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[54] Title: DEVICE FOR AUTOMATICALLY ADJUSTING ROLLER PRESSURE IN RICE-HULLING MACHINE

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[73] Assignee (s): NONE

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4,393,762 7/1983

[57] A B S T R A C T

The present invention relates to a device for automatically adjusting roller pressure in a rice hulling machine comprising a stationary rubber roller, a movable rubber roller, a first number rotatably supporting said movable roller and a means for selecting moving said first member between its operative and inoperative positions.

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DEVICE FOR AUTOMATICALLY ADJUSTING ROLLER PRESSURE IN RICE-HULLING MACHINE

ABSTRACT

The present invention relates to a device for automatically adjusting roller pressure in a rice hulling machine comprising a stationary rubber roller, a movable rubber roller, a first number rotatably supporting said movable roller and a means for selecting moving said first member between its operative and inoperative positions.

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DETAILED DESCRIPTION OF THE INVENTION:

This invention relates to a device for automatically adjusting roller pressure in a rice-hulling machine.

An object of the present invention is to permit atomatic adjustment of the pressure of rice-hulling machine rollers with a simple and rational electric structure.

Heretofore, there have been proposed devices for adjusting roller pressure in various rice-hulling machines. However, the operation of any of these devices has been insufficient.

With the device according to the present invention, smooth operation can be obtained with a simple construction.

In the drawings:

Fig. 1 is a sectional view showing an essential part of a first embodiment of the present invention;

Fig. 2 is a sectional view showing the entire construction of the first embodiment;

Fig. 3 is a sectional view showing the entire construction of a second embodiment of the present invention;

Fig. 4 is a sectional view showing the second embodiment with a detailed showing of a rotary switch-

ing section;

Fig. 5 is a sectional view showing a detector in the second embodiment;

Fig. 6 illustrates the operation of the rotary switching section in the second embodiment;

Fig. 7 is a view showing the rotary switching section in the second embodiment in one operating state;

Fig. 8 is a view showing the rotary switching section in another operating state;

Fig. 9 is a view showing the rotary switching section in the second embodiment in a further operating state; and

Fig. 10 is a view showing the rotary switching section in the second embodiment in a still further operating state.

A first embodiment of the device according to the present invention, which effects the adjustment electrically, will now be described with reference to the drawings, more particularly Figs. 1 and 2. A shaft 1 is mounted in a housing 31. A stationary roller 2 made of rubber or a synthetic resin in mounted only for rotation on the shaft 1. Reference numeral 3 designates an unhulled rice hopper. A feed roller 5 is mounted at the outlet 4 of hopper.

A movable detector 6 is provided to detect the presence of absence of unhulled rice in the hopper 3. A switch 7 is on-off operated with upward and downward rotations of the detector 6. A feed rate control valve 8 is provided such that it can be moved toward and away from the feed roller 5. A rockable arm 10 is mounted at its upper end on the shaft 9 of the feed roller 5. A rockable shaft 11 is mounted in a lower portion of the rockable arm 10. A rockable roller 12 made of rubber or a synthetic resin is mounted on the rockable shaft 11.

The rockable arm 10 has a see-through hole 13 formed in its lower portion and extending in the directions of rocking of the rockable arm 10. An end portion of horizontal rod 14 penetrates the see-through hole 13. A cam 16 is secured to the end 15 of the rod 14 projecting from the see-through hole 13. The diameter of the cam 16 reduces as one goes away from the see-through hole 13. An adjusting screw 19 projects from the lower end 18 of the rockable arm 10 and extends parallel to the cam 16. A switch body 20 is screwed on the screw 19. It has an operating rod 21 which is in contact with the periphery of the cam 16. The cam 17 has a large diameter portion.

The rod 14 has a thread 22 formed in its other end portion. A sprocket 23 is screwed on the thread 22. It can be rotated manually as well, and it is mounted only for rotation in the housing 31. A reversible motor 24 is provided in the neighborhood of the sprocket 23. A chain 26 is passed round the sprocket 23 noted above and a sprocket 25 mounted on the shaft of the motor 24. A spring retainer 27 is screwed on the threaded portion of the rod 14 between the lower end 18 of the rockable arm 10 and the sprocket 23. Another spring retainer 29 is secured to the lower end 18 of the rockable arm 10. A coil spring 28 is provided between the spring retainers 27 and 29. Reference numeral 30 designates a gap between the lower end 18 of the rockable arm 10 and the end face of the cam 16 on side of the large diameter portion 17 thereof.

The switch 7 operable by the detector 7, the switch 20 operable by the cam 16 on the projecting end 15 of the rod 14 and the reversible motor 24 are operatively coupled to one another such that the motor 24 is started in the direction of bringing the rockable roller 12 into contact with the stationary roller 2 when the detector 6 detects the presence of unhulled rice in the hopper 3 and that the motor 24 is stopped

according to the degree of contact between the rockable roller 12 and stationary roller 2.

A second embodiment of the present invention will now be described. This embodiment basically has the same construction as the first embodiment described above. In this embodiment, the pressure control is done not electrically but mechanically. As detector 6 is used one having a hopper-like shape. The detector 6 has an outlet 50 formed at one end of its bottom 51, which is downwardly inclined from its other end toward the outlet 50. A support rod 52 projects integrally from the end wall of the detector 6 opposite the outlet 50. Its free end is pivoted by pin 54 to the top of a projection 53 projecting upright from the top of the housing 31. The detector 6 has a projection 55 projecting from the end wall defining the outlet 50. A lower end of a spring 56 is attached to the projection 55. Its upper end is attached to the lower end of an adjusting screw 57 screwed for vertical displacement in a portion of the housing 31. When the quantity of unhulled rice in the unhulled rice hopper 3 is increased, the detector 6 is pivotally moved downwards against the spring force of the spring 56. Conversely decrease of the unhulled rice quantity causes toward pivotal

movement of the detector 6 by the spring force of the spring 5. Reference numeral 58 designates a fall-out prevention member which is adapted to be relatively inserted into the detector 6 from the above.

Reference numeral 59 designates a rotary switching section, which is used for effecting mechanical pressure adjustment instead of pressure adjustment by the forward and reverse driving of the motor caused by the switches in the first embodiment. It is operable with the pivotal movement of the detector 6.

Means for mechanically bringing hulling rollers toward and away from each other, is provided on the lower end of the rockable arm. 10. More specifically, a screw 60 is securedly screwed on a threaded end 15 of horizontal rod 14 projecting from see-through hole 13 formed in the lower portion of the rockable arm 10. Reference numeral 61 designates the inner face of the screw 60. A gear 62 is secured concentrically to the sprocket 23. The rotary switching section 59 noted above is disposed in the neighborhood of the gear 62. It has an output shaft 63. A gear 62 is fitted for axial movement on the output shaft 63, and it can be meshed with the gear 64. A

spring retainer 27 is screwed on an intermediate threaded portion of the rod 14. A flange 65 is secured to the rod 14 between the spring retainer 27 and the lower end 18 of the rockable arm 10. A large spring 66 is provided between the spring retainer 27 and flange 65. A small spring 67 is provided between the flange 65 and lower end 18.

The rotary switching section 59 has a box-like casing with an integral downward projection 68. The projection 68 has a horizontal see-through hole 69 which is penetrated by the threaded rod 14. The projection 68 has a horizontal section 70 extending from the lower end of its vertical section. The other end of the horizontal section has an integral upright section which is secured by a pin 71 to the lower end 18 of the rockable arm 10. The output shaft 63 noted above penetrates the casing of the rotary switching section 59. A pair of bevel gears 72 and 73, e.g., differential gears, are provided in the casing of the rotary switching section 59. The bevel gears 72 and 73 have respective integral clutches formed on these opposed sides. A clutch body 76 is provided between the bevel gears 72 and 73. The bevel gears 72 and 73 are loosely fitted for axial movement on the output shaft 63. The clutch 76 is splined to

the output shaft 63. An L-shaped link 77 is pivotally mounted on the top of the casing of the rotary switching section 59. One end of the L-shaped link 77 is linked by a rod 78 to a central portion of the support rod 52. A pin 79, which is movable to the left and right but is not movable in the vertical directions, project from one side wall of the casing of the rotary switching section 59 at a position corresponding to right longitudinal center of the output shaft 63. A central portion of a reversal lever 80 is mounted on the pin 79. The upper end of the reversal lever 80 is linked to the other end of the L-shaped link 77. The upper end of a rotary lever 81 is linked to the lower end of the reversal lever 80. It has a pin 82 projecting from its central portion and mounted in the downward projection 68 of the casing. The lower end of the rotary lever 81 is pivoted by a pin 83 to the threaded rod 14. An automatic/manual change-over lever 84 is provided for axially displacing the gear 64. Reference numeral 85 designates a gap.

The bevel gears 72 and 73 are normally in mesh with a bevel gear 88 and coupled to a pulley 89 therethrough. The pulley 89 is rotated via a belt 87 passed round it and a pulley 86 mounted on the

rockable shaft 11.

The operation will now be described in conjunction with the first embodiment. When the on-off valve of the hopper 3 is opened, unhulled rice therein is allowed to fall and strike the detector 6. As a result, the switch 7 is turned on to energize the motor 24, thus causing the sprocket 23 to be rotated through the sprocket 25 and chain 26 to move the rod 14 with the threaded portion 22 in mesh with the sprocket 23 to the right in the Figures. The rockable arm 10 is thus urged by the spring retainer 27 mounted on the rod 14 via the spring 28, causing a rotation of the rockable arm 10 in the counterclockwise direction about the shaft 9 to bring the rockable roller 12 mounted on the rockable arm 10 into contact with the outer periphery of the stationary roller 2. The motor 24 is continually energized to continue rotation of the sprocket 23. The rod 14 is thus caused to project outwards from the see-through hole 13 by compressing the coil spring 28, so that the gap 30 is produced between the cam 16 and lower end 18 of the rockable arm 10. Eventually, the operating rod 21 of the switch 20 is brought to the large diameter portion 17 of the cam 16 to turn off the switch 20, whereupon the motor

24 is stopped.

Thus, the unhulled rice in the hopper 3 is fed out by the feed roller 5 to be hulled between the rollers 2 and 12 under adjusted spring force of the coil spring 28.

The spring force of the coil spring 28 can be adjusted to adjust the hulling ratio by adjusting the position of the switch 20 by turning the screw 19.

When the upper 3 gets out of unhulled rice, that is, when there is no longer unhulled rice striking the detector 6, the switch 7 is turned off. As a result, the motor 24 is energized via a timer, thus causing the sprocket 23 to be rotated reversely via the sprocket 25 and chain 26 so that the rod 14 with the threaded portion 22 in mesh with the sprocket 23 is moved to the left.

The rockable arm 10 is thus rotated about the shaft 9 in the clockwise direction to separate the rockable roller 12 carried by the rockable arm 10 from the outer periphery of the stationary roller 2 and bring it back to the initial position.

The operation will now be described in conjunction with the second embodiment. By supplying unhulled rice to the unhulled rice hopper 3 after ad-

justing the spring force of the spring 56 to a desired strength by turning the adjusting screw 57, the detector 6, which has been held at an upper position, is rotated about the pin 54 in the clockwise direction against the spring force of the spring 56. The rod 78 which is pivoted at the upper end to the support rod 52 is thus lowered to cause rotation of the L-shaped link 77 with the central portion thereof linked to the lower end of the rod 78 in the counterclockwise direction (Fig. 8). With the counterclockwise rotation of the L-shaped link 77, the upper end of the reversal lever 80 linked to the lower end of the L-shaped link 77 is moved toward the rockable shaft 11. The clutch body 76 is thus brought into mesh with the clutch 75 via the pin 79. Since the pulley 86 mounted on the rockable shaft 11 which rotates the rockable roller 12 is being rotated at all time, the pulley 89 is rotated from the pully 86 via the belt 87, thus causing the rotation of the bevel gear 88. Since the bevel gear 72 is in mesh with the bevel gears 72 and 73 at all time, the output shaft 63 turns to be rotated with the coupling between the clutch body 76 and clutch 75. If the automatic/ manual change-over lever 84 is held pulled in the

direction of arrow a so that the gears 64 and 62 are held meshed with each other, the gear 62 is rotated via the gear 64, thus causing the rotation of the sprocket 23. The threaded rod 14 which is screwed in the sprocket 23 is thus moved in the direction of arrow b, thus causing a movement of the lower end 18 of the rockable arm 10 via the large and small springs 66 and 67.

A counterclockwise rotation of the rockable arm 10 about the shaft 9 is thus cased, bringing the rockable roller 12 into contact with the stationary roller 2. Subsequent to this, the sprocket 23 is continually, causing first the contraction of the small spring 67 and then the contraction of the large spring 66. The inner face 61 of the screw 60 is thus progressively moved away from the lower end 18 of the rockable arm 10 to produce gap 85 therebetween.

Since the lower end of the rotary lever 81 is pivoted by the pin 83 to the threaded rod 14, the rotary lever 81 is thus rotated about the pin 82 in the counterclockwise direction, thus causing the lower end of the rotary lever 81 to be moved in the direction of arrow a in Fig. 9. The reversal lever 80 is thus rotated about its portion pivotally linked to the lower end of the L-shaped link 77, causing a movement of the clutch

body 79 away from the clutch 75 via the pin 79. The clutch body 76 is eventually brought to its neutral position so that its rotation is stopped. At this instant, the increase of the pressure of the rockable roller 12 on the stationary roller 2 is stopped.

In this state, unhulled rice falling from the outlet 50 is fed out by the adjusting valve 8 and feed roller 5 and hulled between the stationary roller 2 and rockable roller 12. When the hulling operation is continued for a long time, the diameters of the rockable roller 12 and stationary roller 2 are progressively reduced due to wear.

The reduction of the diameters is madeup for by corresponding elongations of the large and small springs 66 and 67 to urge the lower end 18 of the rockable arm 10 toward the end 15 of the rod 14 so as to have the rockable roller 12 and stationary roller 2 in forced contact with each other. The movement of the rockable roller 12 in the direction of arrow b causes movement of the downward projection 68 coupled to the lower end 18 in the same direction to move the pin 82 mounted in the downward projection 68. This is equivalent to a movement of the lower end of the rotary lever 81 in the direction of arrow a. Thus, the upper end of the rotary lever 81 is moved

again in the direction of arrow b, bringing the clutch body 76 into mesh with the clutch 75. The rotation of the bevel gear 73 is thus transmitted to the output shaft 63 so that the rockable roller 12 is automatically brought into forced contact with the stationary roller 2 in the manner described above.

When the hopper 3 gets out of unhulled rice, the detector 6 is raised by the spring force of the spring 56 to raise the rod 78 via the support rod 52 so as to cause rotation of the L-shaped link 77, thus causing movement of the reversal lever 80 in the direction of arrow a to bring the clutch body 76 into mesh with the clutch 74 via the pin 79. Since the bevel gear 72 which is integral with the clutch 74 is being rotated counterclockwise with the rotation of the rockable shaft 11 transmitted to it via the pulley 86, belt 87, pulley 89, bevel gear 88 and bevel gear 72 in the mentioned order, the output shaft 63 is rotated counterclockwise via the clutch 76. The rotation of the output shaft 63 is transmitted via the gears 64 and 82 to the sprocket 23, thus moving threaded portion 22 of the rod 14 screwed in the sprocket 23 in the direction of arrow a. The rockable arm 10 is thus rocked in the direction of arrow

a via the inner face 61 of the screw 60 to separate the rockable roller 12.

When the rockable roller 12 is separated a constant distance from the stationary roller 2, the lower end of the rotary lever 81 is moved in the direction of arrow a. That is, the rotary lever 81 is rotated clockwise about the pin 82 to cause counter-clockwise rotation of the reversal lever 80, thus bringing the clutch body 76 to the neutral position via the pin 79.

WHAT IS CLAIMED IS:

1. A device for automatically adjusting roller pressure in a rice-hulling machine comprising:

a pair of stationary rubber roller and movable rubber roller;

a first member rotatably supporting said movable roller, and mounted on said machine for movement between an operative position in which said movable roller is urged resiliently into forced contact with said stationary roller, and an inoperative position in which said movable roller is separated from said stationary roller;

means for selectively moving said first member between its operative and inoperative positions, including a second member mounted for reciprocation transversely of said rollers; and

said means including a spring secured at one end to the said second member for reciprocation therewith, and resiliently engageable at its opposite end with said first member, thereby to apply a predetermined pressure between said rollers, when said first member is in its operative position.

2. A device for automatically adjusting roller

pressure in a rice-hulling machine including a pair of stationary rubber roller and movable rubber roller, said movable roller disposed to be moved between an operative position in which said movable roller is urged resiliently into forced contact with said stationary roller and an inoperative position in which said movable roller is separated from said stationary roller, and means for moving said movable roller between its operative and inoperative positions, comprising:

a sprocket mounted only for rotation in a casing;

a rod having a threaded portion screwed in a central threaded hole of said sprocket;

a rockable arm carrying said movable roller and having therethrough a hole slidably penetrated by an intermediate portion of said rod;

a cam mounted on an end portion of said rod projecting from said hole beyond said arm;

a coil spring mounted on said rod between said sprocket and said arm and having one end attached to a spring retainer mounted on said rod adjacent said sprocket and having the other end attached to said rockable arm;

a switch mounted on said rockable arm and hav-

ing an operating rod in contact with said cam;

a reversible motor for rotating said sprocket selectively in opposite directions, thereby to reciprocate said rod and to rock said arm in a direction selectively to move said movable roller into or out of its operative position; and

said switch being operative to stop said motor when said movable roller reaches its operative position.

3. A device for automatically adjusting roller pressure in a rice-hulling machine comprising:

a pair of stationary rubber roller and movable rubber roller;

said movable roller disposed to be moved between an operative position in which the movable roller is urged resiliently into forced contact with said stationary roller and an inoperative position in which the movable roller is separated from said stationary roller;

a hopper-like unhulled rice storing section vertically movable according to the quantity of unhulled rice stored therein;

a rotary switching section rotatable in opposite directions according to the vertical movement of said unhulled rice storing section;

means for selectively bringing said movable roller into contact with said stationary roller and for separating the former from the latter;

said means including a spring for resiliently urging said movable roller into contact with said stationary roller with a predetermined amount of pressure when said rotary switching section is rotated in one direction, and for separating said movable roller from said stationary roller when said rotary switching section is rotated in a reverse direction; and

said means further including means mounting said spring for translational movement with said movable roller between its operative and inoperative positions thereby to maintain the stress in said spring constant during the last-named movement.

4. A device for automatically adjusting roller pressure between movable and stationary rollers in a rice-hulling machine, comprising a hopper-like unhulled rice storing section vertically movable to a position below an hulled rice supply hopper according to the quantity of unhulled rice stored therein, a threaded rod for urging a spring having one end in contact with said movable roller, a rotary switching section forwardly and reversely rotatable to a desired position, and a link mechanism coupling said

rotary switching section, said threaded rod and said unhulled rice storing section such that:

(a) said rotary switching section is reversely rotated to cause retreatment of said threaded rod so as to separate said movable roller from said stationary roller in response to a vertical movement of said storing section, and without altering the stress in said spring, and

(b) said rotary switching section is forwardly rotated to cause advancement of said threaded rod so as to bring said movable roller into contact with said stationary roller, said spring being operative to exert a predetermined resilient pressure to said movable roller each time the latter is moved into contact with said stationary roller.

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26089

Fig. 1

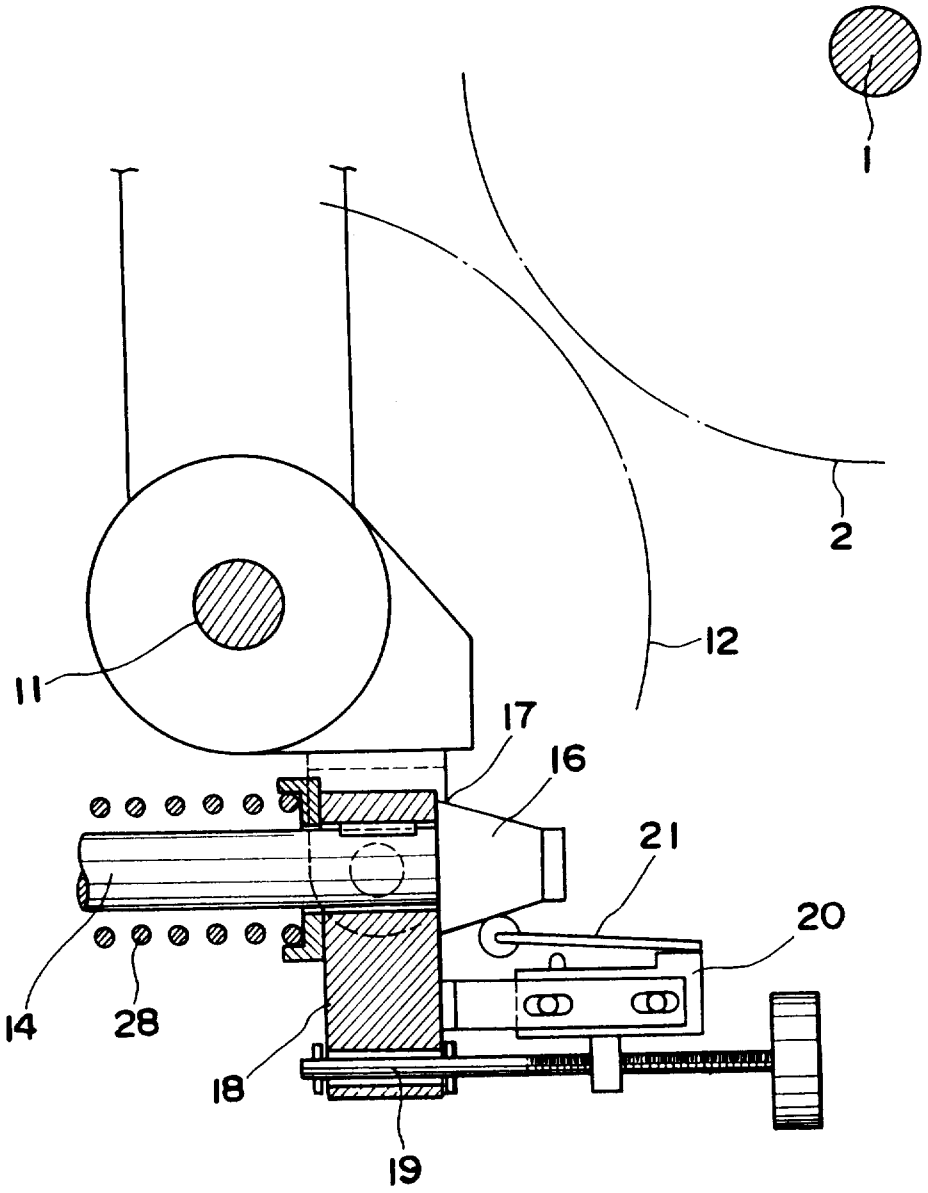

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Fig. 2

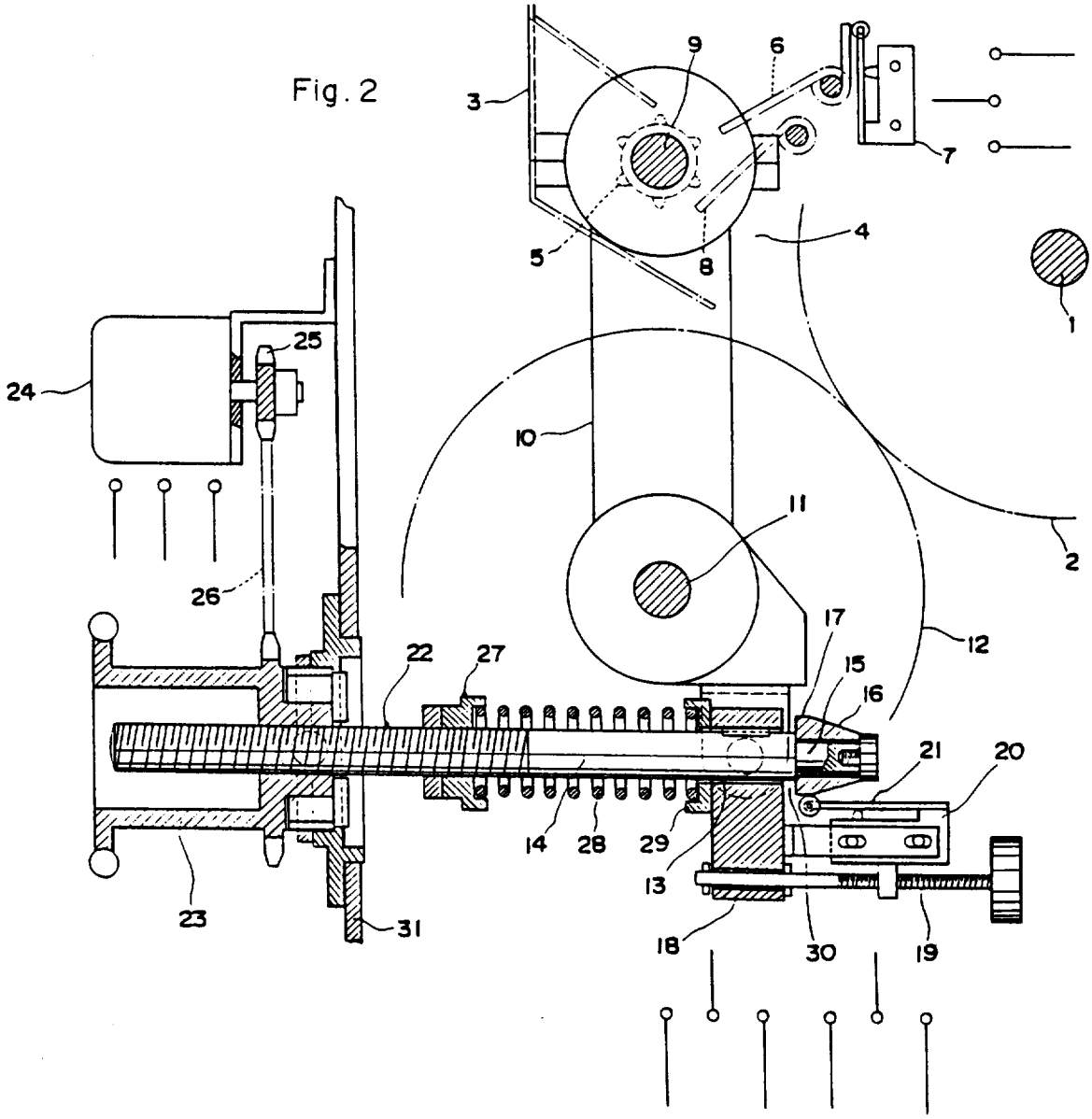
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Fig.3

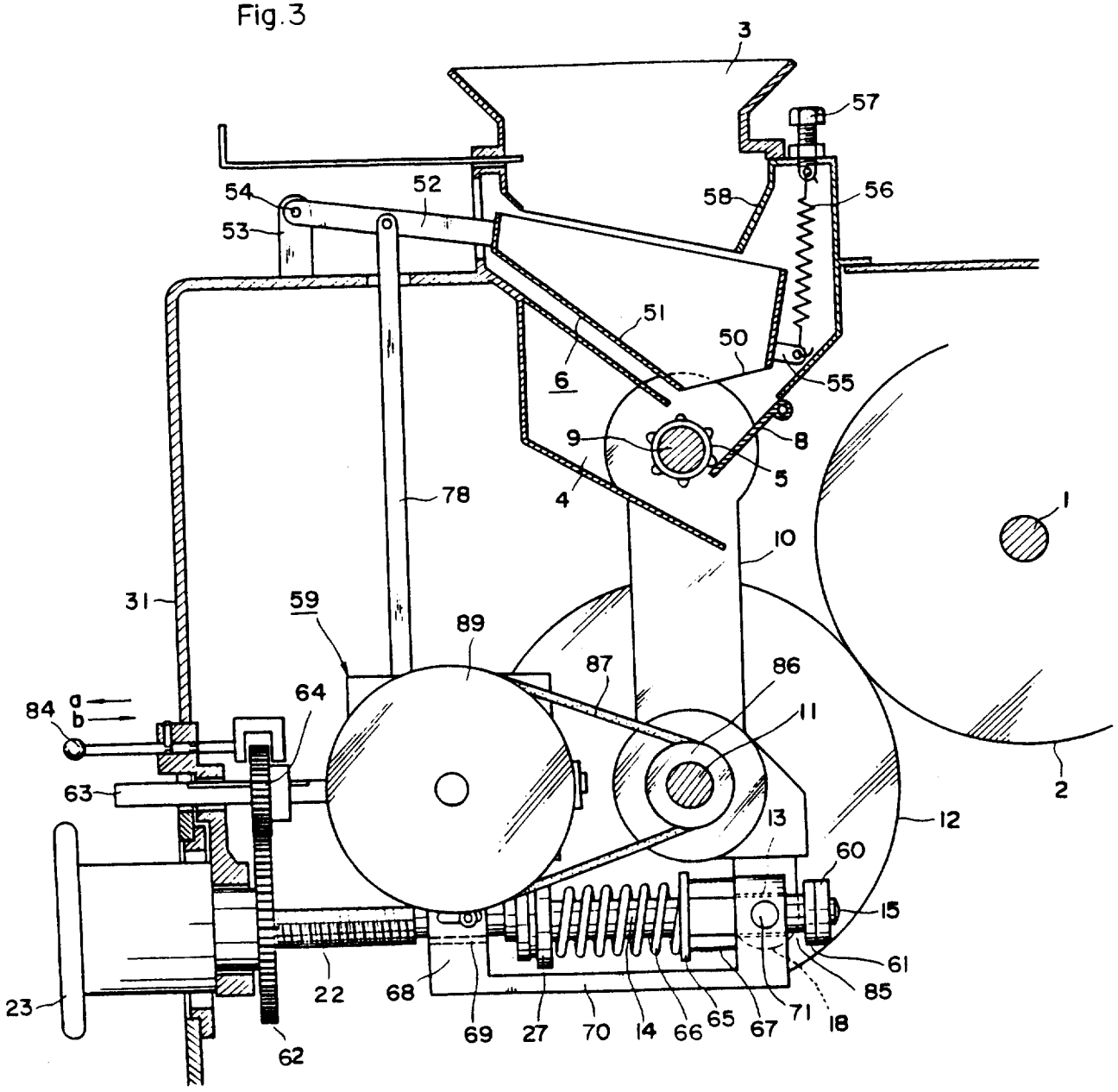
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Fig. 4

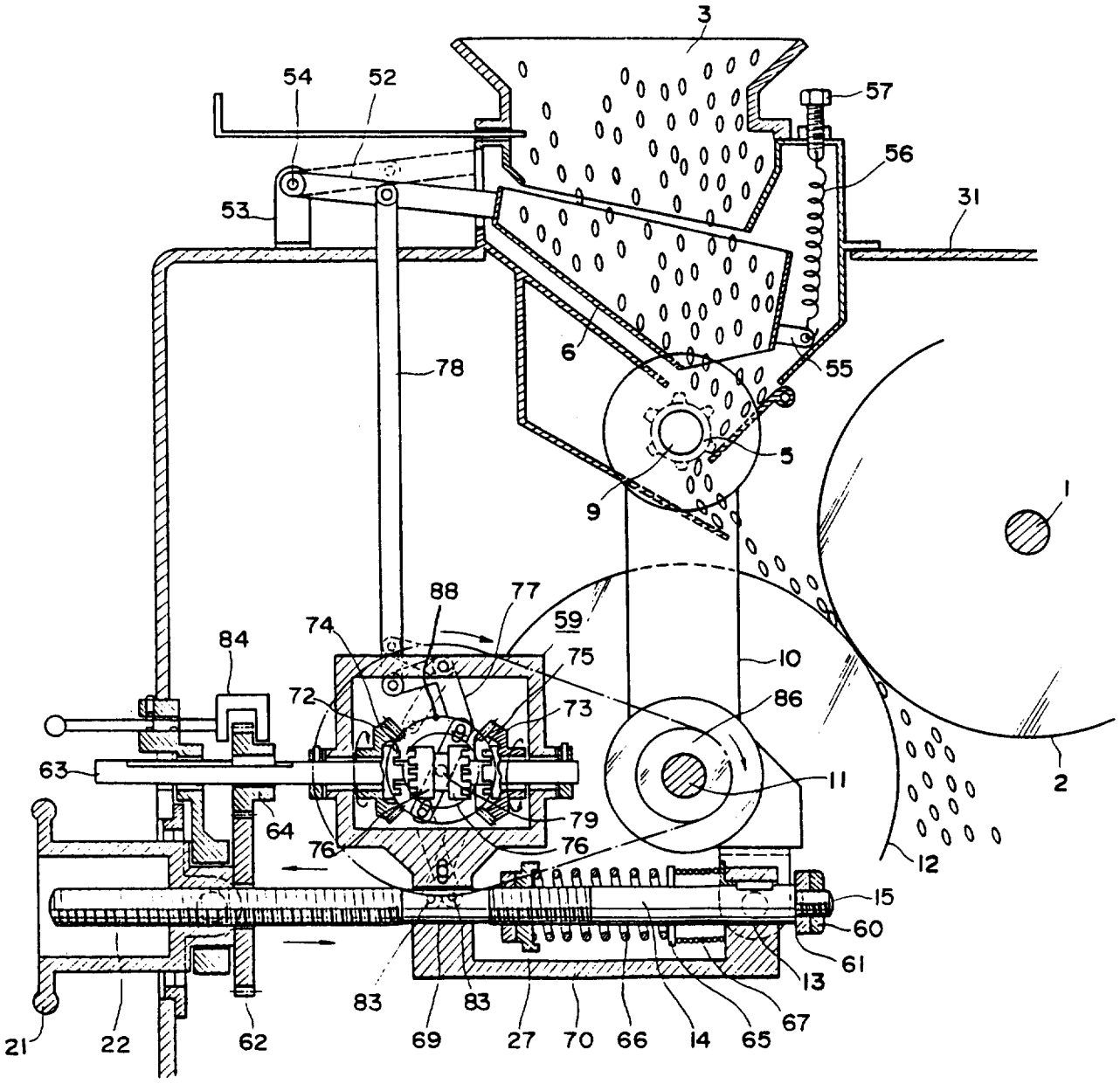
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Fig.5

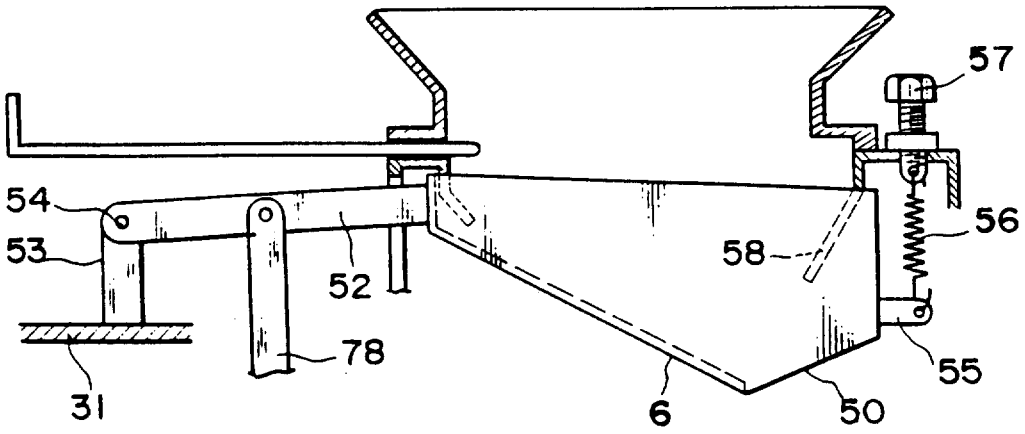

Fig.6

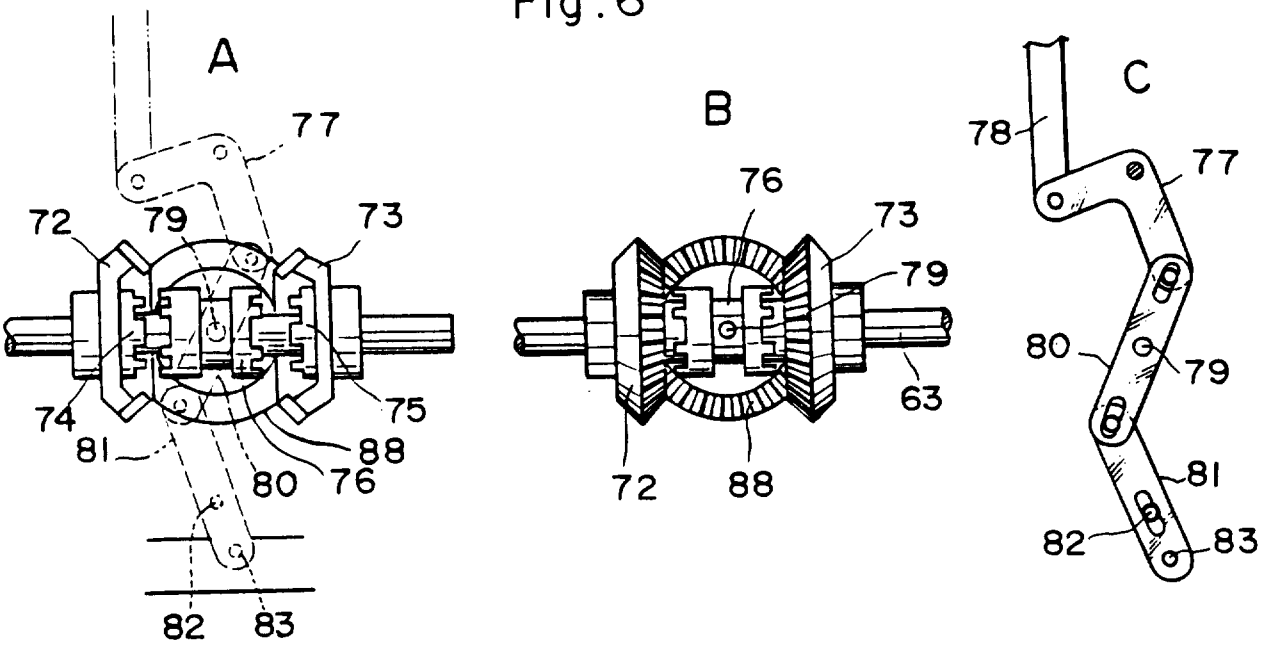

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Fig.7

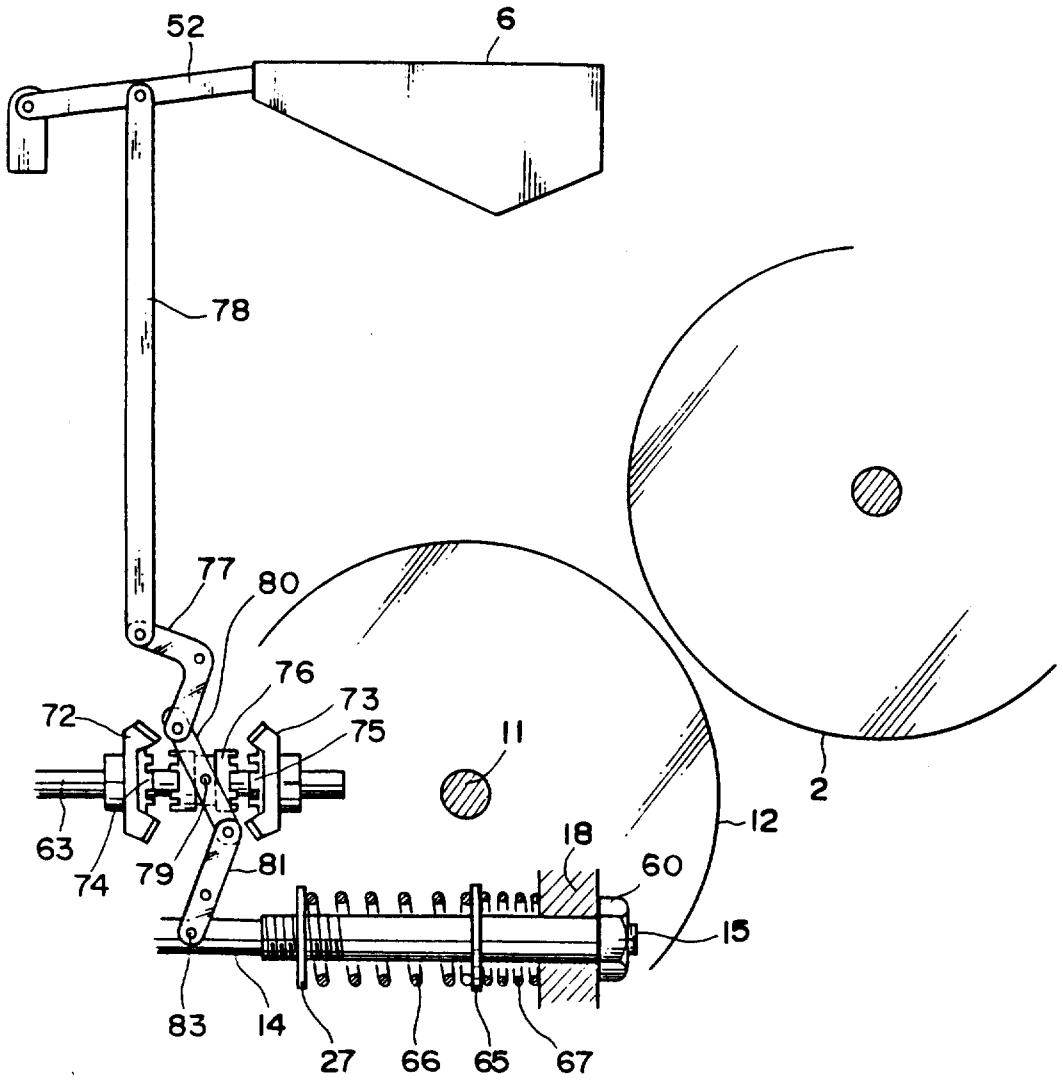

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Fig.8

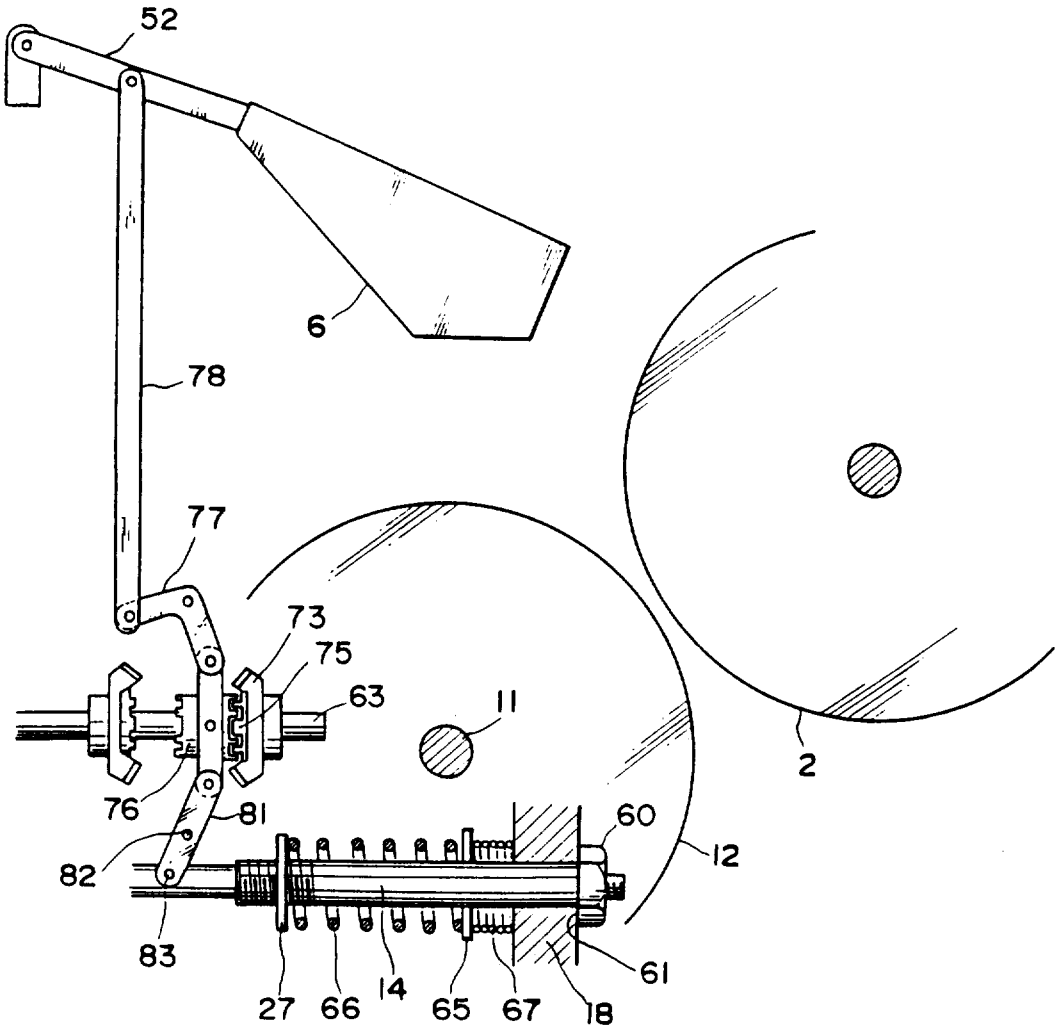

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Fig.9

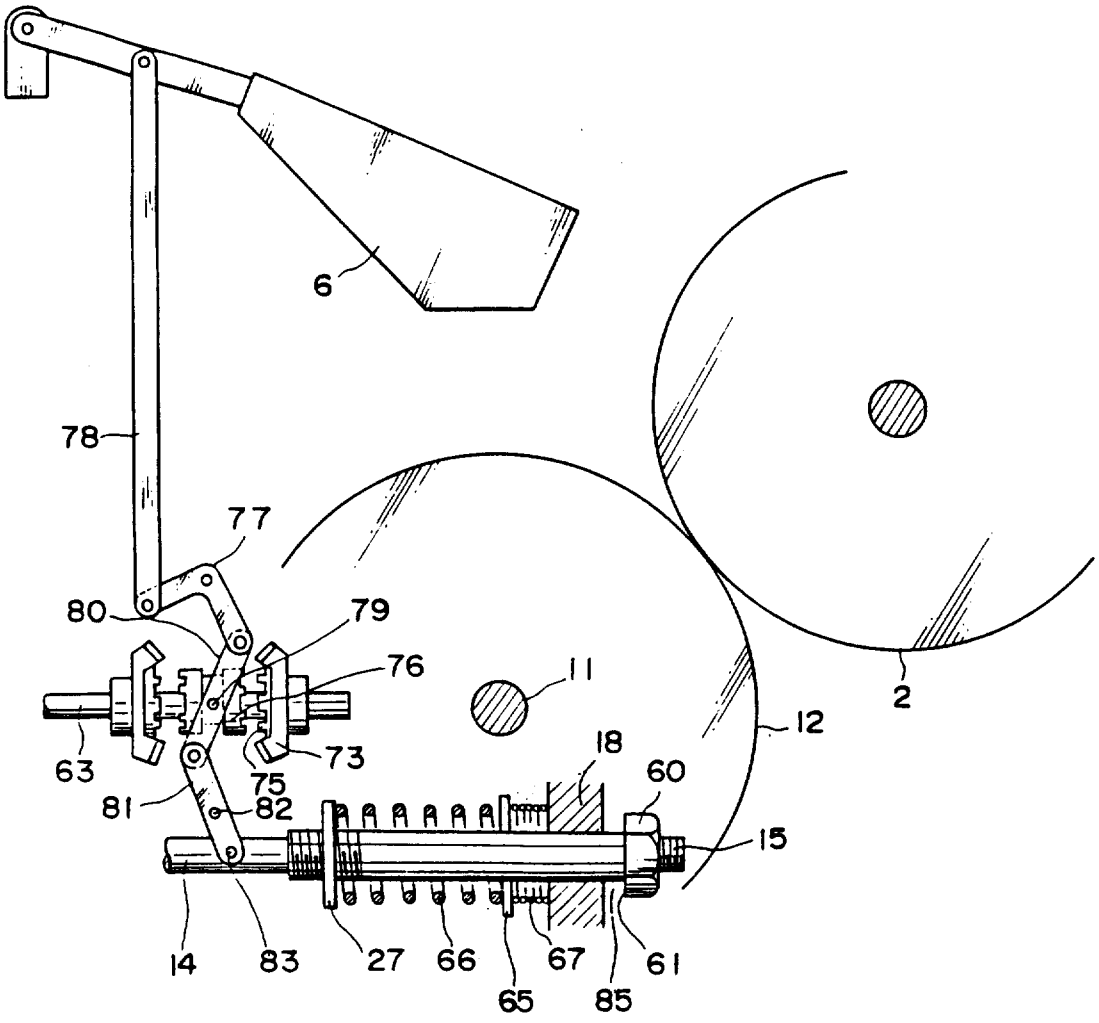

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Fig. 10