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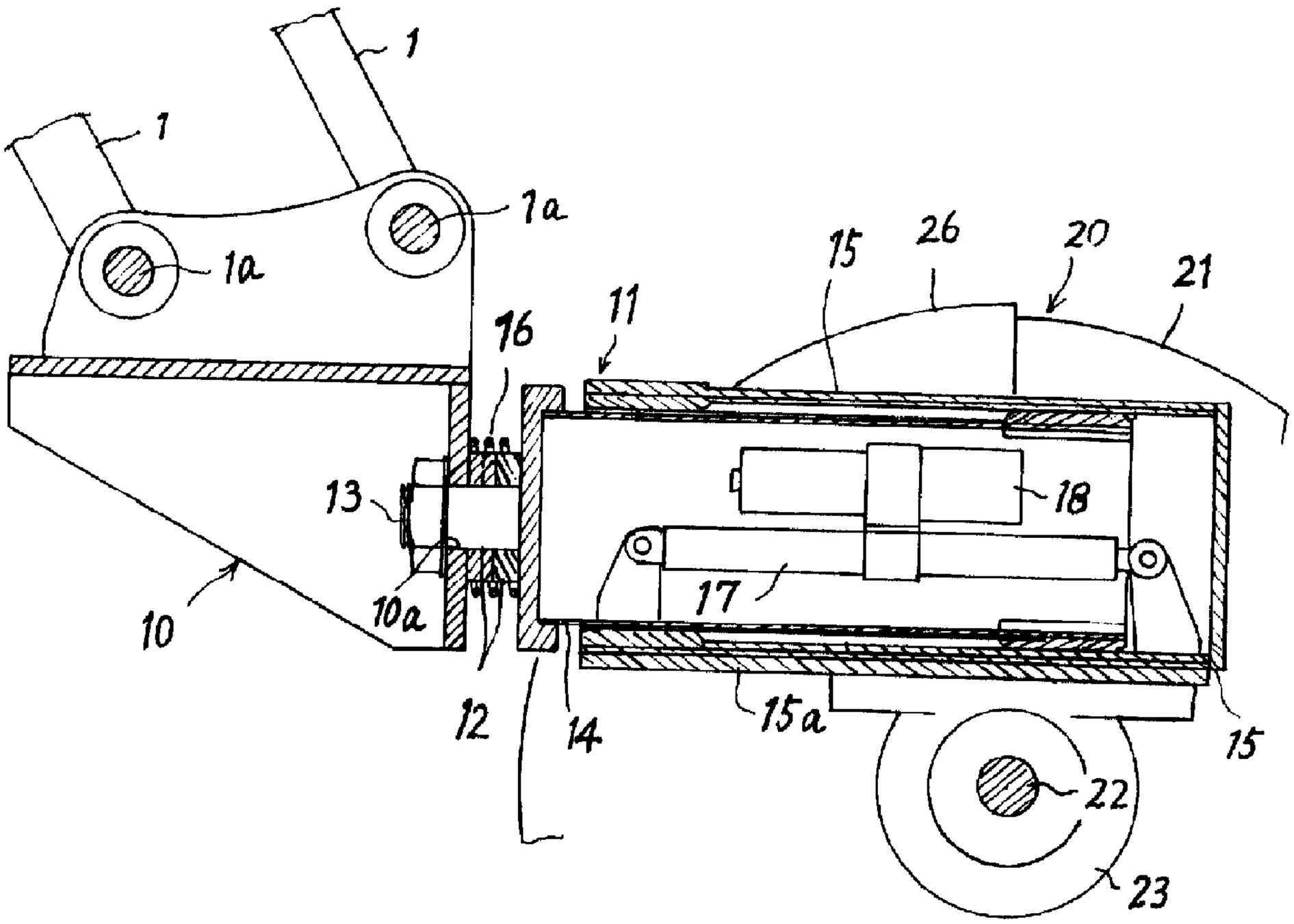

(57) Abrégé/Abstract:
A cutting machine comprising a base connected to an end of an arm of the construction machine with a pin. The cutter mounting assembly rotatable to the base, and a rotating cutter assembly mounted to the rotating cutter assembly, wherein the rotating cutter mounting assembly has a fixed portion and a movable portion, a moving device that expands and contracts in one direction being disposed on the fixed portion, a rotating cutter being disposed on the movable portion, the rotating cutter mounting assembly being rotatable to the base assembly.

ABSTRACT

A cutting machine comprising a base connected to an end of an arm of the construction machine with a pin. The cutter mounting assembly rotatable to the base, and a rotating cutter assembly mounted to the rotating cutter assembly, wherein the rotating cutter mounting assembly has a fixed portion and a movable portion, a moving device that expands and contracts in one direction being disposed on the fixed portion, a rotating cutter being disposed on the movable portion, the rotating cutter mounting assembly being rotatable to the base assembly.

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Cutting Machine

Background of the Invention

1. Field of the invention

The present invention relates to a cutting machine that is disposed at an end of an arm of a civil construction machine such as a backhoe and that is adapted for cutting a large and hard material such as a concrete pipe on site.

2. Description of the prior art

Conventionally, a desired attachment is selectively mounted to an end of an arm of a backhoe or the like so as to perform a desired civil construction work other than a work using a bucket. On a civil construction site, concrete products may be manually cut. Such a work is dangerous and thereby a worker's accident results in. To solve such a problem, the inventor of the present invention has proposed a cutting machine that can be attached to the bucket of a backhoe (as disclosed in Japanese Patent Laid-Open Publication No. 1-207507).

However, since the cutting machine is fixed to the bucket, the cutting surface direction of a rotating cutter is limited to one. Thus, the user cannot freely select the cutting surface direction of the rotating cutter.

An object of the present invention is to provide a cutting machine that is disposed at an end of an arm of a backhoe or the like and adapted for freely selecting the cutting surface angle of a rotating cutter.

Summary of the Invention

The present invention provides a cutting machine comprising a base means connected to an end of an arm, a

cutter mounting means rotatably fixed to the base means, and a rotary cutter means mounted to the cutter mounting means. The cutter mounting means has a fixed portion, a movable portion, a drive means that extends and retracts linearly and is disposed on the fixed portion. The rotary cutter is disposed on the movable portion.

The cutting machine may further comprise two angle setting means that mate with each other and that are disposed between the base means and the cutter mounting means, wherein the two angle setting means allow an angular orientation of a cutting surface of the rotating cutter means to be freely changed.

The cutting machine may alternatively further comprise a hydraulic motor disposed between the base means and the cutter mounting means, whereby an angle between a cutting surface of rotary cutter means and the base means may be freely changed by controlling a rotation of the hydraulic motor.

The cutting machine may further comprise a compression spring disposed between the base means and the cutter mounting means.

The cutter mounting means may comprise a movable outer ceratoid cylinder means and a fixed inner cylinder means. An actuator may be disposed between the outer cylinder means and the inner cylinder means, so that the outer cylinder means is traveled by the actuator and the rotating cutter is traveled at a constant speed.

The actuator may have a built-in hydraulic pump.

The actuator may be driven by a hydraulic circuit connected to an external device.

The angle setting means may comprise two angle setting plates that fit each other and that are disposed between the base means and the rotating cutter mounting means. Corresponding to the angle that is set with the two angle setting plates, the surface of the rotating cutter is freely changed. The rotary cutter mounting means may comprise a movable outer cylinder means and a fixed inner cylinder means. An actuator may be disposed between the inner cylinder means and the outer cylinder means. With the actuator, the outer cylinder means is traveled so that the rotating cutter is traveled at a predetermined speed.

When necessary, the shaft can be rotated for 30°, 45°, 90°, 120°, 180°, or the like to a reference position. The shaft can be fixed at the selected angle. At the set angle, the rotating cutter is traveled in the extended direction of the axis line so as to cut a concrete product/material or the like. Thus, the cutting machine according to the present invention allows the user to much safely perform a civil construction work than a manual cutting machine. In addition, since the rotating cutter is stably traveled at a constant speed, an excessive load is not applied to the rotating cutter. Thus, the blade of the rotating cutter can be prevented from being broken.

Brief Description of the drawings

FIG. 1 is a sectional view of a cutting machine comprises a base means, a rotating cutter mounting means and a rotating cutter means of the present invention;

FIG. 2 is a right side view of a cutting machine;

FIG. 3 is a left side view of a cutting machine;

FIG. 4 is a perspective view of a pair of the angle setting means; and

FIG. 5 is a top plan view of a rotating cutting means of the present invention.

Description of the preferred embodiment

In Fig. 1, reference numeral 1 represents two arm end portions of a construction machine such as a backhoe. With two pins 1a, a link is formed. Reference numeral 10 represents a base means. The base means 10 forms a supporting portion for a pin that mounts a rotating cutter mounting means 11 to the arm end portions 1. A hole 10a is formed at a lower position of the base means 10. The hole 10a allows the rotating cutter mounting means to be rotatably fixed. As shown in Fig. 1, the rotating cutter mounting means 11 is composed of an inner ceratoid cylinder portion 14 and an outer ceratoid cylinder portion 15. A center bolt means 13 is disposed on one end of the inner ceratoid cylinder portion 14. The center bolt means 13 fits the hole 10a of the base means 10. Two angle setting plates 12 are

mounted on the center bolt means 13 in such a manner that the two angle setting plates 12 fit each other. The first angle setting plate 12 is fixed to the base means 10. The second angle setting plate 12 is fixed to the rotating cutter mounting means 11.

As shown in Fig. 4, one of the angle setting means 12 has concave portions 12a formed at intervals of 90°. The other angle setting means 12 has convex portions 12b formed at intervals of 90°. The concave portions 12a of the angle setting means 12 fit the convex portions 12b of the angle setting means 12. Thus, the angle setting means 12 can be rotated at intervals of 90°. When the concave portions 12a of one angle setting means 12 fit the convex portions 12b of the other angle setting means 12, the angle position is fixed. It should be noted that the angles of intervals of the concave portions 12a and the convex portions 12b can be freely set. For example, the concave portions 12a and the convex portions 12b may be formed at intervals of 15°, 30°, or 45°. When the angle of the intervals of the concave portions 12a and the convex portions 12b is 15°, the number of the concave portions 12a and the convex portions 12b is 24 each. When the angle of the intervals of the concave portions 12a and the convex portions 12b is 30°, the number of the concave portions 12a and the convex portions 12b is 12 each. When the angle of the intervals of the concave portions 12a and the convex portions 12b is 45°, the number of the concave portions 12a and the convex portions 12b is 8 each.

In Fig. 1, a compression spring 16 is disposed between the base means 10 and the rotating cutter mounting means 11. When a nut 10 is loosened, the compression spring 16 causes the angle setting means 12 to separate. Thus, the angle of the rotating cutter mounting means 11 can be easily changed.

Alternatively, a hydraulic motor may be disposed between the base means 10 and the rotating cutter mounting means 11 so as to variably set the angle of the rotating cutter mounting means 11. A part of the hydraulic motor circuit (for example,

an operation lever) may be disposed in a construction machine. In this case, the user can operate the operation lever in the operator cab of the construction machine so as to drive the hydraulic motor.

One end of an expanding/contracting actuator 17 is fixed to the inner ceratoid cylinder portion 14 that is fixed. The other end of the expanding/contracting actuator 17 is fixed to the outer ceratoid cylinder portion 15 that is movable. The expanding/contracting actuator 17 is a linear actuator (Kayaba Kogyo. K.K., trade mark "Mini Motion Package"). The linear actuator is composed of a hydraulic circuit and a metal cover that houses the hydraulic circuit. The hydraulic circuit is composed of a cylinder portion, an electric motor, a hydraulic pump, a valve, an oil tank, and so forth.

Thus, the expanding and contracting operations of the actuator 17 cause the outer ceratoid cylinder portion 15 to expand and contract against the inner ceratoid cylinder portion 14. The actuator 17 is driven by a built-in hydraulic pump 18 with a power supply of 12 V. To allow the outer ceratoid cylinder portion 15 to smoothly move against the inner ceratoid cylinder portion 14, a member that has high wearing resistance and high sliding characteristic is disposed between the outer ceratoid cylinder portion 15 and the inner ceratoid cylinder portion 14.

A rotating cutter assembly 20 is disposed on one side of the outer ceratoid cylinder portion 15. As shown in Figs. 1 and 5, the rotating cutter assembly 20 is composed of a rotating shaft 22, two bearings 23, a hydraulic motor 24, and a belt 25 that are disposed on a base plate 15a. A rotating cutter blade 21 is disposed on one end of the rotating shaft 22. The two bearings 23 bear the rotating shaft 22. The two bearings 23 are fixed with bolts 23a. The belt 23a transmits the motion of the hydraulic motor 24 to the rotating shaft 22. To prevent the user from getting injured with the motion of the belt 25, a cover 33 is fixed to the base plate 15 with bolts 34. A semi-

circular cover 26 is disposed in the vicinity of the rotating cutter blade 21 so as allow the user to safely operate the cutting machine. The outer diameter of the rotating cuter blade 21 is around 50 cm to 200 cm. The cover 26 is held by a stay 31 disposed on the base plate 15a. To give off heat of the rotating cutter blade 21, a spray shower 27 is disposed. The spray shower 27 sprays water to the edge of the rotating cutter blade 21. The hydraulic pressure of the hydraulic motor 24 may be supplied from the main body of the construction machine. The bearings 23 can be moved with push screws 28 so as to adjust the tension of the belt 25.

To form the rotating cutter assembly 20, each part thereof may be disposed on a base plate 29 instead of the base plate 15a so as to allow the rotating cutter assembly 20 to be removed from the outer ceratoid cylinder portion 15.

Thus, as shown in Fig. 1, in the cutting machine disposed at an end of the arm of the construction machine, after the angle of the cutting machine is set with the angle setting plates 12, the expanding/contracting speed of the actuator 17 is selected corresponding to the material of a work material. Thus, the rotating cutter blade 21 is linearly traveled to the maximum stroke of the actuator 17 so as to cut a concrete product or the like. When the cutting depth is changed, as with the bucket moving operation, the positions of the pins at the end of the arm of the construction machine are changed by adjusting the hydraulic valve.

In this case, the hydraulic circuit of the actuator may have a circuit that causes the actuator to expand at high speed and to contract at low speed. The cutting depth may be automatically set corresponding to output signals of various sensors disposed in the cutting machine. In addition, when the actuator extends to a predetermined stroke, the operation of the spray shower and the rotation of the rotating cutter may be stopped so as to reduce noise and dangers of the cutting machine.

As described above, the present invention is a cutting machine comprising a base means connected to an end of an arm with a pin, a cutter mounting means rotatable to the base means, and a rotating cutter means mounted to the rotating cutter means, wherein the rotating cutter mounting means has a fixed portion and a movable portion, a moving means that expands and contracts in one direction being disposed on the fixed portion, a rotating cutter being disposed on the movable portion, the rotating cutter mounting means being rotatable to the base means. Thus, the cutting surface of the rotating cutter is not limited to one unlike with the conventional cutting machines. Since the cutting surface can be freely set, a work material such as a concrete pipe can be cut at a right angle. In addition, when concrete pipes are connected in an L letter shape, the connected portion can be cut at 45°. Thus, the cutting machine according to the present invention allows the user to much safely perform a civil construction work than a manual cutting machine. In addition, since the rotating cutter is stably traveled at a constant speed, an excessive load is not applied to the rotating cutter. Thus, the blade of the rotating cutter can be prevented from being broken.

Although I have described a preferred embodiment and alternatives thereof of the invention herein, it is understood that it is not to be limited thereto, except in so far as such limitations are included in the following claims and allowable functional equivalents thereof.

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CLAIMS:

1. A cutting machine comprising:

(A) a base means connected to an end of an arm;

(B) a cutter mounting means rotatably fixed to the base means, wherein the cutter mounting means comprises;

a fixed inner cylinder portion;

a movable outer cylinder portion fitted over the inner cylinder portion for slidably moving thereon; and

a drive means that extends and retracts linearly and is disposed on the fixed inner cylinder portion;

(C) a rotary cutter means mounted to the outer cylinder portion of the cutter mounting means; and

(D) a pair of angle setting means which mate with each other and are disposed between the base means and the cutter mounting means, whereby the pair of angle setting means allow an angular orientation of a cutting surface of the rotary cutter means to be freely changed.

2. The cutting machine as claimed in claim 1, wherein the pair of angle setting means (D) comprise;

a compression spring disposed between the base means and the cutter mounting means;

a first angle setting plate having concave portions formed at an angular interval of 15°, 30°, 45° or 90°; and

a second angle setting plate having convex portions for mating with the concave portions and formed at an angular interval of 15°, 30°, 45° or 90°.

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3. The cutting machine as claimed in claim 1 or 2, wherein the drive means is a built-in actuator comprising:

a first end fixed to the inner cylinder portion;

a second end fixed to the outer cylinder portion; and

a built-in pump for fluidically driving the actuator to extend and retract.

4. The cutting machine as claimed in claim 1 or 2, wherein the drive means is a built-in actuator comprising:

a first end fixed to the inner cylinder portion;

a second end fixed to the outer cylinder portion; and

an external pump for fluidically driving the actuator to extend and retract.

5. The cutting machine as claimed in claim 3 or 4, wherein the rotary cutter means comprises;

a rotatable shaft;

bearings supporting the rotatable shaft;

a hydraulic motor;

a belt for transmitting rotary motion from the hydraulic motor to the rotatable shaft; and

a rotatable cutter blade disposed on the rotatable shaft.

6. The cutting machine as claimed in claim 5, wherein the rotary cutter means further comprises;

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a spray shower disposed on a cover of the rotatable cutter blade so as to spray water to a cutting surface of the rotatable cutter blade.

7. The cutting machine as claimed in claim 6, wherein the spray shower comprises;

means for stopping an operation of the spray shower so as to reduce noise of the cutting machine when the built-in actuator extends to a predetermined extent.

8. The cutting machine as claimed in claim 5, wherein the rotary cutter means further comprises;

means for stopping a rotation of the rotatable cutting blade so as to reduce noise and dangers of the cutting machine when the built-in actuator extends to a predetermined extent.

9. A cutting machine comprising:

(A) a base means connected to an end of an arm;

(B) a cutter mounting means rotatably fixed to the base means and comprising:

a fixed assembly;

a movable assembly; and

a drive means that extends and retracts linearly and has one end fixed to the fixed assembly;

(C) a rotary cutter means mounted to the cutter mounting means and disposed on the movable assembly; and

(E) a hydraulic motor disposed between the base means and the cutter mounting means, whereby an angle between a cutting surface of the rotary cutter means and the

base means is freely changed by controlling a rotation of the hydraulic motor.

10. The cutting machine as claimed in claim 9, which further comprises a pair of angle setting means having a compression spring disposed between the base means and the cutter mounting means.

11. The cutting machine as claimed in claim 9 or 10, wherein:

the fixed assembly comprises and inner ceratoid cylinder; and

the movable assembly comprises an outer ceratoid cylinder.

12. The cutting machine as claimed in any one of claims 9 to 10, wherein the drive means is a built-in actuator comprising:

a first end fixed to the fixed assembly;

a second end fixed to the movable assembly; and

a built-in pump.

13. The cutting machine as claimed in any one of claims 9 to 10, wherein the drive means is a built-in actuator comprising:

a first end fixed to the fixed assembly;

a second end fixed to the movable assembly; and

an external pump.

14. The cutting machine as claimed in claim 12 or 13, wherein the rotary cutter means comprises;

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a rotatable shaft;

bearings supporting the rotatable shaft;

a hydraulic motor;

a belt for transmitting rotary motion from the hydraulic motor to the rotatable shaft; and

a rotatable cutter blade disposed on the rotatable shaft.

15. The cutting machine as claimed in claim 14, wherein the rotary cutter means further comprises;

a spray shower disposed on a cover of the rotatable cutter blade so as to spray water to a cutting surface of the rotatable cutter blade.

16. The cutting machine as claimed in claim 15, wherein the spray shower comprises;

means for stopping an operation of the spray shower so as to reduce noise of the cutting machine when the built-in actuator extends to a predetermined extent.

17. The cutting machine as claimed in claim 14, wherein the rotary cutter means further comprises;

means for stopping a rotation of the rotatable cutting blade so as to reduce noise and dangers of the cutting machine when the built-in actuator extends to a predetermined extent.

18. The cutting machine as claimed in any one of claims 1 to 17, wherein the base means (A) is connected to an end of an arm of a construction machine by pins; and the cutting machine is adapted to cut a concrete pipe.

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19. The cutting machine as claimed in claim 18, wherein the construction machine is a backhoe.

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Fig. 1

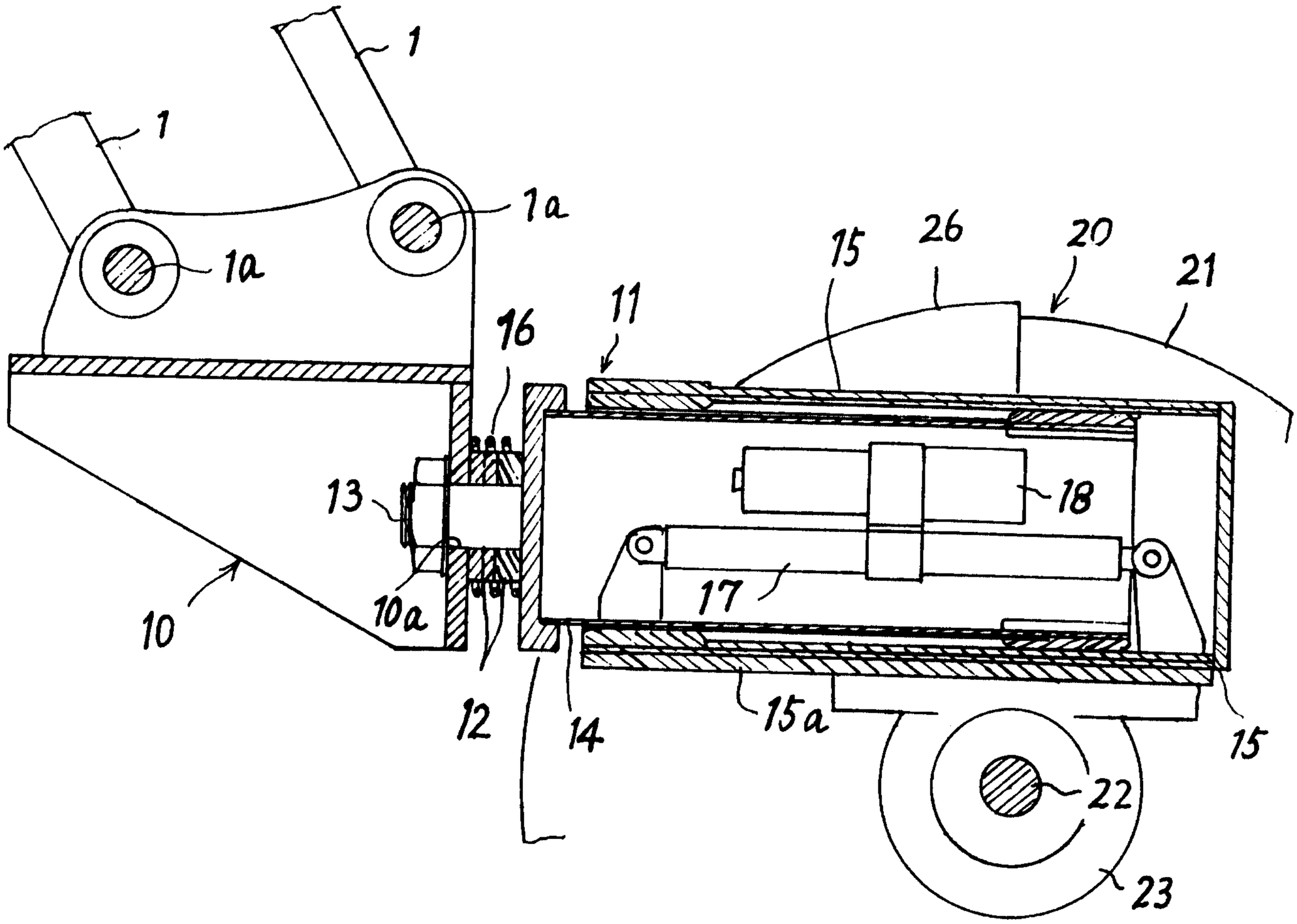

Fig. 2

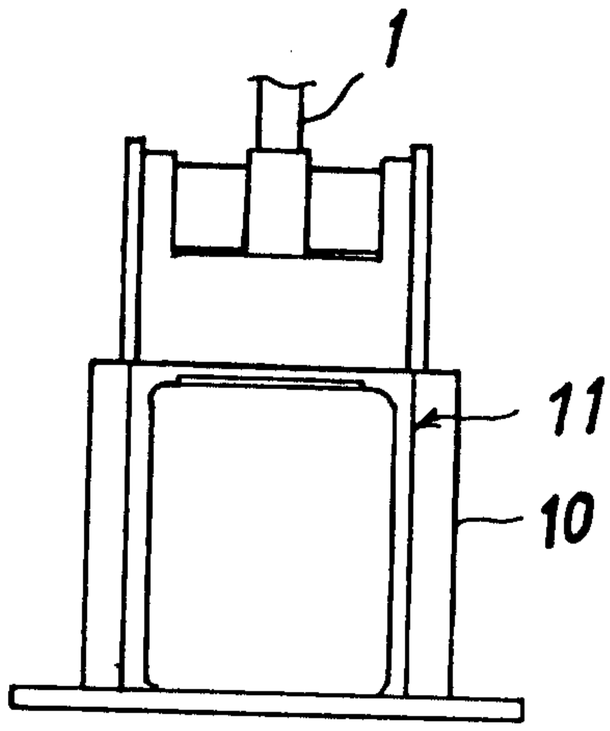

Fig. 3

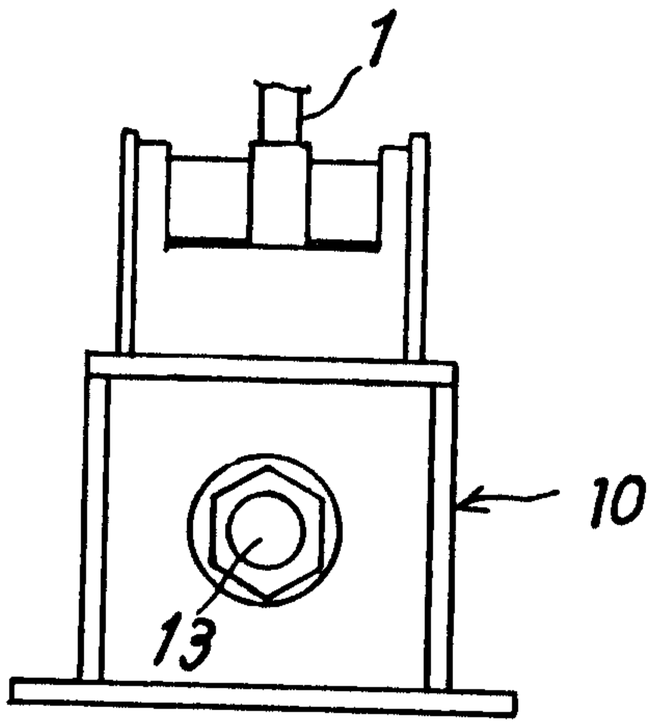

Fig. 4

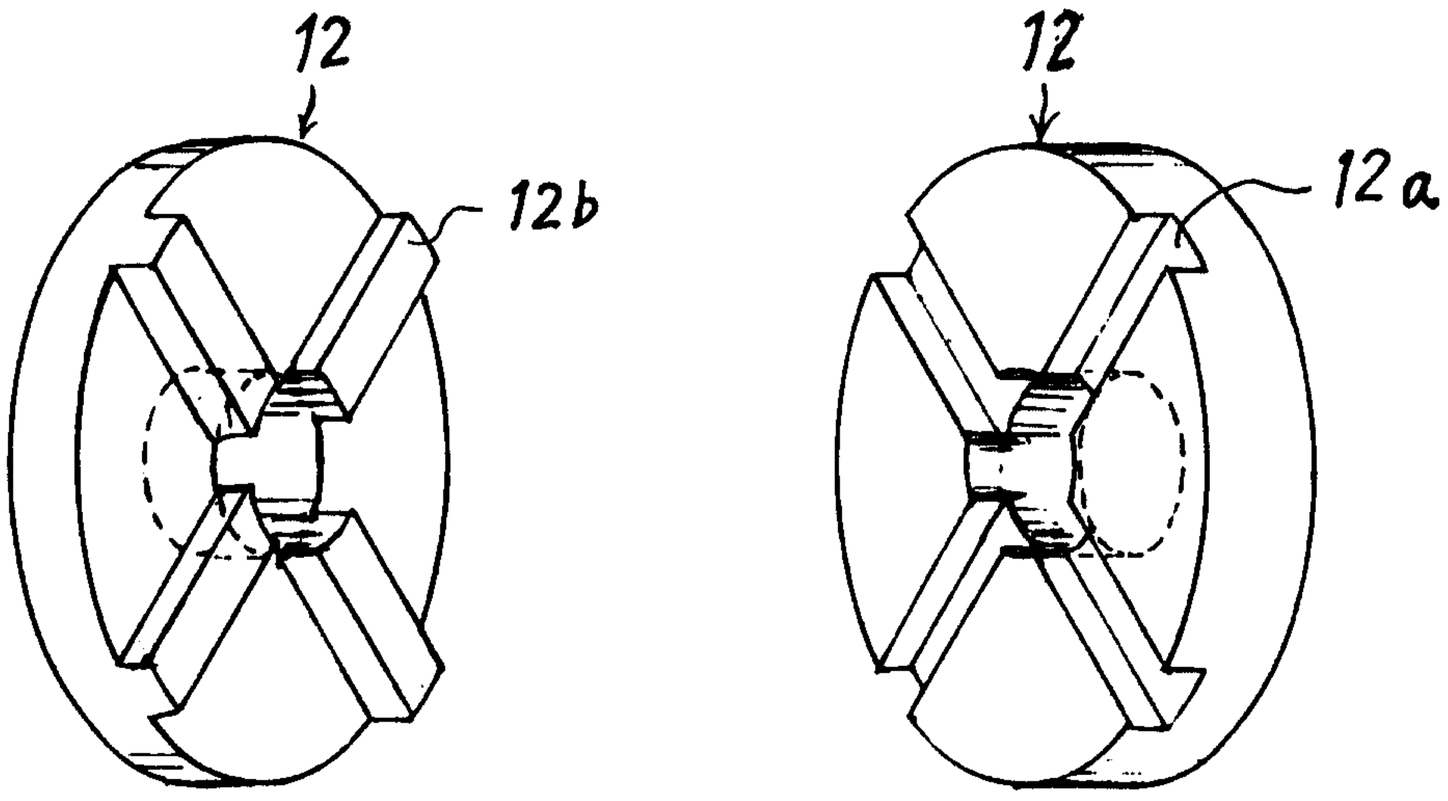
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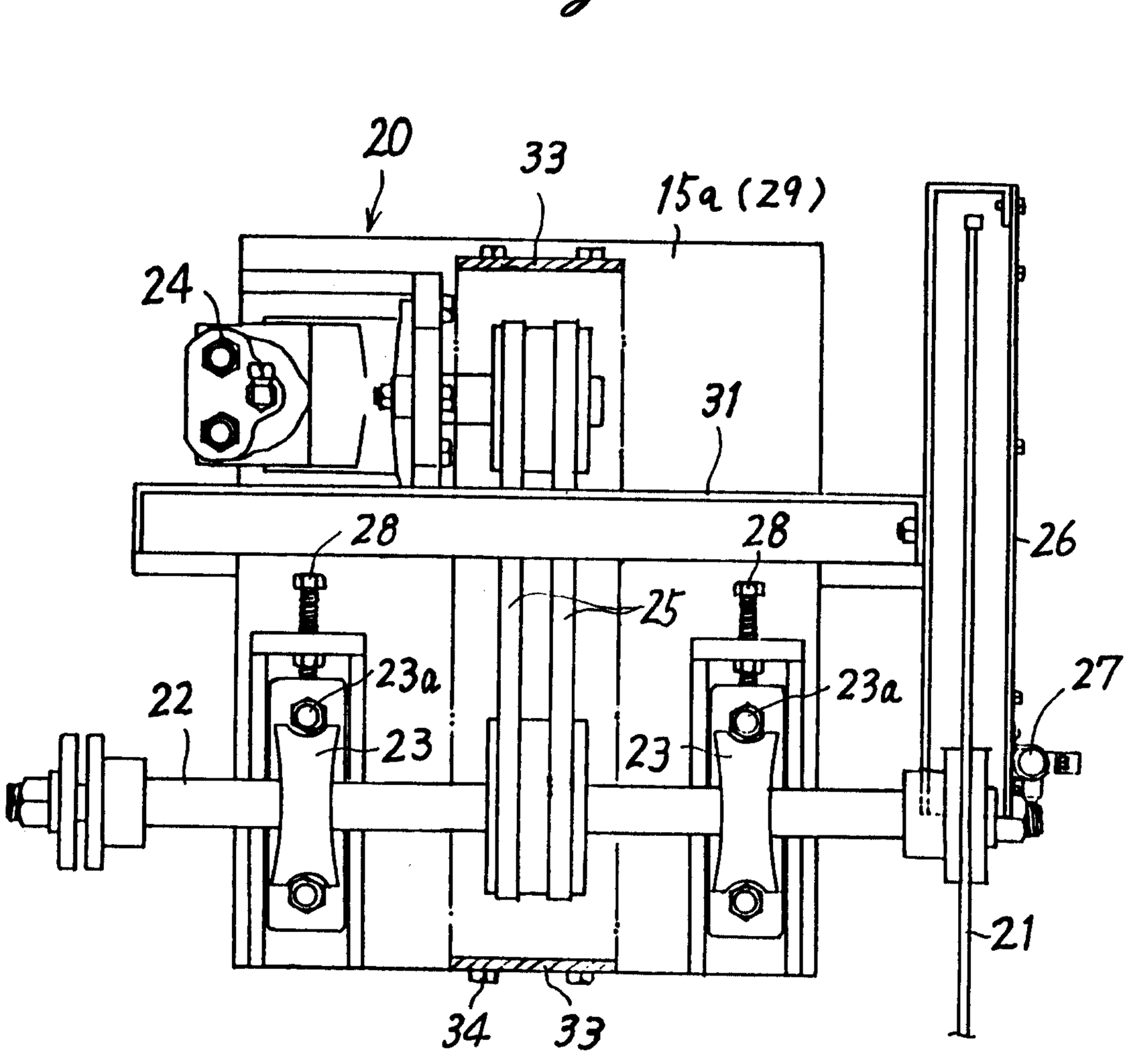
Fig. 5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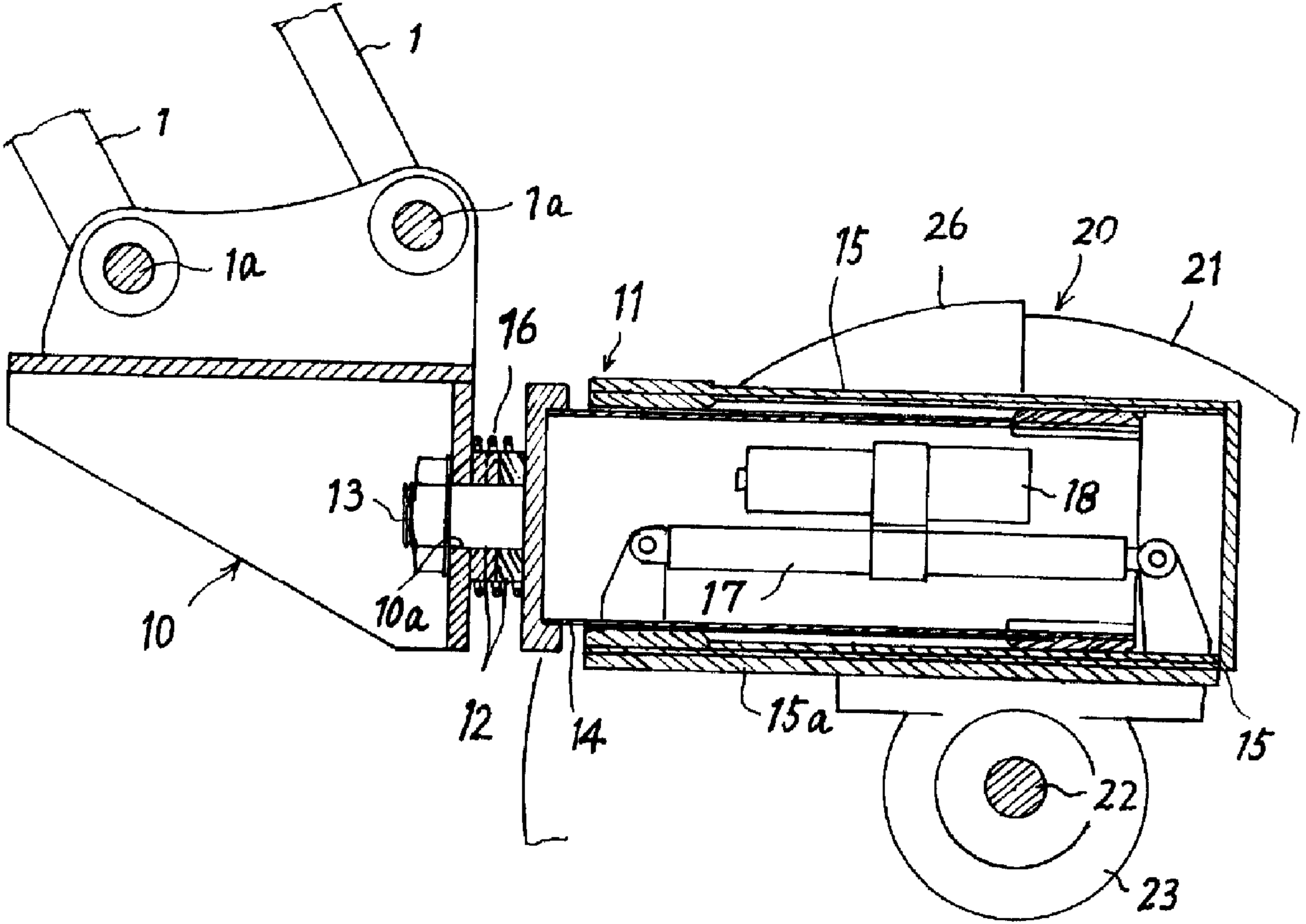
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