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(72) Inventor: **Bassett, Alexander Anthony Denny**
Kenilworth, Warwickshire CV8 2RU (GB)

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(74) Representative: **Evans, Huw David Duncan**
Chapman Molony
Cardiff Business Technology Centre
Senghennydd Road
Cardiff, South Wales CF24 4AY (GB)

(71) Applicant: **HOOVER LIMITED**
Merthyr Tydfil South Wales CF48 4TU (GB)

(54) **Vacuum cleaner**

(57) An upright vacuum cleaner comprises a floor-engaging head portion 11 having a dirty air inlet 12, an upright body portion 10 pivotably mounted to the floor-engaging head portion 11 for movement between parked and in-use positions, an agitator 13 rotatably mounted across the dirty air inlet 12, a motor for driving the agitator via motor shaft 14, a pulley assembly 15 pivotably mounted for rotation between first and second positions about an axis which extends parallel to the axes of rotation of the agitator 13 and motor shaft 14, the assembly 15 in-

cluding an idler pulley 16 connected to the motor shaft 14 by a first drive belt 18 and to the agitator 13 by a second drive belt 19, the idler pulley 16 being mounted for rotation about an axis which is offset from the axis of rotation of the assembly 15, and an externally-operable foot pedal 30. In use, the pulley assembly 15 is pivoted into the second position by a rotary member 22 to disconnect the drive between the motor shaft 14 and the agitator 13 when the upright body portion 10 is in its parked position or when the externally-operable foot pedal 30 is operated.

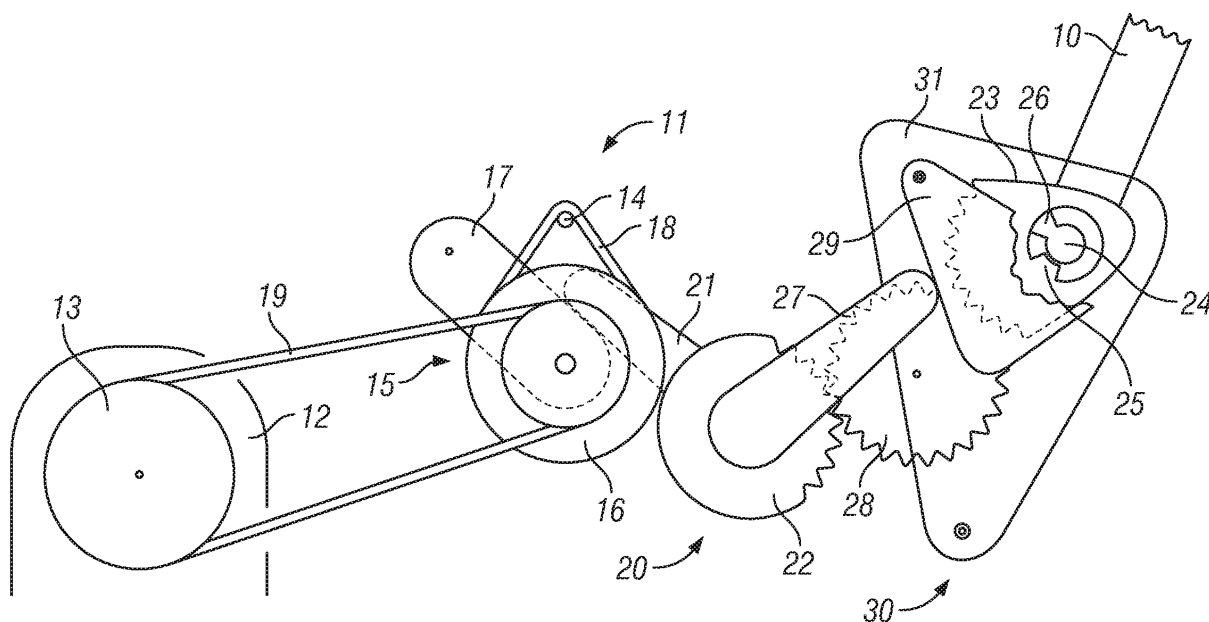


FIG. 1

Description

[0001] This invention relates to a vacuum cleaner.

[0002] Known vacuum cleaners are either of the so-called upright type or the so-called cylinder type. A typical upright vacuum cleaner comprises an upright portion pivotally connected at its lower end to a wheeled floor-engaging portion for partial rotation forwardly and rearwardly about a transverse axis. The floor-engaging portion encloses a motor/fan unit which draws air into a dust separation device through an inlet in the floor-engaging portion of the cleaner. A handle is provided at the upper end of the upright portion for pushing the cleaner to and fro. A motor-driven rotary agitator brush is mounted across the inlet in the floor-engaging portion to beat and sweep the floor in the region of the airflow into the cleaner. The rotary agitator brush is driven by a belt interconnecting the motor spindle and a pulley on the agitator.

[0003] The use of high-speed motor/fan units in modern vacuum cleaners has necessitated reduction gearing in the agitator drive to achieve acceptably low rotational speed of the agitator. A two-belt transmission system is commonly used to effect this speed reduction, whereby a primary belt connects the motor spindle to a large-diameter pulley, which is rotationally fixed to a small-diameter pulley, the small-diameter pulley driving the agitator by way of a secondary belt.

[0004] A typical cylinder vacuum cleaner comprises a body which encloses a motor/fan unit which draws air into a dust separation device through an elongate flexible hose. A plurality of tools are provided for fitting to the end of the hose.

[0005] Upright vacuum cleaners are better at cleaning carpets than cylinder vacuum cleaners because of the action of the rotating agitator brush. However, cylinder vacuum cleaners are better suited for above-floor cleaning and for cleaning in places where an upright cleaner cannot be used.

[0006] In order to provide a cleaner having the advantages of both upright and cylinder cleaners, it is known to provide an upright cleaner having an elongate flexible hose which can either be connected to the floor-engaging portion of the cleaner for conventional floor cleaning, or connected to an extension tube and/or cleaning tools for above-floor cleaning.

[0007] When performing above-floor cleaning, whilst the cleaner is stationery, it is desirable to stop the rotation of the agitator, partly to prevent the agitator from running against the same point on the floor and partly to alleviate any risk that the rotation will be inhibited and the cleaner damaged. Accordingly, various ways of selectively engaging/disengaging the agitator drive have been proposed. Most commonly, this has been achieved by lateral shifting of the agitator drive belt onto a free-running idler pulley.

[0008] GB2196836 discloses a two-belt agitator drive whereby a freely-rotating idler pulley is present on an intermediate shaft, and a mechanical arrangement pro-

vided to shift the belt laterally onto the idler pulley to disengage the drive. The belt-shifting is affected by a shifting fork having a pair of arms that enclose the belt. The position of the shifting fork is determined by whether the upright cleaner body is in its upright position (i.e. parked or in use for above-floor cleaning with a hose) or is inclined for floor cleaning. The position is also determined by the momentary setting of an agitator stop pedal mounted on the floor-engaging portion of the cleaner

[0009] The arrangement described in GB 2196536 makes considerable demands on space within the floor-engaging portion of the cleaner for reason of the requirement to shift the belt laterally. A more compact construction can be achieved by mounting the speed-reduction pulley assembly on an arm pivoted about an axis which extends parallel to the rotational axis of the motor and agitator. US 2006/0174439 discloses one such construction in which the pivoted arm pivots in response to the operator pressing a pedal on the cleaner body, such that the axis of the speed-reduction pulley is shifted away from the agitator and closer to the motor spindle: this is possible by virtue of the secondary drive belt being resilient. Tension in the non-resilient primary drive belt is thus relieved and the drive interrupted.

[0010] United Kingdom patent GB 2089463 discloses an agitator drive system for an upright vacuum cleaner incorporating two drive belts and a speed-reduction pulley unit mounted on a pivoted arm. The primary belt is of resilient material. Should rotation of the agitator become blocked during use, increased tension in the secondary belt causes the speed-reduction pulley unit to be pulled towards the agitator, the resilience of the primary belt permitting this movement, with the result that the secondary belt is relieved of tension. Stalling of the motor shaft on occurrence of a blocked agitator is thus avoided, and the danger of burned-through or broken belts substantially eliminated.

[0011] The object of the present invention is to provide an agitator control system for an upright vacuum cleaner whereby on/off switching of the agitator, without switching of the motor, is automatically effected in response to inclination of the upright body of the cleaner, and can also be effected independently of the inclination of the cleaner body by means of a pedal, the agitator drive further providing immunity from belt damage and motor stalling in the event of agitator blockage.

[0012] We have now devised a vacuum cleaner which meets the above-mentioned objectives.

[0013] In accordance with this invention, there is provided a vacuum cleaner comprising:

a floor-engaging head portion having a dirty air inlet;
an upright body portion pivotably mounted to the floor-engaging head portion for movement between parked and in-use positions;
an agitator rotatably mounted across the dirty air inlet;
a motor for driving the agitator;

a pulley assembly pivotably mounted for rotation between first and second positions about an axis which extends parallel to the axes of rotation of the agitator and motor, the assembly including an idler pulley connected to the motor by a first drive belt and to the agitator by a second drive belt, the idler pulley being mounted for rotation about an axis which is offset from the axis of rotation of the assembly, and an externally-operable actuator, wherein the pulley assembly is pivotable into said second position to disconnect the drive between the motor and the agitator in when the upright body portion is in said position or when said externally-operable actuator is operated.

[0014] In this manner the above-mentioned objects of the present invention are met.

[0015] Preferably, the drive between the motor and the agitator is disconnected by pivoting the pulley assembly into said second position, such that the axis of rotation of the pulley moves away from the motor and towards the agitator to slacken said second belt, said first belt being resiliently extendable.

[0016] Preferably a displacement means acts on the assembly to move the latter into said second position, the assembly preferably being arranged to return to said first position under the applied bias of said first belt.

[0017] Preferably the displacement means pivotably mounted to the floor-engaging head portion and is arranged to be rotationally driven by said upright body portion or said actuator to disconnect the drive between the motor and the agitator.

[0018] Preferably, the displacement means is geared to an operating gear rotationally coupled to said upright body portion, the coupling preferably being arranged to permit the upright body portion to pivot independently of the operating gear when said externally-operable actuator is operated.

[0019] Preferably, the displacement means is geared to the operating gear via an intermediate gear.

[0020] Preferably the externally-operable actuator acts directly the displacement means.

[0021] Preferably the actuator comprises an portion for engagement by the user and an operating portion which acts on the displacement means, said engagement portion being biased away from the operating portion into a rest position, said operating portion being moveable by said engagement portion and being lockable in position by a toggle mechanism when said engagement portion returns to said rest position under the applied bias. In this manner the actuator does not visibly move as the displacement means is operated by the pivoting of the upright portion of the cleaner.

[0022] An embodiment of the present invention will now be described by way of an example only and with reference to the accompanying drawings, in which:

Figure 1 is a schematic side view of the agitator

mechanism of an upright vacuum cleaner in accordance with this invention, when configured for floor cleaning; and

Figure 2 is a schematic side view of the agitator mechanism of Figure 1, when configured for above-floor cleaning.

[0023] Referring to Figure 1 of the drawings, there is shown an upright vacuum cleaner comprising an upright portion 10 pivotally connected at its lower end to a floor-engaging portion 11 for partial rotation forwardly and rearwardly about a transverse axis between parked and in-use positions (Figures 1 and 2 respectively). The floor-engaging portion comprises a dirty air inlet 12 which is connected to a suction source (not shown). A rotary agitator 13 is mounted across the dirty air inlet 12 for beating and sweeping the floor surface.

[0024] A motor drives the agitator via motor output shaft 14. The motor preferably also drives a fan unit (not shown) which creates the suction at the dirty air inlet 12. A pulley assembly 15 comprises an arm 17 which is pivotably mounted at one end to the floor-engaging portion 11 for rotation between first and second positions about an axis which extends parallel to the axes of rotation of the agitator 13 and motor shaft 14. An idler pulley 16 is rotationally mounted to the opposite end of the arm 17. The idler pulley 16 comprises a first axial portion connected to the motor shaft 14 by a first drive belt 18 and a second axial portion which is connected to the agitator 13 by a second drive belt 19. The diameter of the first axial portion is greater than the diameter second axial portion, so as to reduce the drive speed to the second belt 19. The first belt 18 is formed of a resiliently extendable elastomeric material and the belt 18 acts on the rotatable pulley assembly 15 to bias it in a counter-clockwise direction into the first position shown in Figure 1. The bias also acts to pull the second belt 19 into a taught condition so that the motor drive is applied to the agitator 13 via the pulley 16.

[0025] A displacement member 20 is pivotably mounted to the floor-engaging head portion 11. The displacement member 20 comprises a projecting arm 21 which abuts the outer end of the arm 17 of the pulley assembly 15 and which extends radially from a toothed drive wheel 22. The toothed drive wheel 22 is geared via an intermediate gear 28 to an operating gear 23 which is freely rotationally mounted on the support axle 24 of the upright body portion 10. The operating gear 23 comprises a radially inwardly projecting lug 25 which only engages a radially outwardly projecting lug 26 on the axle 24 in the last 20 degrees of movement as the upright portion 10 is brought into the fully upright position.

[0026] The displacement member 20 comprises a second projecting arm 27 which abuts an engagement member 29 of a foot pedal assembly 30. The foot pedal assembly 30 further comprises a pivotable member 31 for operation by the user's foot. A spring (not shown) acts between the operating and engagement members 29,31

to bias the pivotable engagement member 31 outwardly (to the right as shown in Figure 1) into a rest position. The spring also acts to bias the engagement member 29 against the second projecting arm 27. In this manner the actuator 30 does not visibly move as the displacement member 22 is operated by the pivoting of the upright portion 10 of the cleaner.

[0027] Referring to Figure 2 of the drawings, when the operating member 31 of the foot pedal assembly 30 is pushed inwardly, it acts on the engagement member 29 of the assembly 30 and rotates the second projecting arm 27 of the displacement member 20 in a counter-clockwise direction, thereby causing the first projecting arm 21 of the displacement member 20 to bear against the arm 17 of the pulley assembly 15, thereby causing the assembly 15 to pivot in a clockwise direction. The first belt 18 stretches as the assembly pivots and the second belt 19 slackens on the pulley 16, thereby removing the drive to the agitator 13. A toggle catch (not shown) holds the engagement member 29 of the foot pedal assembly 30 in the operated position when the operating member 31 of the foot pedal assembly 30 is released to return to the rest position under the spring bias. Further actuation of the operating member 31 releases the toggle catch.

[0028] It will be appreciated that the above-mentioned rotation of the displacement member 20 is also transmitted to the operating gear 23 via the intermediate gear 28. However, the operating gear 23 is free to rotate in the counter-clockwise direction due to the arrangement of the lugs 25, 26. The arrangement of the lugs 25, 26 also allow the upright portion 10 to be pivoted down independently of the operating gear 23 when the actuator 30 is operated to disconnect the agitator as shown in Figure 2.

[0029] When the actuator 30 is operated to release the agitator and engage the drive, the assembly returns to the configuration of Figure 1 under the applied bias of the drive belt 18. However, as the upright portion 10 is be pivoted upwardly into the parked or upright position, the lugs 25, 26 engage in the last 20 degrees of movement to rotate the operating gear 23 in the counter-clockwise direction. This movement then drives the displacement member 20 in the counter-clockwise direction via the intermediate gear 28, so that the drive to the agitator is again disconnected. Whilst the engagement member 29 of the foot pedal assembly 30 also moves, the movement is not visibly transmitted to the operating member 31 of the foot pedal assembly due to the spring acting therebetween.

[0030] A vacuum cleaner in accordance with this invention is uncomplicated in construction yet provides an agitator control system whereby on/off switching of the agitator, without switching of the motor, is automatically effected in response to inclination of the upright body of the cleaner, and can also be effected independently of the inclination of the cleaner body by means of a pedal, the agitator drive further providing immunity from belt damage and motor stalling in the event of agitator block-

age.

Claims

1. A vacuum cleaner comprising:

a floor-engaging head portion having a dirty air inlet; an upright body portion pivotably mounted to the floor-engaging head portion for movement between parked and in-use positions; an agitator rotatably mounted across the dirty air inlet; a motor for driving the agitator; a pulley assembly pivotably mounted for rotation between first and second positions about an axis which extends parallel to the axes of rotation of the agitator and motor, the assembly including an idler pulley connected to the motor by a first drive belt and to the agitator by a second drive belt, the idler pulley being mounted for rotation about an axis which is offset from the axis of rotation of the assembly, and an externally-operable actuator, wherein the pulley assembly is pivotable into said second position to disconnect the drive between the motor and the agitator in when the upright body portion is in said parked position or when said externally-operable actuator is operated.

2. A vacuum cleaner as claimed in claim 1, in which the drive between the motor and the agitator is disconnected by pivoting the pulley assembly into said second position, such that the axis of rotation of the pulley moves away from the motor and towards the agitator to slacken said second belt, said first belt being resiliently extendable.

3. A vacuum cleaner as claimed in claims 1 or 2, in which displacement means acts on the assembly to move the latter into said second position,

4. A vacuum cleaner as claimed in claim 3 as appended to claim 2, in which assembly is arranged to return to said first position under the applied bias of said first belt.

5. A vacuum cleaner as claimed in claims 3 or 4, in which said displacement means is pivotably mounted to the floor-engaging head portion and is arranged to be rotationally driven by said upright body portion or said actuator to disconnect the drive between the motor and the agitator.

6. A vacuum cleaner as claimed in claim 5, in which said displacement means is geared to an operating gear rotationally coupled to said upright body portion.

7. A vacuum cleaner as claimed in claim 6, in which the operating gear is rotationally coupled by a coupling arranged to permit the upright body portion to pivot independently of the operating gear when said externally-operable actuator is operated. 5
8. A vacuum cleaner as claimed in claims 6 or 7, in which the operating gear is rotationally coupled to the displacement means via an intermediate gear. 10
9. A vacuum cleaner as claimed in any of claims 3 to 8, in which the externally-operable actuator acts directly the displacement means.
10. A vacuum cleaner as claimed in claim 6, in which the actuator comprises an portion for engagement by the user and an operating portion which acts on said displacement means, said engagement portion being biased away from the operating portion into a rest position, said operating portion being moveable by said engagement portion and being lockable in position by a toggle mechanism when said engagement portion returns to said rest position under the applied bias. 15 20 25

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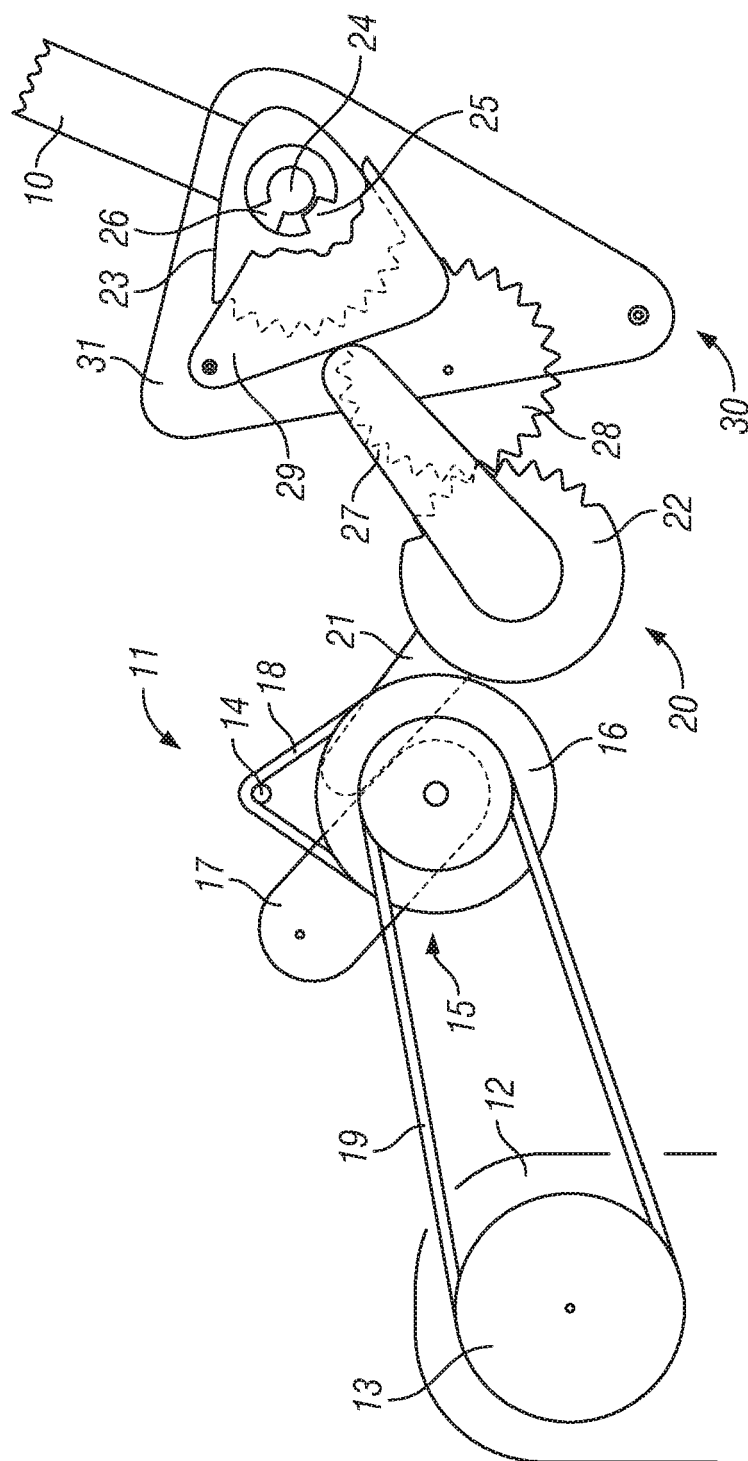


FIG. 1

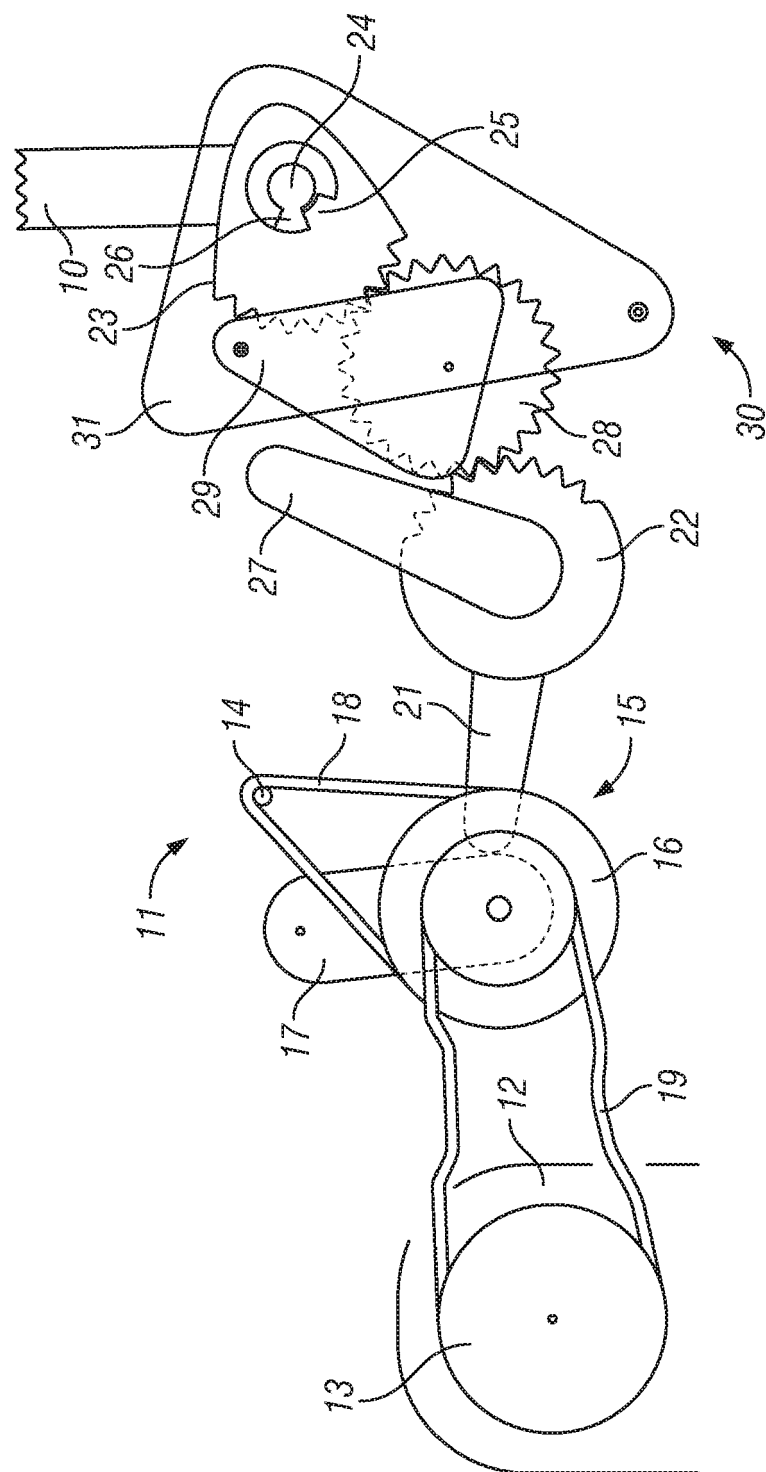


FIG. 2

REFERENCES CITED IN THE DESCRIPTION

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