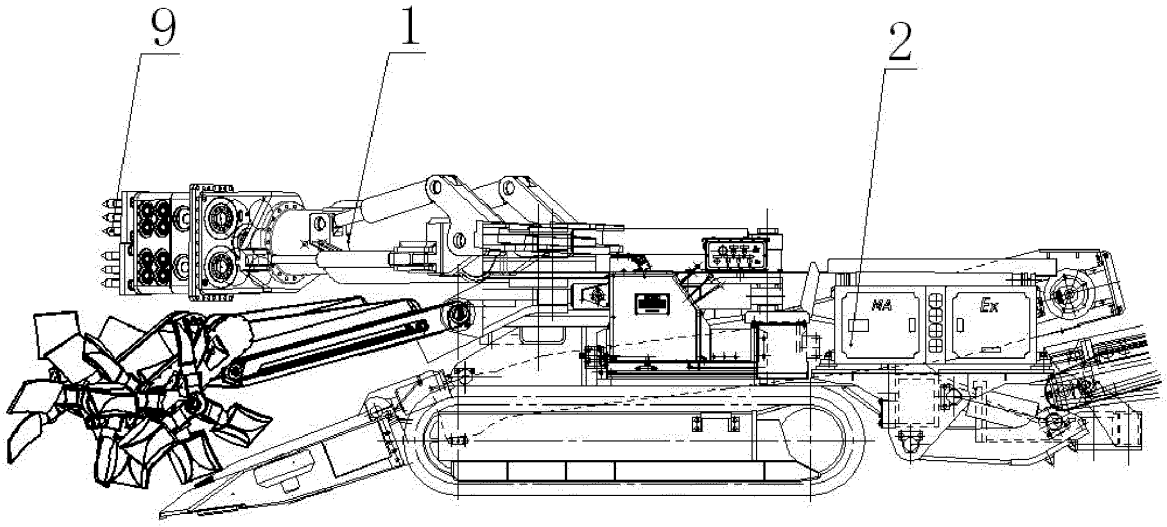

Fig.1

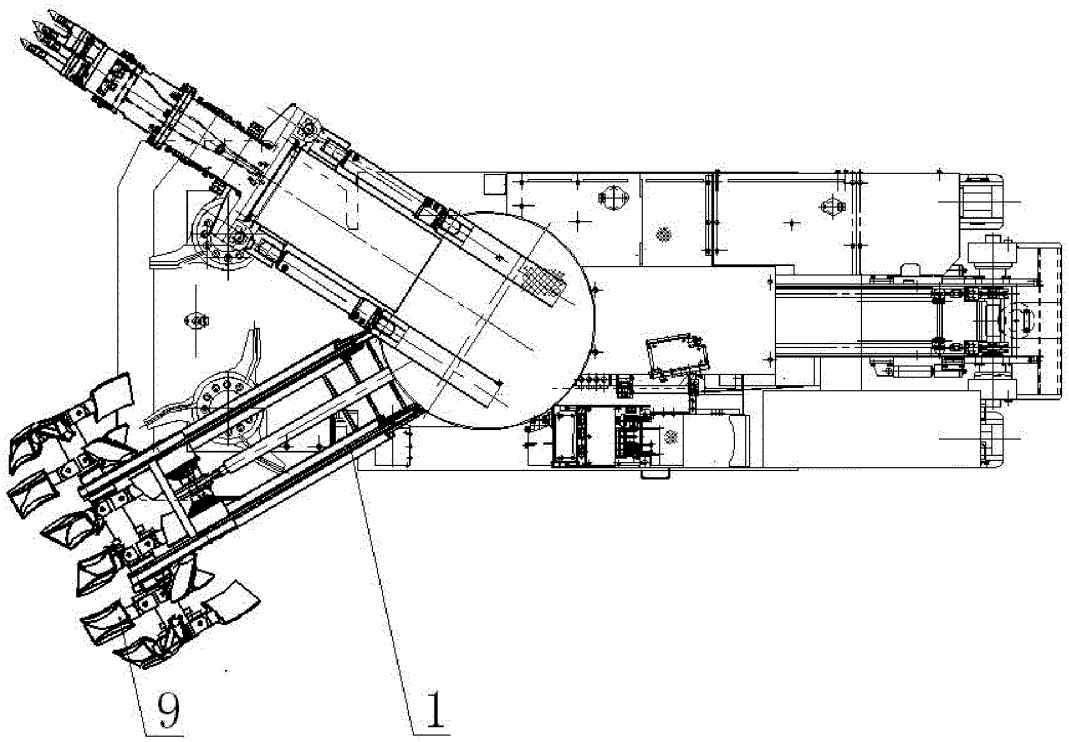

Fig.2

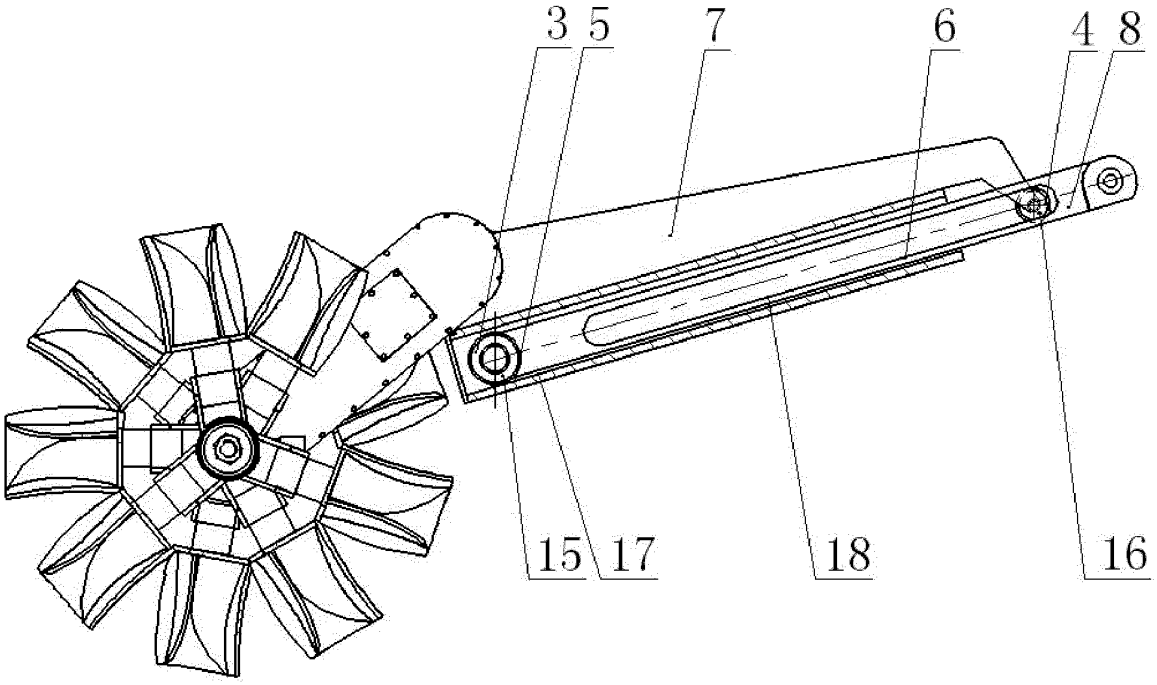

Fig.3

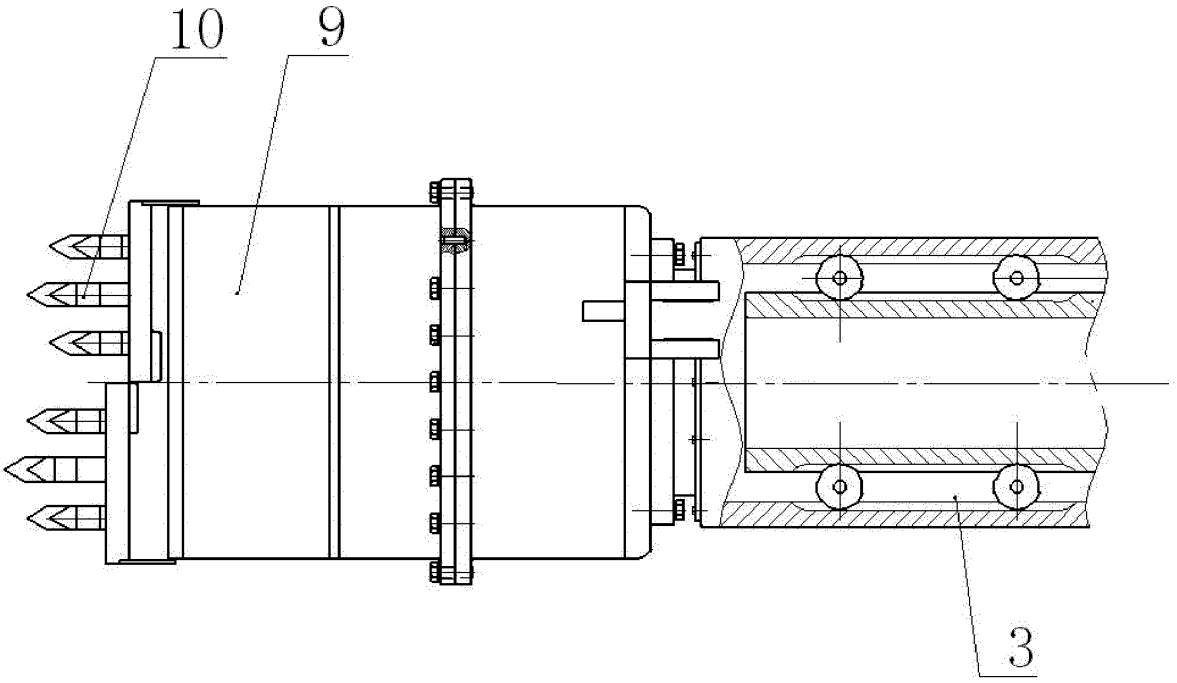

Fig.4

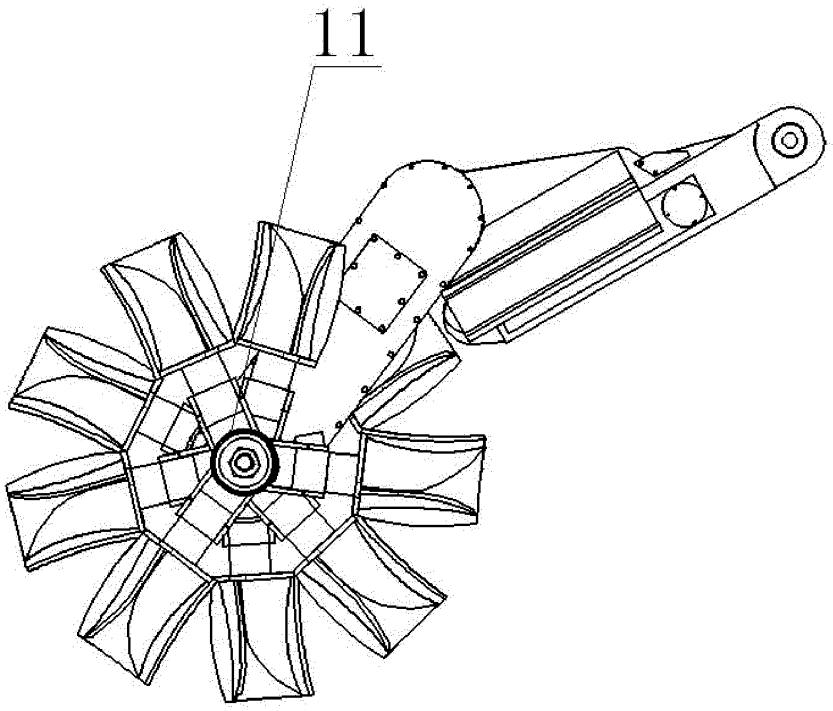

Fig.5

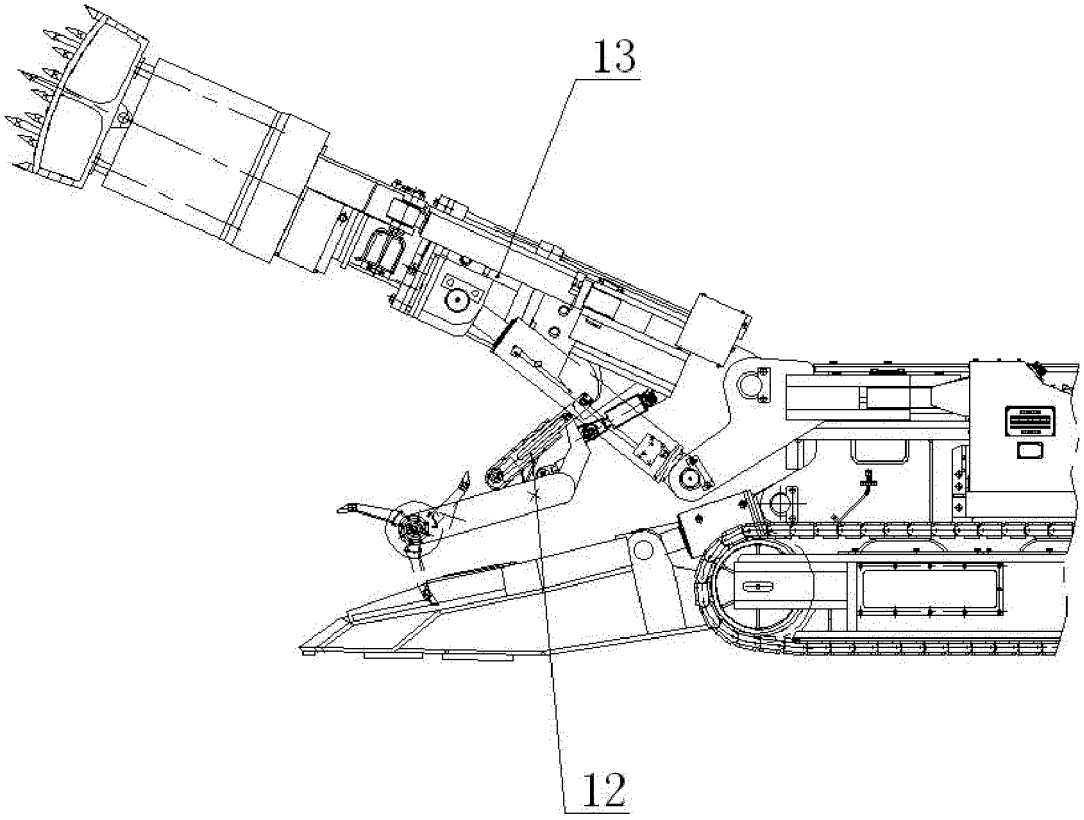

Fig.6

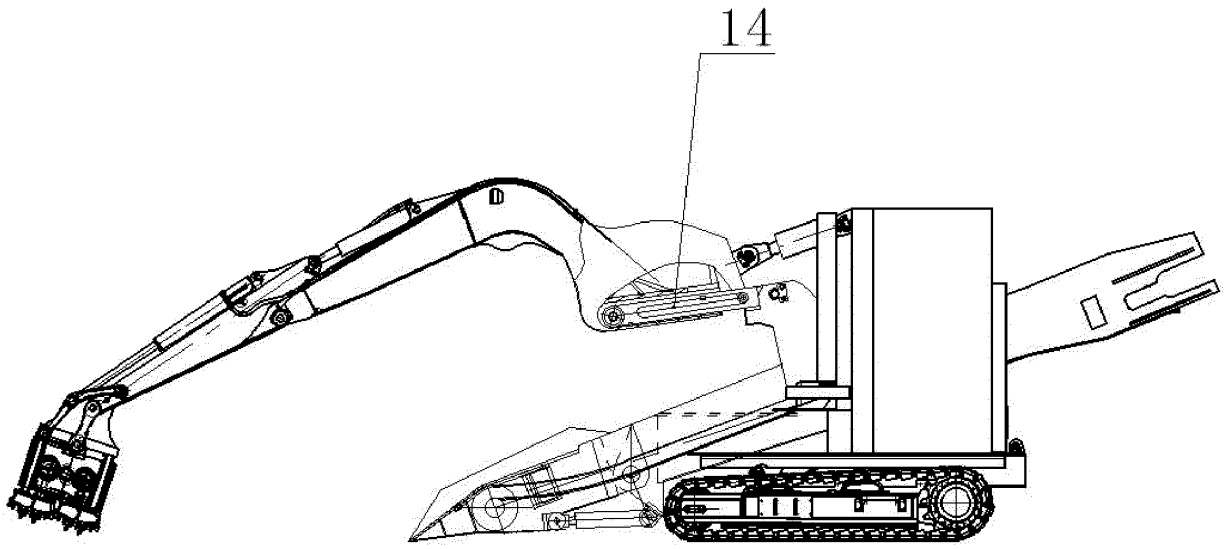

Fig.7

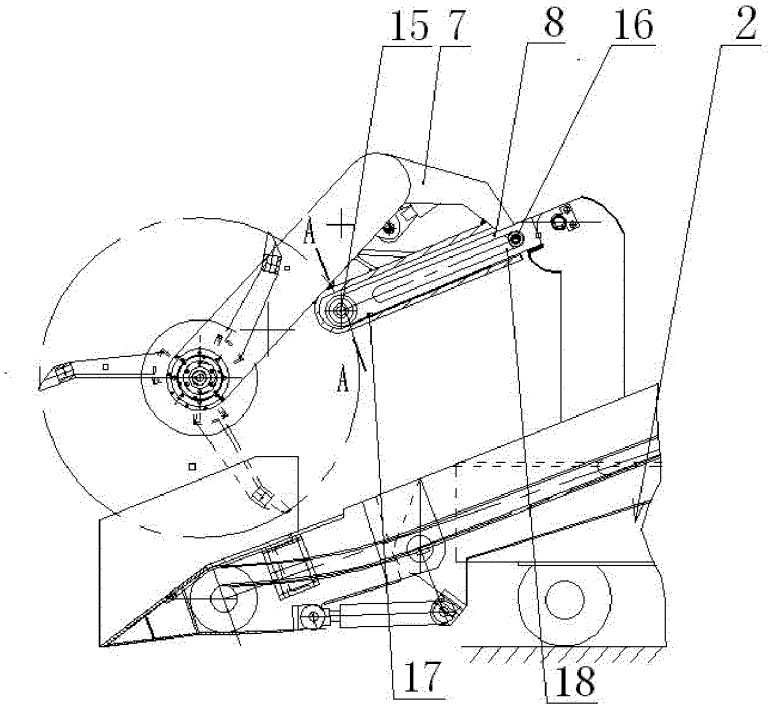

Fig.8

A-A

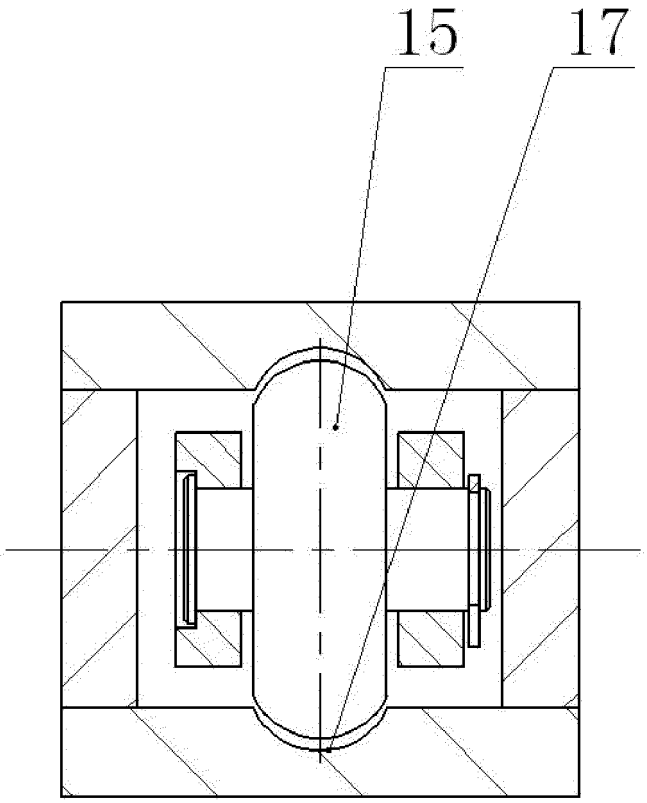

Fig.9

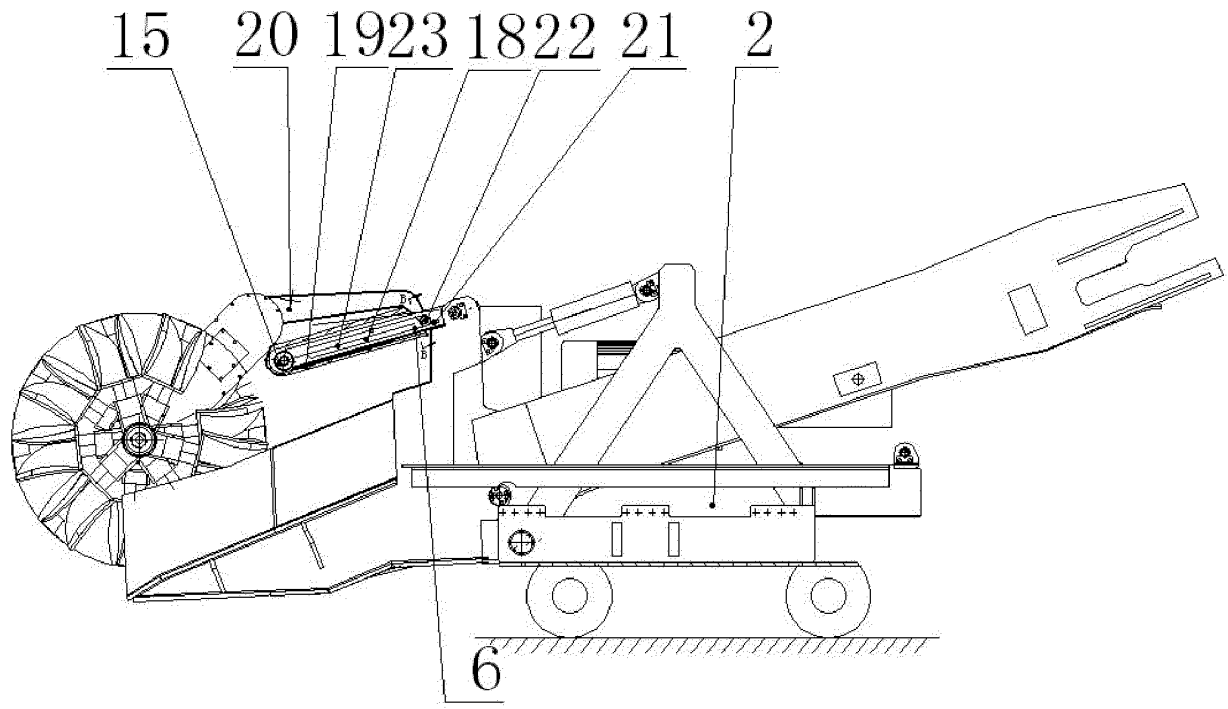

Fig.10

B-B

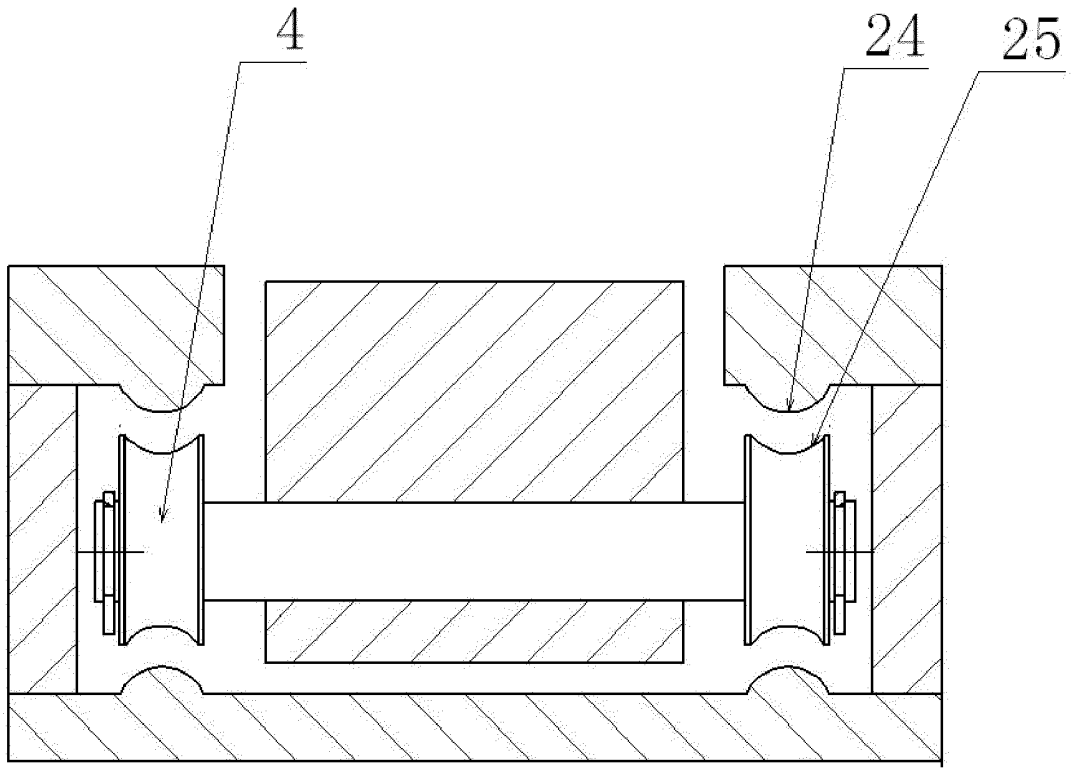

Fig.11

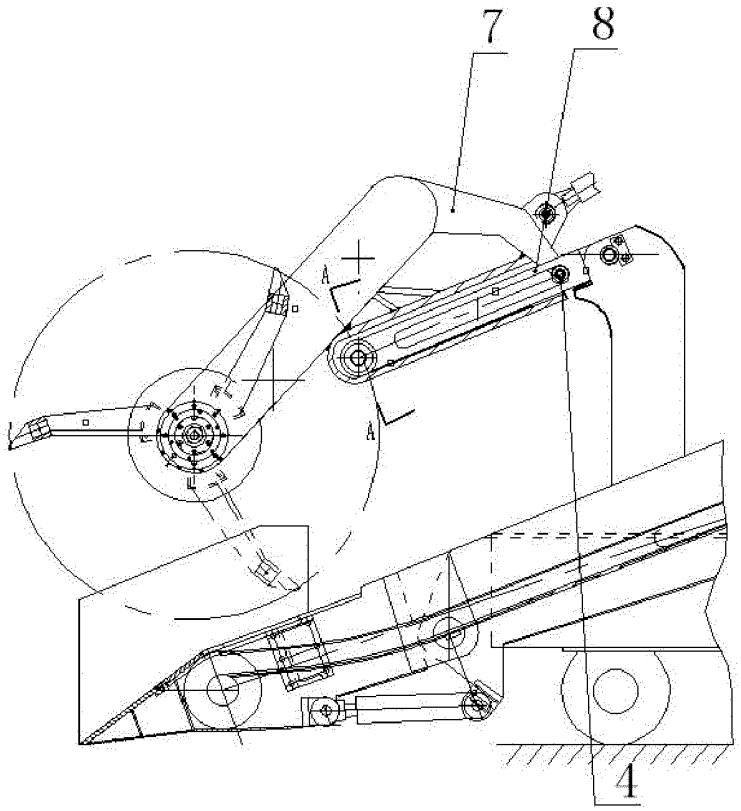

Fig.12

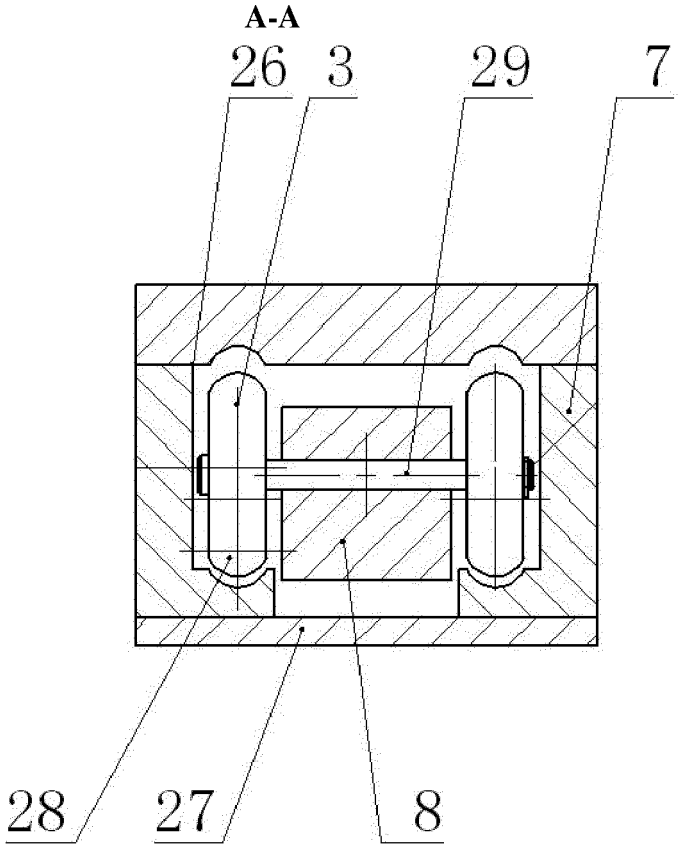

Fig.13

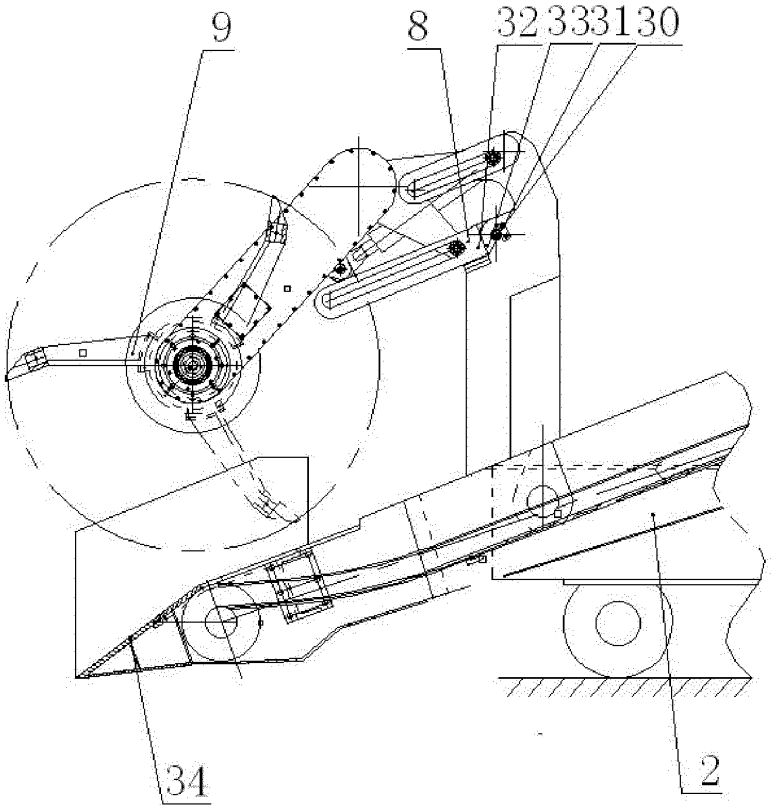

Fig.14

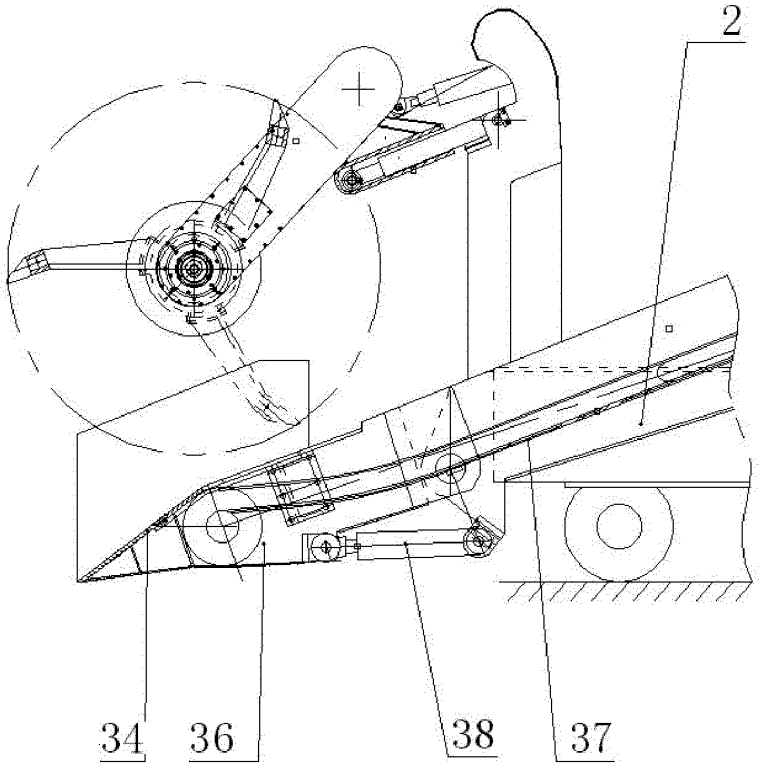

Fig.15

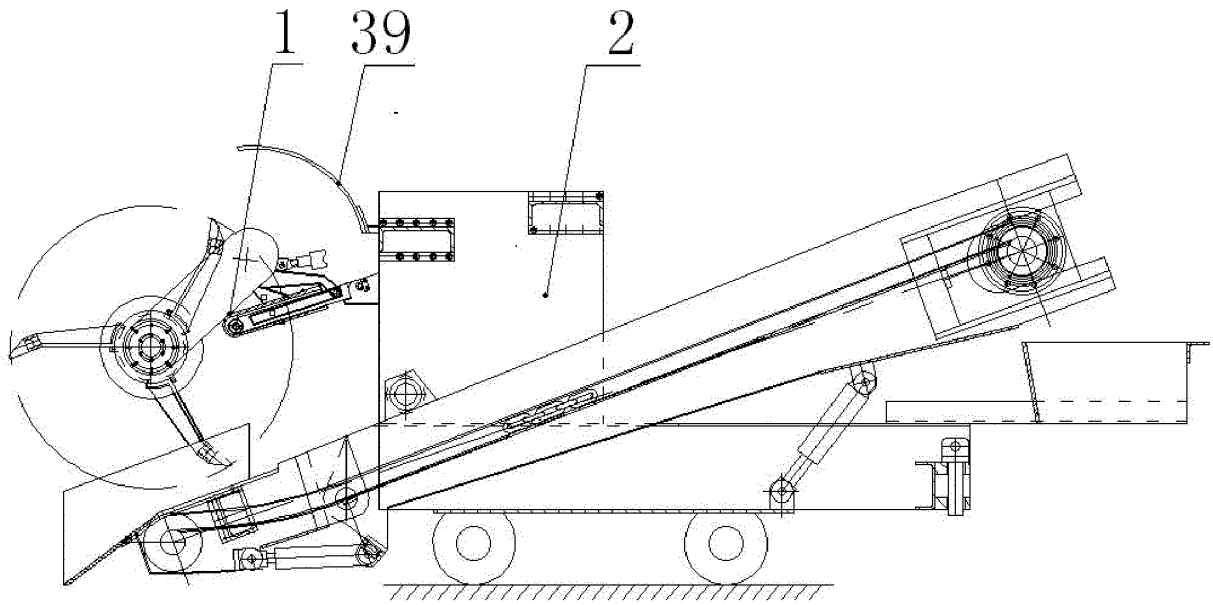

Fig.16

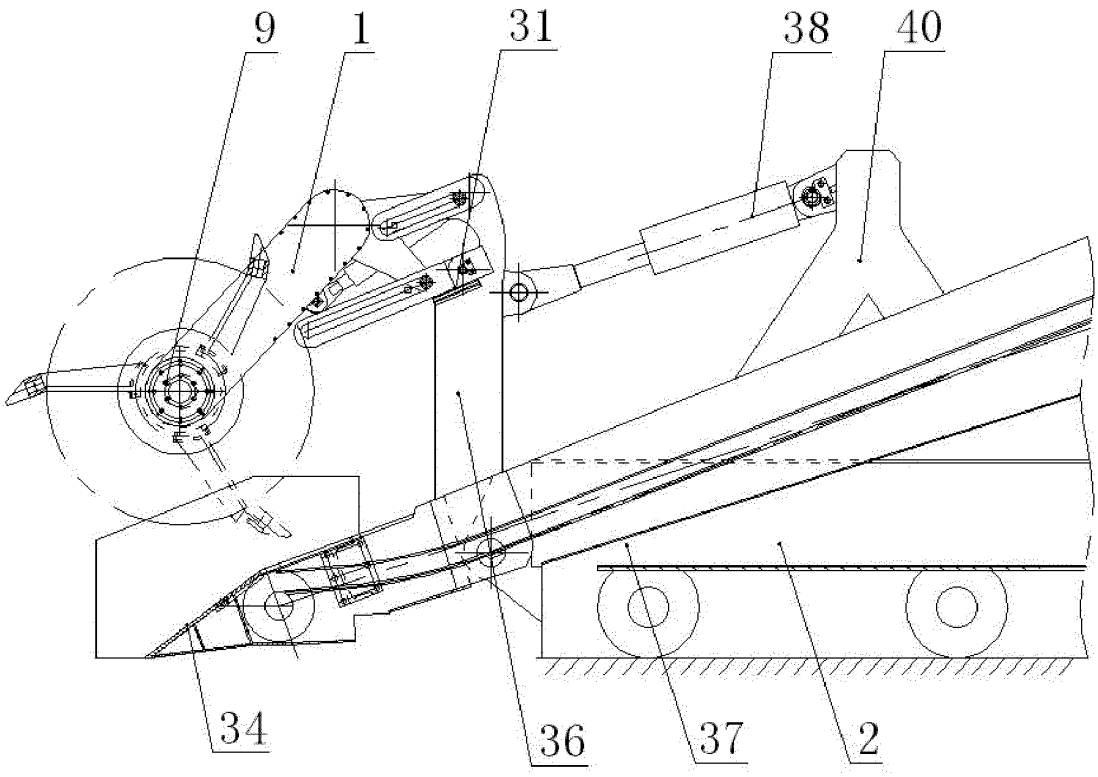

Fig.17

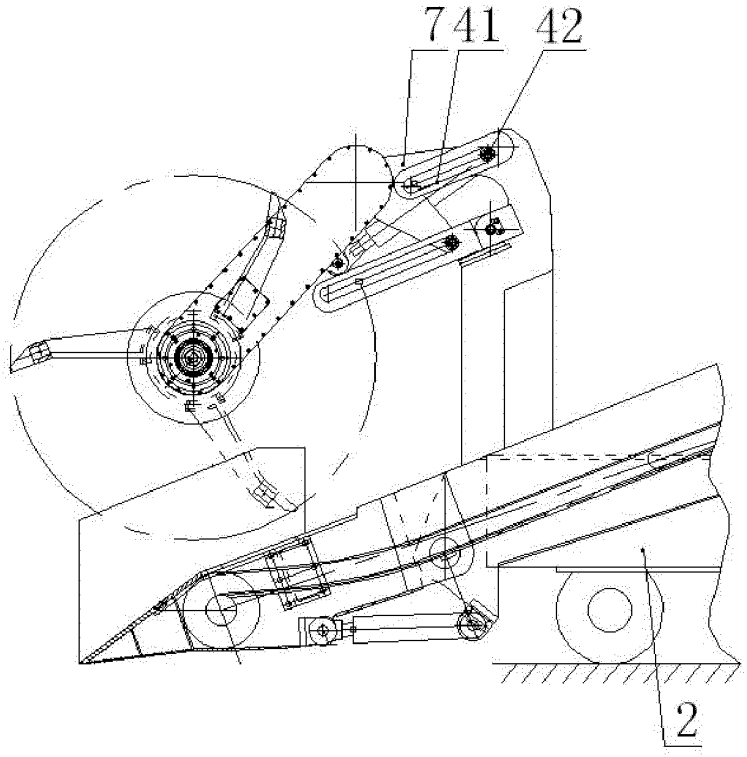

Fig.18

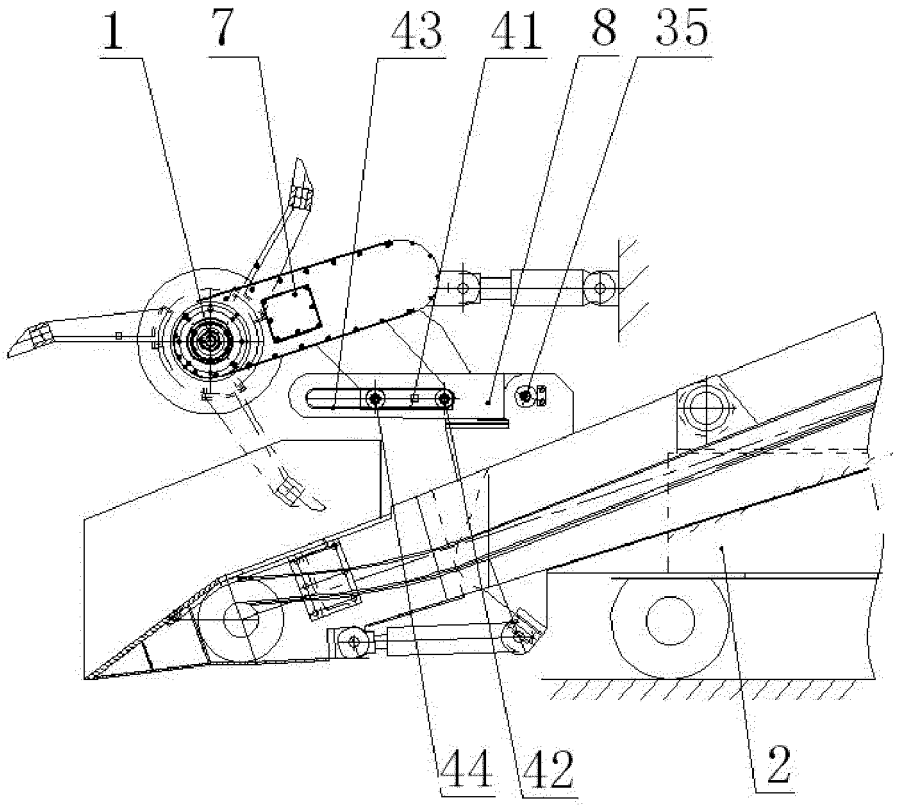

Fig.19

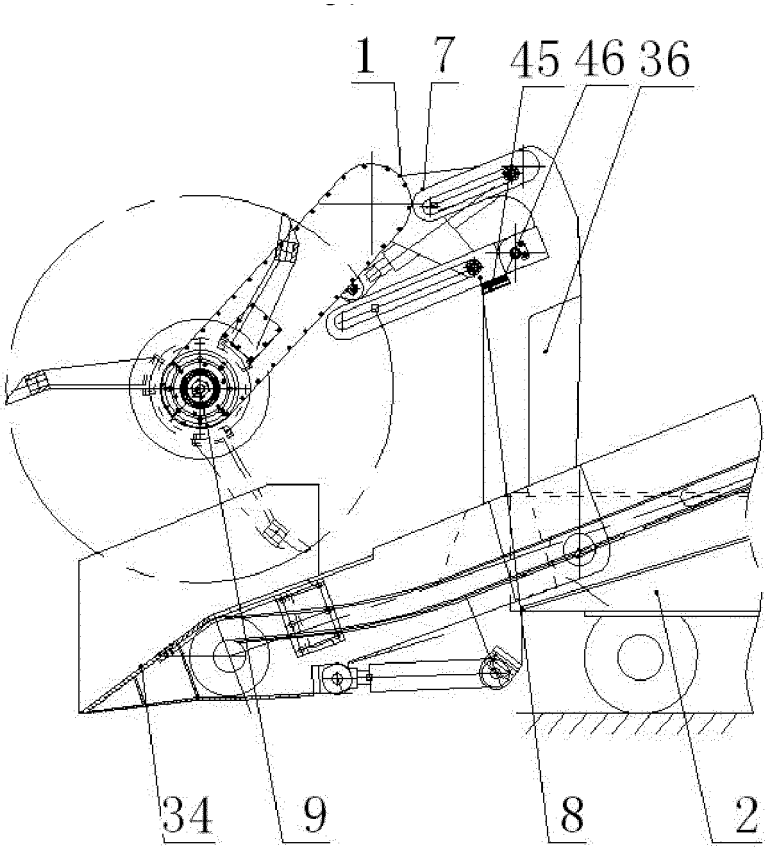

Fig.20

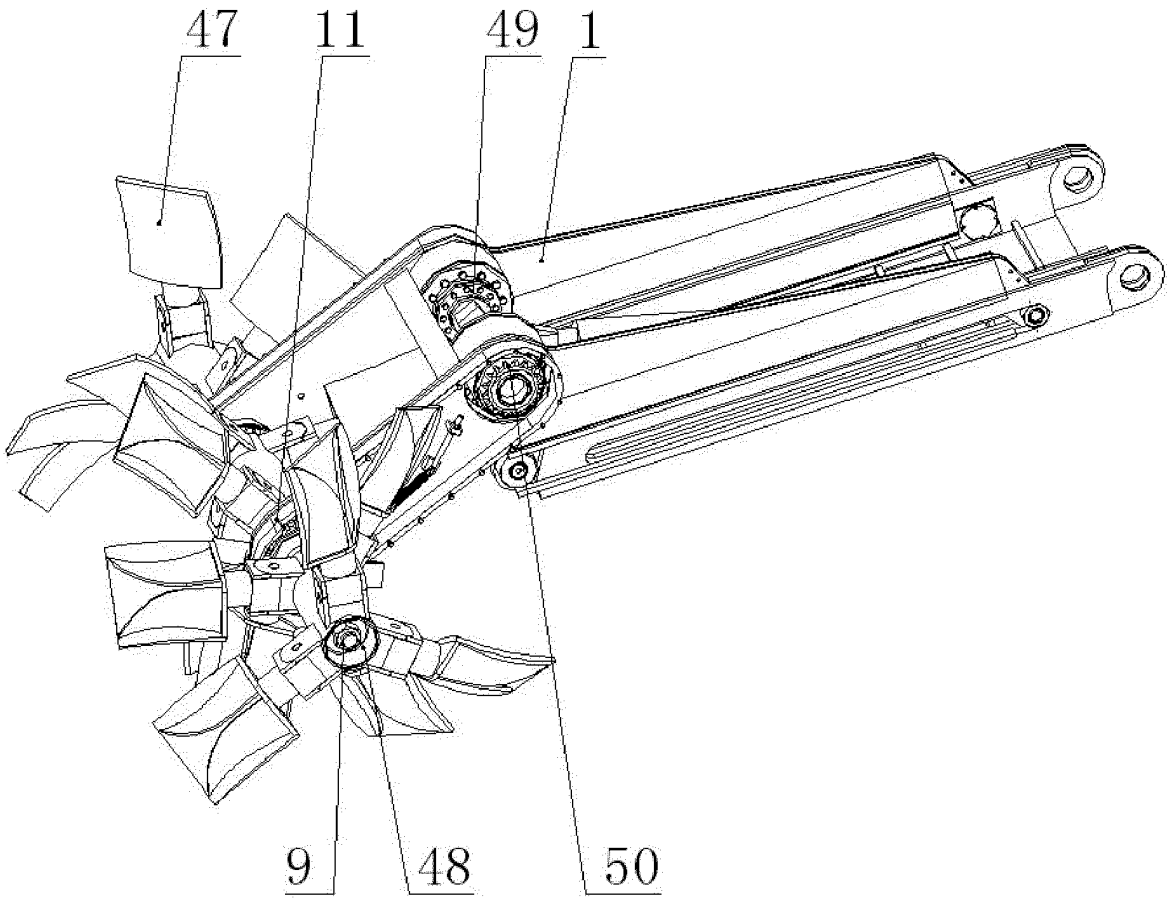

Fig.21

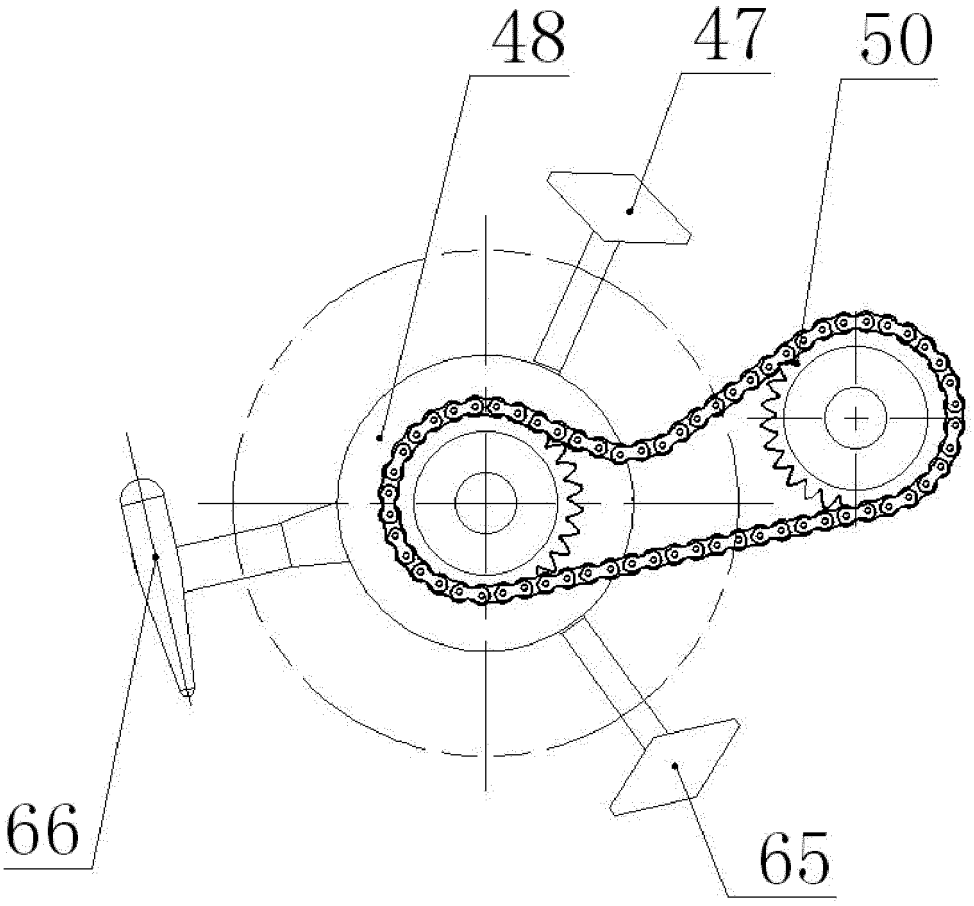

Fig.22

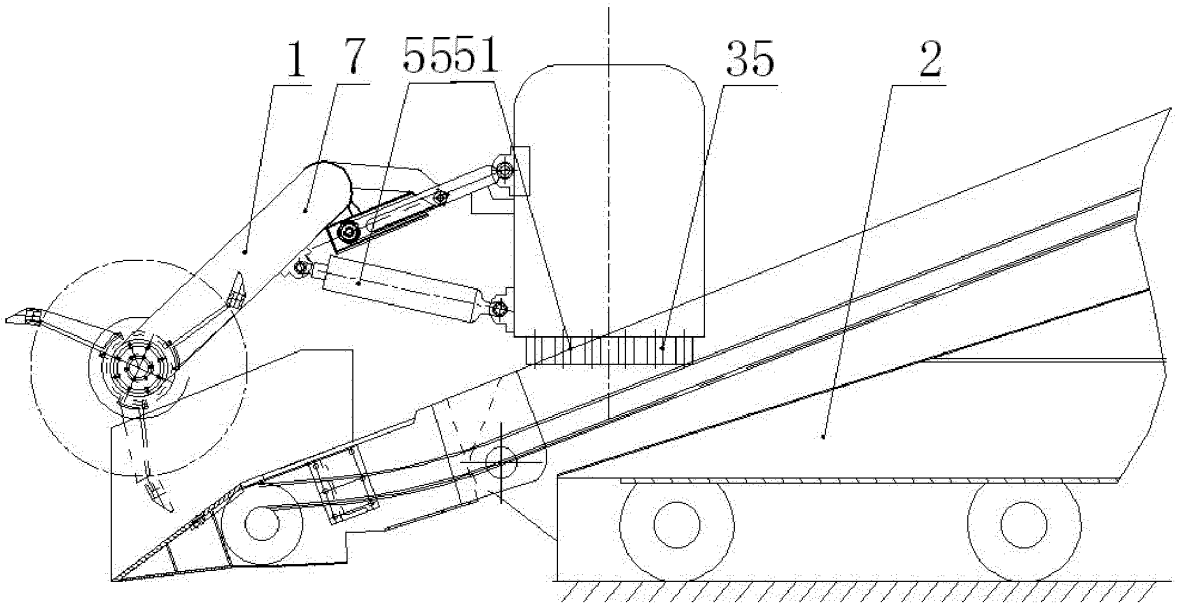

Fig.23

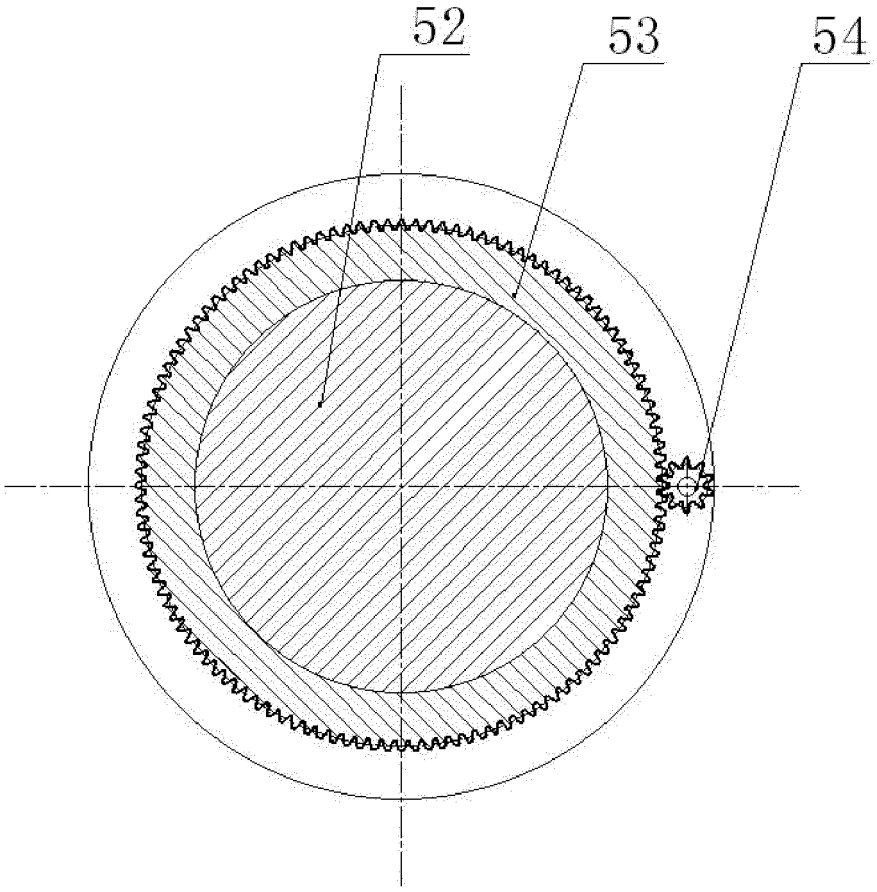

Fig.24

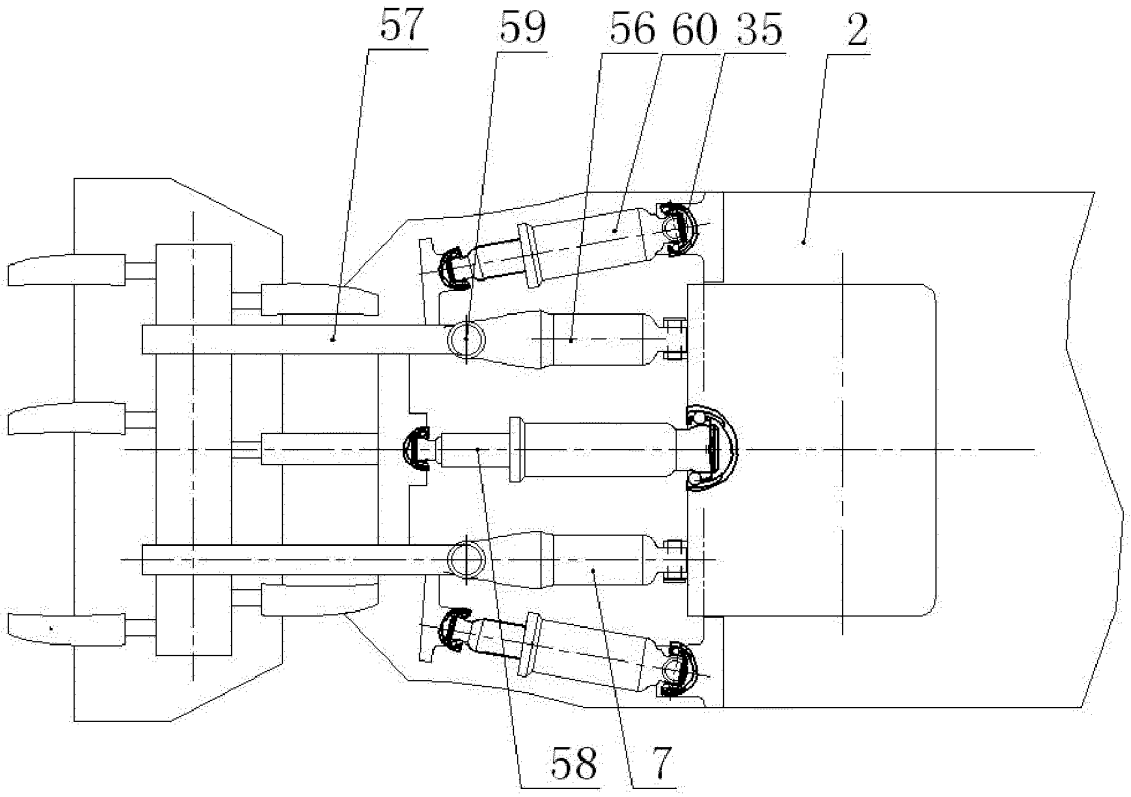

Fig.25

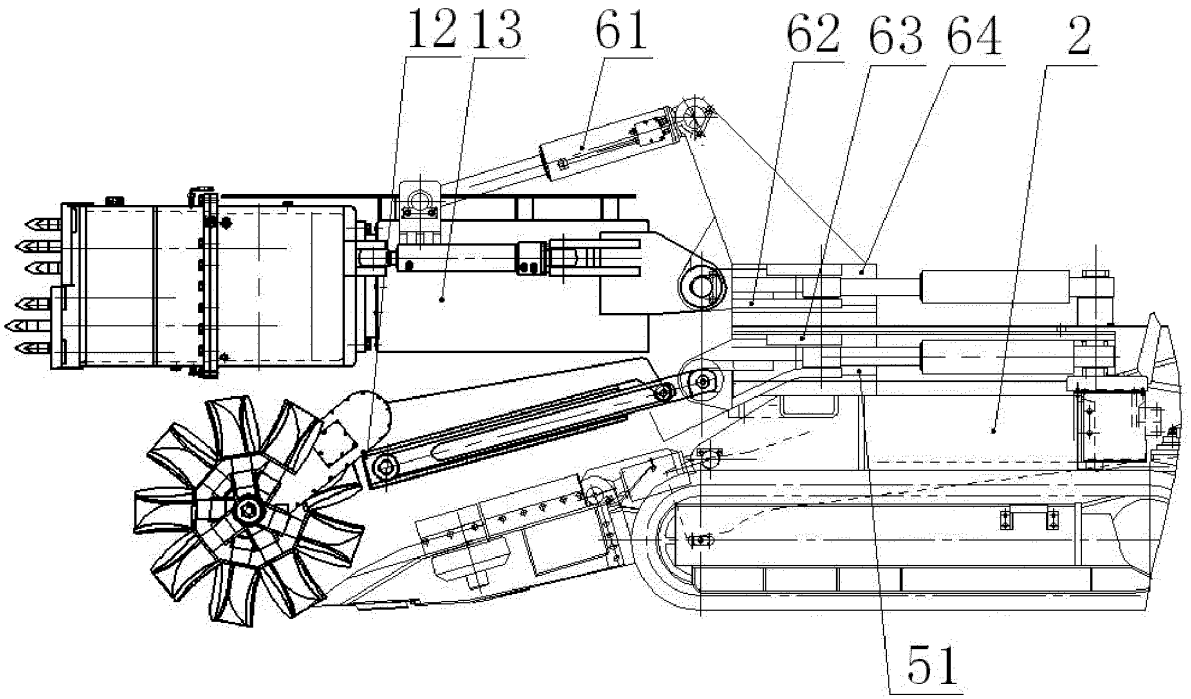

Fig.26

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2013/001448

A. CLASSIFICATION OF SUBJECT MATTER

E21C 31/10 (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: E21C, B65G, E02F

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: mining machine, tunnelling machine, loader, rocker, scroll wheel, roll, stretch, parallel, front, lager

WPI, EIPDOC: roadheader?, tunneling machine, tunneller?, mining machine, loader?, rocker?, ranging arm, roll+, expans+, stretch+, telescopic+, parallel, front, anterior, after, later

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 102713146 A (FABRYKA MASZYN FAMUR S.A. et al.), 03 October 2012 (03.10.2012), description, particular embodiments, and figures 1-3	1-35
A	CN 2559619 Y (XUZHOU LOADING MACHINERY FACTORY), 09 July 2003 (09.07.2003), the whole document	1-35
A	CN 2761696 Y (XIAMEN XGMA MACHINERY CO., LTD.), 01 March 2006 (01.03.2006), the whole document	1-35
A	CN 101942845 A (JIANGSU LIUGONG MACHINERY CO., LTD. et al.), 12 January 2011 (12.01.2011), the whole document	1-35
A	CN 201826338 U (CHANGLIN COMPANY LIMITED), 11 May 2011 (11.05.2011), the whole document	1-35
A	SU 777215 A1 (ORE MINING EQPT RES), 07 November 1980 (07.11.1980), the whole document	1-35

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"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)

"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

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"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

"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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 February 2014 (10.02.2014)	**27 February 2014 (27.02.2014)**
Name and mailing address of the ISA/CN: State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No.: (86-10) 62019451	Authorized officer **CHEN, Gang** Telephone No.: (86-10) **62085154**

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2013/001448

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
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