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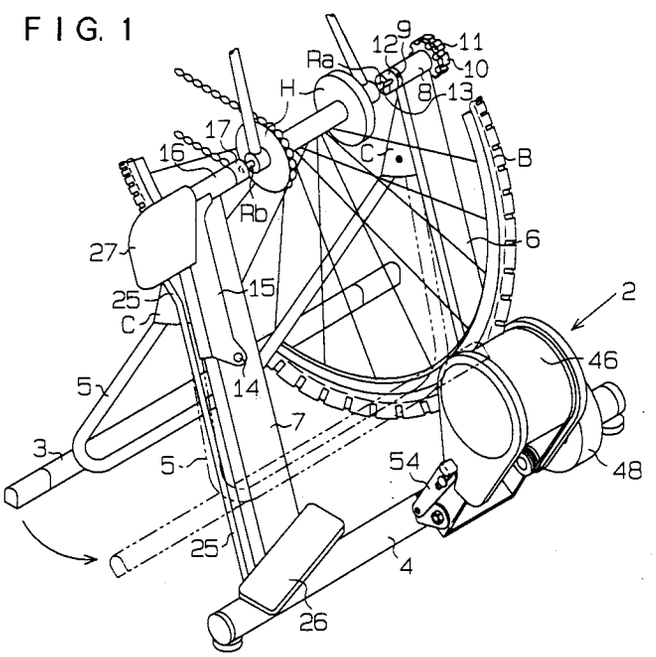
(54) Exercise stand for a bicycle.

(57) The stand has a loading device (2) which is mounted on a frame (1) supporting a rear wheel (B) of a bicycle (90). The loading device (2) includes a resistance generator (48) which has a rotary shaft (49) connected to a drive drum (46) urged against a tire (91) of the rear wheel (B). The drive drum (46) has an outer diameter so that the drum (46) is able to contact a plurality of block typed tread patterns adjacently disposed in the circumferential direction of the tire (91).

FIG. 1



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TECHNICAL FIELD

This invention relates to an exercise stand for a bicycle, and more particularly to a bicycle exercise stand which holds the drive wheel of the bicycle clear of the floor surface and exerts a load on a drive wheel so that bicycle pedaling exercise simulates actual cycling.

RELATED BACKGROUND ART

Using a bicycle as an indoor training apparatus has been done for several decades. There are on the market exercise stands which support a drive wheel, i.e. a rear wheel, of the bicycle clear of the floor and with which, by rotating the pedals, the user can achieve an exercise effect similar to that of actual cycling. One such stand is shown in Fig. 9. A pair of tubular members 101, 102 extend perpendicular to the drawing sheet and parallel with each other for forming a frame 100. Two pairs of legs 103, 104 (only the leg on the near side is shown) which extend upward are mounted at ends of the tubular members 101, 102. The upper portions of the legs 104 are pivotally supported at the upper portions of the legs 103. A pair of holding members 105 (only one is shown), for firmly holding the hub 111 of the rear wheel, are mounted at the top ends of the legs 103.

A loading device 106 is mounted on the tubular member 101, said device 106 generating a resistive force in accordance with the rotational speed of the rear wheel 111 . As shown in Fig. 14, the loading device 106 includes a resistance generator 107, having a rotating shaft 108, and a small-diameter drive cylinder 109 which is mounted on the rotating shaft 108 and makes contact with the tire 112 of the rear wheel 111. The resistance generator 107 includes a pair of permanent magnets and a metallic rotary disk secured to the rotary shaft. The magnets are disposed on the opposite side and face each other. The rotation of the rotary disk results in eddy currents and exerts a load on the rotating rotary shaft.

When the rear wheel 111 of the bicycle 110 has been placed on the drive cylinder 109, by firmly holding the hub of the rear wheel 111 between the two holding members 105, preparation of the bicycle 110 for exercise is completed. A load resistance in accordance with to the rotational speed of the rear wheel 111 is generated in the generator 107, and that load resistance is transmitted to the rear wheel 111 through the drive cylinder 109.

When the tread pattern is of the rib type extending continuously in the circumferential direction, the drive cylinder 109 and the tread pattern are in contact with each other at every moment as the drive cylinder 109 rotates along with the rotation of the rear wheel 111. As a result, if the rear wheel 111 rotates at the substantially constant velocity, the constant load continuously transmitted to the rear wheel 111 from the cylinder 109 enables the user carry out the smooth pedaling operation.

Furthermore, the contact of the drive cylinder with the tread pattern of the tire causes the noise. However, continuous contact without having any proper gap suppresses the sound wave to travel resulting in this noise not to be loud.

However, the loading device 106 has the drive cylinder 109 with a small diameter. This construction causes the problem when a special bicycle, e. g. a cross-country bicycle, is used as the exercising material. More specifically, the construction disables the cylinder 109 from continuously contacting block type patterns 112a adjacent to one another in the circumferencial direction as shown in Fig. 14. Therefore, as the rear wheel 111 rotates, the corner of the next pattern 112a collides with the drive cylinder 109. This causes the magnitude of resistive force to be changeable, resulting in loud noise and unsmooth pedaling exercise.

DISCLOSURE OF THE INVENTION

Therefore, it is an object of the present invention to provide an exercise stand for a bicycle capable of reducing the noise due to the contact between the rotating drive body and tire.

It is another object of the invention to provide an exercise stand for realizing a smooth pedaling operation irrespective of the shape of tread pattern of the tire being used.

In order to achieve the above objects, an exercise stand for a bicycle is diclosed. The stand includes a frame for supporting the drive wheel of the bicycle. The stand also has a loading device having a rotary drive member which rotates and contacts with a tread pattern provided with an outer peripheral surface of a tire as the drive wheel is rotated by the rotation of the pedals of the bicycle. The loading device is arranged to exert a resistive load to the drive wheel. Furthermore, the rotary drive member has an outer diameter enabling the rotary drive member to contact with a plurality of adjacent tread patterns circumferentially juxtaposing in a tire, wherein said the tread pattern is block type.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention, together with objects and advantages thereof, may best be understood by reference to the following description of the presently preferred embodiments together with the accompanying drawings, in which:

Fig. 1 is a perspective view showing the exercise stand of the present invention together with a bicycle;
Fig. 2 is a front elevational view showing a bicycle set up on the exercise stand;
Fig. 3 is a front elevational view showing a loading device set in the non-working position;
Fig. 4 is a front elevational view showing the loading device set in the standby position;
Fig. 5 is a front elevational view showing the loading device in the working position;
Fig. 6 is a lateral cross-sectional view of the loading device;
Fig. 7 is an enlarged cross-sectional view showing the holding lever and the metal bracket;
Fig. 8 is a vertical sectional view of the loading device;
Fig. 9 is a cross-sectional view taken along the line A-A of Fig. 8, showing the arrangement of the permanent magnets;
Fig. 10 is a front elevational view of the adjustment knob of the loading device;
Fig. 11(a) is a view illustrating the state of the flux in the rotary disk when substantially no load being provided to the pedals;
Fig. 11(b) is a view illustrating the state of the flux in the rotary disk when the load being provided to the pedals of the bicycle is roughly half of maximum;
Fig. 11(c) is a view illustrating the state of the flux in the rotary disk when the load being provided to the pedals of the bicycle is at its maximum;
Fig. 12 is a characteristic graph showing the relation-ship between the setting of the knob and the load provided to the pedals;
Fig. 13 is a front elevational view showing a bicycle set up on a conventional exercise stand; and
Fig. 14 is a cross-sectional view showing the relation-ship between the drive cylinder and the rear wheel in an example of a conventional resistance-providing device.

DESCRIPTION OF SPECIAL EMBODIMENTS

A preferred embodiment of the present invention will now be described in detail, with reference to Figs. 1 to 16. It is to be noted that an exercise stand supports a cross-country type bicycle.

Fig. 1 shows an exercise stand for a bicycle set up on a floor surface. The stand has a frame 1 supporting a loading device 2. The frame 1 has a pair of tubular bases 3, 4 at a front and rear portions, respectively. Each pair of bases extend parallelly each other and positioned on the floor. A U-shaped portion 5 mounted on the front base 3 extends rearward inclining upward. A pair of legs 6, 7 are mounted on the rear base 4 oppose the U-shaped portion 5 and extend upward. The U-shaped portion 5 is pivotally linked from below to the opposing legs 6, 7 through pieces C fitted to the upper ends of the U-shaped portion 5. When the stand is not used, the portion 5 is in the pivoted position as shown by the dotted lines so as to fold the whole stand for storage.

A holding cylinder portion 8 secured to the upper end of the right leg 6 extends horizontally. A positioning screw 9 is received by the cylinder 8. The inner end of the screw 9 projects inward from the cylinder 8. An adjusting knob 10 is mounted on the outer end (the right-hand end) of the screw 9. A locking knob 11 is fitted on the screw 9 between the knob 10 and the outer wall of the cylinder 8. A receiving sleeve 12 is mounted on the inner end of the screw 9. The amount of inward extension of the screw 9 is adjusted by the manipulating operation of the knob 10.

A support arm 15 is pivotally attached to the left leg 7 by a pin 14. An cylinder portion 16 is mounted on the upper portion of this support arm 15, and a fitting sleeve 17 which projects inward from the cylinder 16 is mounted on the inner end of the cylinder 16. Inside a plastic cover 27, the support arm 15 is linked to the upper end of a lift rod 25. The lower end of the lift rod 25 is linked to a pedal 26 mounted on the leg 7.

A first rotary shaft Ra which projects from the hub H of the rear wheel B is inserted into the sleeve 12, and positioning of the rear wheel B is thereby performed. Subsequently, the pedal 26 is operated to move the rod 25 in the substantially vertical direction. Therefore, the support arm 15 rotates about the pin 14 for switching the positions of the sleeve 17.

As a result, the sleeve 17 is fitted onto the second rotation shaft Rb projecting from the hub H of the rear wheel B, and the rear wheel B is rotatably held by the sleeve 17 and the sleeve 12.

The loading device 2 will now be described in detail.

As shown in Fig. 3, a metal bracket 41 is mounted on the rear base 4. As shown in Fig. 6, an opposed pair of pieces 41a, 41b are formed at the respective ends of the bracket 41. A metal support 42 is pivotally mounted between the two pieces 41a, 41b by a bolt 43 near its base portion.

The support 42 has a pair of arms 42a, 42b and a link 42c connecting two arms 42a, 42b. A shaft 44 is mounted between the ends of the arms 42a, 42b. A steel drive drum 46, which also serves as a flywheel, is rotatably supported on the shaft 44 by way of a pair of bearings 45, and the tire 91 of the rear wheel B of the bicycle 90 makes contact with the outer peripheral surface of this drive drum 46. As shown in Fig. 5, the drive drum 46 has

an outer diameter so as to contact with a plurality of block tread patterns 91a adjacently disposed in the circumferential direction of a tire 91.

A plate 47 is mounted on the central portion of the arm portion 42b, and a resistance generator 48 exerting a resistive force on the rear wheel B is mounted on the plate 47. The rotary shaft 49 of the generator 48 projects out through the arm 42b, but does not interfere with the arm 42b. A pulley 50 mounted on the outer end of the rotary shaft 49 is operably connected to the drum by way of a V-belt 51.

A pair of engaging bolts 52 (only one of which is illustrated) are screwed into the central portions of the arm portions 42a, 42b. A pair of tension springs 53 urging the support 42 toward the frame 1 are disposed between the bolts 52 and the bracket 41.

As shown in Figs. 7 through 9, a holding lever 54 is rotatably mounted on the outer surface the piece 41a by means of a pin 55. An L-shaped elongated hole 56, including a guide 56a extending to the pin 55 and a stopper 56b intersecting with the guide 56a at the other end of the lever 54, is provided with the lever 54. A pin 57, mounted on and projecting from the arm 42a, undetachably passes through the hole 56 so as to move along the hole 56.

As shown in Fig. 7, the pin 55 supports a U-shaped spring 58 interposed between the lever 54 and the piece 41a. Ends of the spring 58 are abuts a projection 59 formed on the piece 41a, and a projection 60 formed on the lever 54, respectively. The urging force of the spring 58 causes the lever 54 to be biased to the support 42.

Consequently, when the pin 57 is positioned at the guide 56a, the support 42 is pivoted toward the frame 1 according to the force of the spring 58 as shown Fig. 3. Thus, the pivoting lever 54 permits the stopping pin 57 to move. On the contrary, as shown in Fig. 4, when the pin 57 is received in the stopper 56b which restricts the movement of the pin 57, the loading device 2 is held in the standby position.

A pair of plastic covers 61, made of a hard artificial resin such as polyvinyl chloride, are secured to the outer surface of the arm 42a, 42b by screws 62. A plurality of spacer plates 63 are securely disposed between the covers 61 by screws 64 for maintaining the clearance between the covers 61.

Next, the resistance generator will be described, with reference to Figs. 12 to 14. An inner case 65 is mounted on the plate 47 by means of screws 66. As shown in Fig. 8, the rotary shaft 49 is rotatably mounted to the case 65 by means of a pair of bearings 67. A metal rotary disk 68 is mounted via a bush 69 to the inner end of the shaft 49. An outer case 70 having a substantially bowl shape and mounted on the inner case 65 covers the rotary disk 68.

A plurality of fixed permanent magnets 71 are mounted through the plate 72 on the inner surface of the case 65 in the vicinity of to the rotary disk 68. As shown in Fig. 9, these permanent magnets 71 are arranged on the mounting plate 72 in a circular sequence with adjacent polarities being alternating.

A plurality of holes 68a formed in the inner peripheral portion of the rotary disk 68 are juxtaposed in the circumferential direction for preventing the rotary disk 68 from overheating.

As shown in Fig. 8, a support plate 73 is rotatably supported on the inner surface of the outer case 70. The plate 73 is held stationary by a plurality of legs 74 mounted on the outer case 70. A plurality of movable permanent magnets 75 mounted on the plate 73 face the permanent magnets 71. These permanent magnets 75 are juxtaposed on the plate 73 in a circular sequence in such a way that adjacent poles are alternate. The permanent magnets 75 work in conjunction with the permanent magnets 71, when the rotary disk 68 is rotating, to induce eddy currents on the rotary disk 68. A rotation resistance is exerted in the rotary disk 68 by these eddy currents, and a load is applied to the pedals 92.

As shown in Fig. 10, an adjusting knob 76 for adjusting the load applied to the pedals 92 is mounted on the central portion of the outer surface of the case 70. As shown in Fig. 8, the knob 76 is rotatable with respect to the case 70 about a pin 77. The knob 76 is also linked to the plate 73, via a plurality of link pieces 79 on a plate 78 mounted in the knob 76. A point mark 80 is provided on the end surface of the knob 76. A scale 81 for indicating the setting value of the load applied to the pedals 92 is provided on the surface of the case 70.

When the mark 80 is in the position corresponding to "L" of the scale 81, it indicates a low load. In this state, the permanent magnets 75 and the permanent magnets 71 are positioned in such a way that the opposed magnets 71, 75 have identical polarities. When the mark 80 is in the position pointing to the "H" of the scale 81, it selects a high load. In this state, the opposed permanent magnets 71, 75 have alternating polarities. The knob 76 is moved between the "H" and "L" of the scale 81, the desired magnitude of the load applied to the pedals 92 is selected.

As shown in Fig. 8, a ball mounted to the case 70 via a spring 83 is urged against the knob 76 for selecting one of holes 84 provided with the link plate 78, so that the magnets 75 are held in the desired setting position indicated by the mark 80.

The exercise stand is operated as below.

The loading device 2 held upright as shown in Fig. 3, is pivoted clockwise (away from the frame 1) against the force of the springs 53. The pin 57 rotates together with the support 42 and engages the guide 54 for rotating the lever 54. When the pin 57 reaches the stopper 56b as shown in Fig. 5, the lever 54 is biased by the spring 58 and further pivoted clockwise for bringing the stopper 56b into the engagement with the pin 57. Since the movement of the pin 57 is restricted by the stopper 56b, the loading device 2 is held in the standby position shown in Fig. 4.

In the above state, the rear portion of the bicycle 90 is lifted up, and the first rotary shaft Ra of the rear wheel B is received into the sleeve 12. When the rotary shaft Ra is completely fitted into the sleeve 12, the right side of the rear wheel B is positioned by the sleeve 12 and the screw 9.

Subsequently, the rear portion of the bicycle 90 is carefully held up by the user with both hands so that rotary shaft Ra is kept in the sleeve 12. Then, the pedal 26 is operated by the user with feet for moving the rod 25 in the substantially vertical direction, resulting in the arm 15 to pivot about the pin 14 and shifting the position of the sleeve 17. As a result, the sleeve 17 is fitted onto the second rotary shaft Rb projecting from the hub H of the rear wheel B. Therefore, the rear wheel B is rotatably held by the sleeves 12, 17.

Subsequently, the drum 46 is held to be slightly urged downward until the engagement of the stopper 56b and the pin 57 is released by the rotating movement of the lever 54 against the force of the spring 58. Then, the loading device 2 rotates toward the frame 1 by the force of the springs 53. The loading device 2 stops to rotate when the drum 46 abuts against the tire 91 of the rear wheel B. In this stationary position or non-working position, the drum 46 is pressed against the tire 91 by the force of the springs 53. Thus, the preparatory positioning of the bicycle 90 for exercise is complete. In this state, the drum 46 makes contact with the block type tread patterns adjacently disposed in the circumferential direction of the tire 91.

In this bicycle exercise stand, when the user operates the pedals 92 of the bicycle 90, the drive power of the rear wheel B is transmitted to the pulley 50 through the drum 46 for rotating the rotary shaft 49. The rotary disk 68 is rotated integrally with the shaft 49. Therefore, the eddy current is induced in the rotary disk 68 by the flux of the permanent magnet arrays 71, 75. Accordingly, the resistive load is applied to the disk 68 rotating according to the pedalling operation.

More specifically, the mark 80 pointing to the "L" of the scale 81 in Fig. 10, arranges the magnets 71, 75 having the identical polarities as shown in Fig. 11(a) In this state, no flux passes through the rotary disk 68. Generally, eddy current is generated according to the flux and the rotational motion of the rotary disk 68 for exerting the resistive load for hindering the rotation of the rotary disk 68. Therefore, no flux results in no eddy current and, thus, no resistive force applied to the pedal.

The mark 80 selecting the "H" of the scale 81 in Fig. 10, arranges the magnets 71, 75 having the alternating polarities as shown in Fig. 11(c). The number of flux increases and the resistance becomes larger. The permanent magnets 75 are continuously moved, with respect to the permanent magnets 71, in the circumferential direction from the position shown in Fig. 11(a) through the intermediate position shown in Fig. 11(b). The number of flux increases linearly, and, accordingly, the eddy current also linearly becomes greater. Therefore, the load magnitude varying in accordance with the degree of angular displacement the knob 76 is represented by a line shown in Fig. 12. Accordingly, the desired magnitude of resistive load is easily obtained by turning the knob 76 in respect with the scale 81.

In this embodiment, the drive drum 46 makes surface contact with the tread pattern of the tire at every moment. As a result, the magnitude of the resistive load applied to the rear wheel B can be kept substantially constant resulting in the smooth pedaling exercise. Also, collision of the corners of the tread patterns 91a, moving along with the rotation of the rear wheel B, with the drive drum 46 is prevented, and the generation of noise due to the contact between the drum 46 and the tire 91 is suppressed.

The loading device 2 in this embodiment has the drum 46 rotatably supported on the support 42 rotated by the force of the springs 53. The drive drum 46 is pushed against the rear wheel B of the bicycle for applying the resistive force to the wheel B. This construction enables the exercise stand to exert a resistive load to any wheels regardless of the diameters, resulting in the versatile applicability to the wide range of bicycles with a different wheel diameters, from an adult's bicycle with a large wheel diameter to a child's bicycle with a small wheel diameter.

Furthermore, the drive drum 46 serving as a flywheel assists the user to experience the actual-cycling-feeling. Furthermore, this drum 46 enables an actual flywheel to be omitted for minimizing the size of I size of the apparatus.

It is to be noted that the bicycle exercise stand of this embodiment can be used to apply resistive load to the bicycle tires having rib type or lug type tread patterns.

It is also to be noted that the present invention, which is not limited to the disclosure of the above

embodiment, can for example also be practiced in the following manners:

(1) A timing belt can be used in place of the V-belt 51 which connects the drive drum 46 to the pulley 50.

(2) A resistance generator having a fan for exerting the resistive load can be used.

Claims

1. An exercise stand for a bicycle (90) including a frame (1) for supporting the drive wheel (B) of the bicycle (90), and a loading device (2) having a rotary drive member (46) which rotates and contacts with a tread pattern provided with an outer peripheral surface of a tire (91) as the drive wheel(B) is rotated by the rotation of the pedals (92) of the bicycle (90), said loading device (2) being arranged to exert a resistive load to the drive wheel (B) characterized by that:

   said rotary drive member (46) has an outer diameter enabling the rotary drive member (46) to contact with a plurality of adjacent tread patterns circumferentially juxtaposing in a tire (91), wherein said the tread pattern is block type.

2. An exercise stand according to Claim 1, wherein the loading device includes a resistance generator (48) having a rotary shaft (49) operably connected to the rotary drive member (46) to a resistive load in accordance with the rotation of the rotary shaft (49).

3. An exercise stand according to Claims 1 or 2, further including means (42, 53) for urging the rotary drive member (46) against the drive wheel(B) supported by the frame (1).

4. An exercise stand according to Claim 3, wherein the urging means has:

   a metal support member (42) pivotally mounted on the frame (1) and rotatably supporting the rotary drive member (46); and

   a tension spring (53) disposed between the frame (1) and the support member (42), for urging the support member (42) toward the frame (1).

5. An exercise stand according to Claim 4, wherein the resistance generator (48) is mounted on the support member (42) and the rotary drive member (46) and the rotary shaft (49) are operably connected by a belt (51).

6. An exercise stand according to anyone of Claims 3 to 5, further comprising:

   holding means (54), for, against the urging force of the urging means (42, 53), holding the rotating drive member (46) in an non-pushing position in which it is clear of the drive wheel-(B).

7. An exercise stand according to Claim 6, wherein the holding means includes:

   a stop pin (57) mounted on and projecting from the metal support member (42); and

   a holding lever (54) mounted pivotally with respect to the frame (1) having an elongate hole (56), said hole (56) having a guide portion (56a) for allowing the pin (57) to move and a stopper portion (56b) for restricting the movement of the pin (57).

8. An exercise stand according to Claim 7 including means (58) for urging the holding lever (54) in a direction away from the frame (1); said stopper portion (56b) extending in the opposite direction to the urging direction of the means (58).

9. An exercise stand according to anyone of Claims 2 to 8, wherein the resistance generator (48) comprises:

   a metal rotary disk (68) secured to the rotary shaft (49) and for generating a resistive force; and

   a pair of eddy current generator members (72, 73, 75), disposed one on the opposite sides in respect with the rotary disk (68), and generating eddy currents in the rotary disk (68); each eddy current generator members (72, 73, 75) including a plurality of permanent magnets disposed in a circular sequence with adjacent polarities being alternating.

FIG. 1

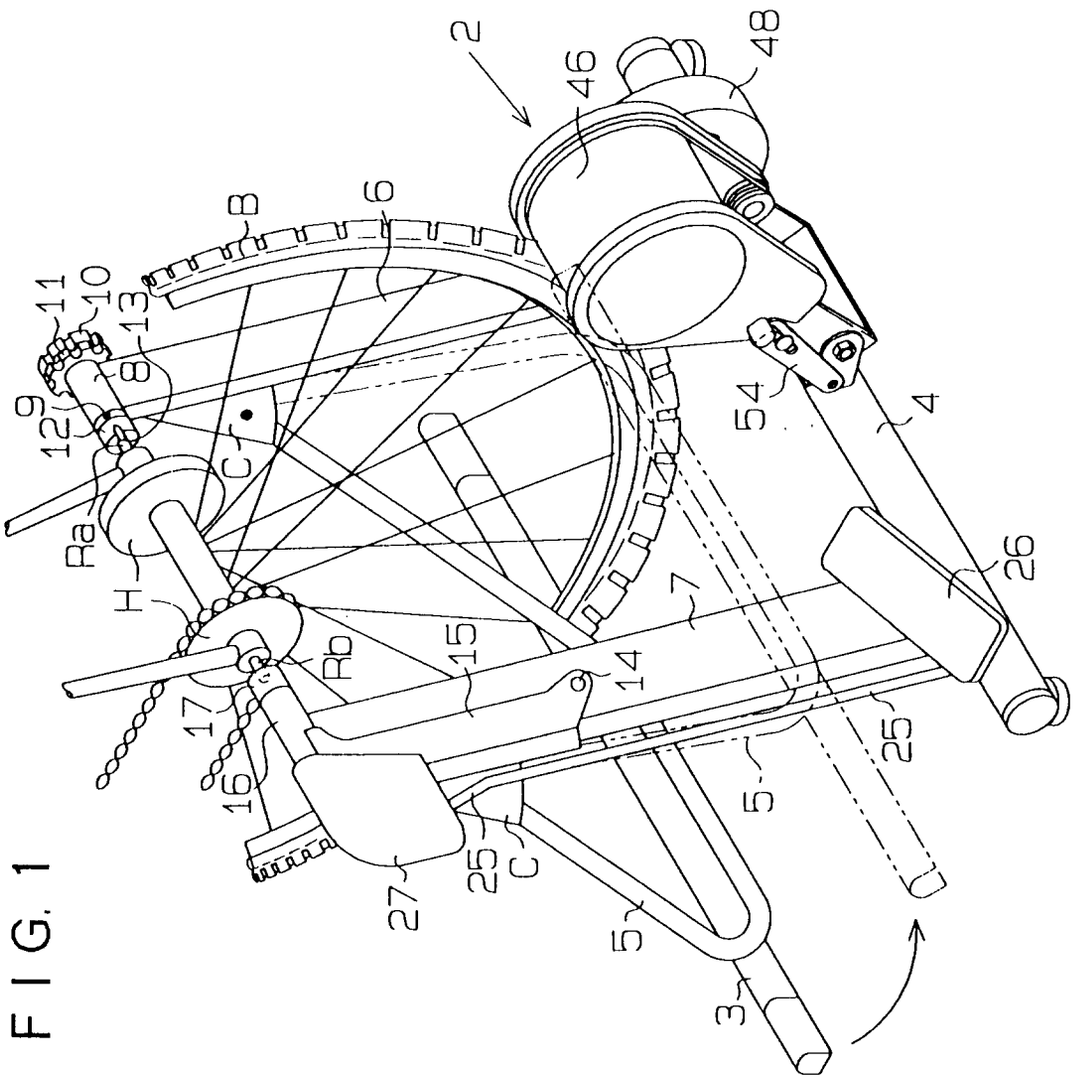

FIG. 2

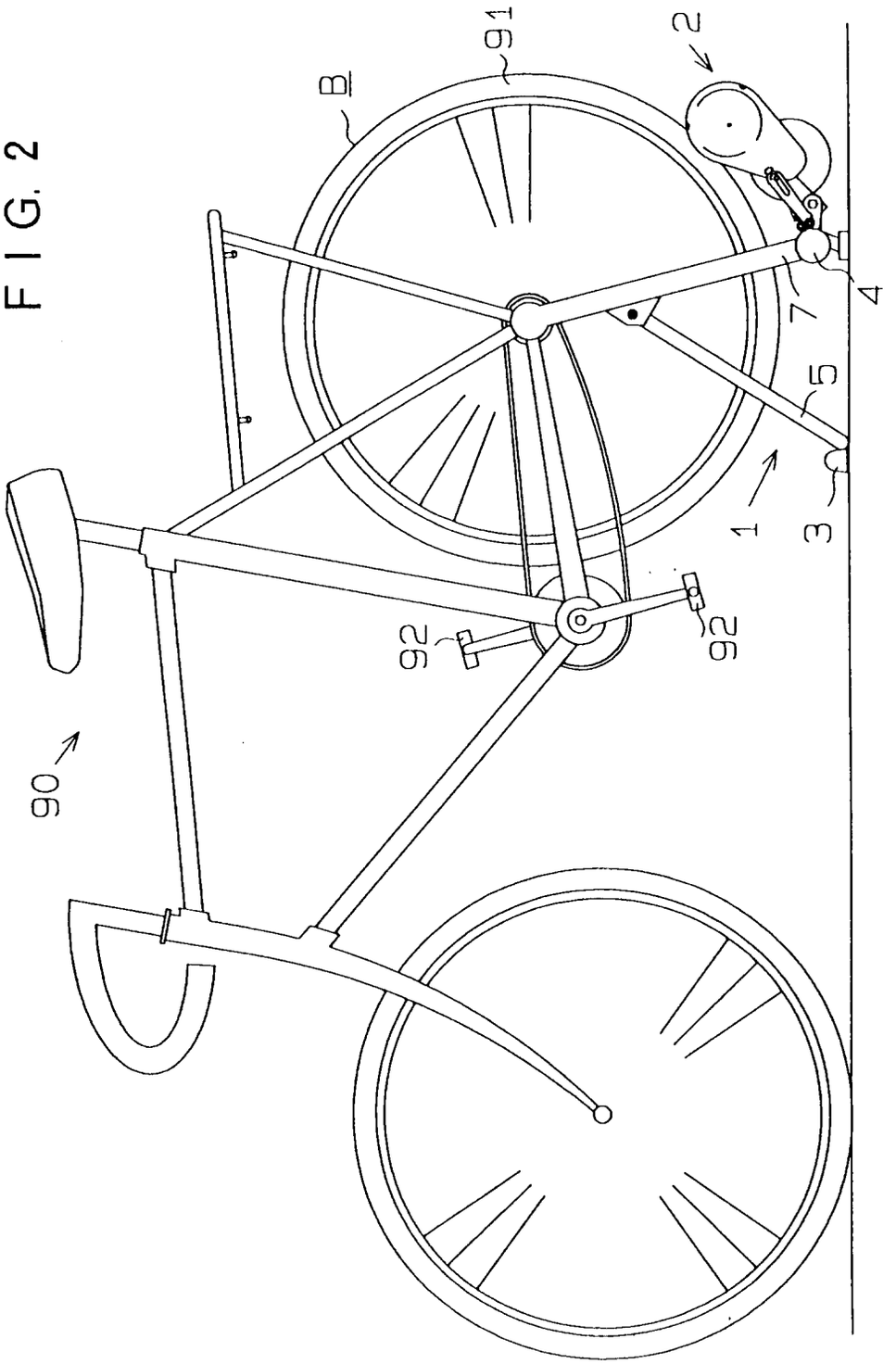

FIG. 3

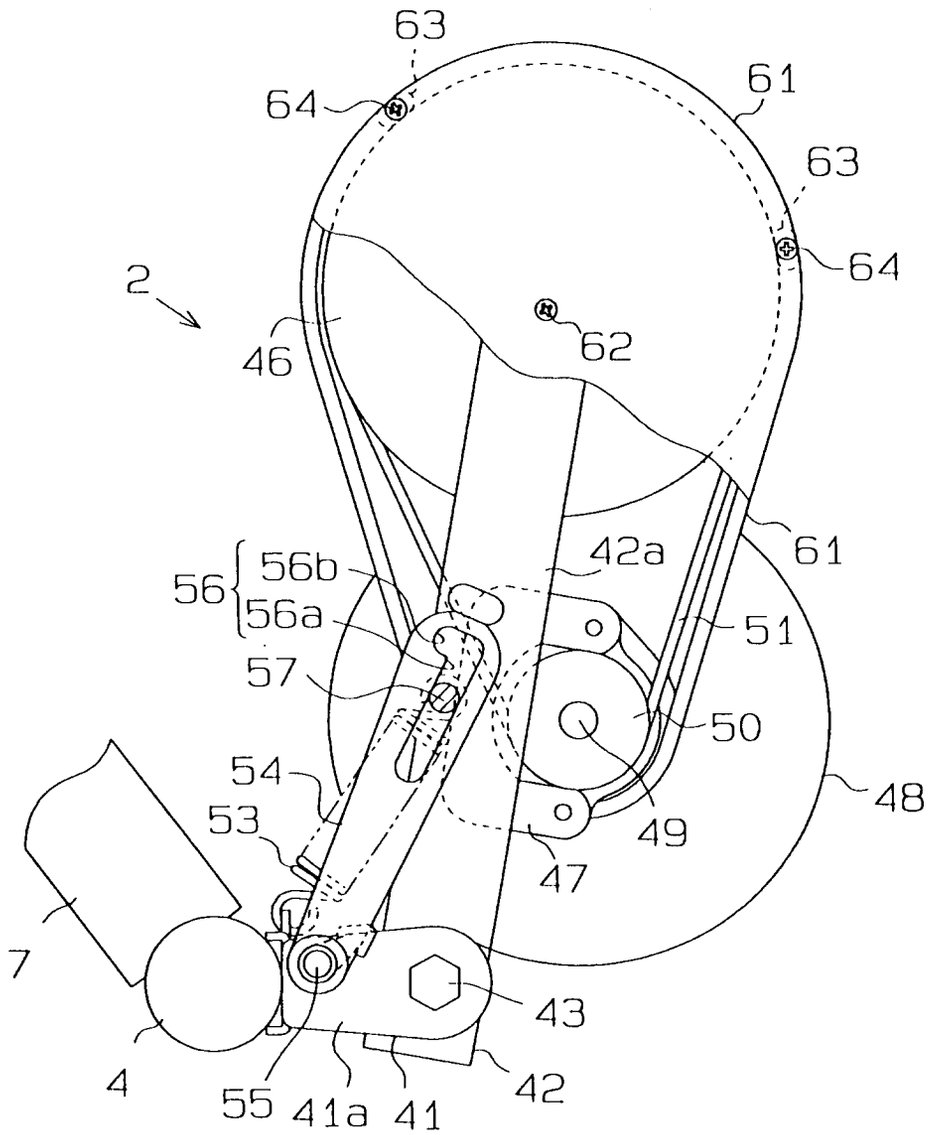
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FIG. 4

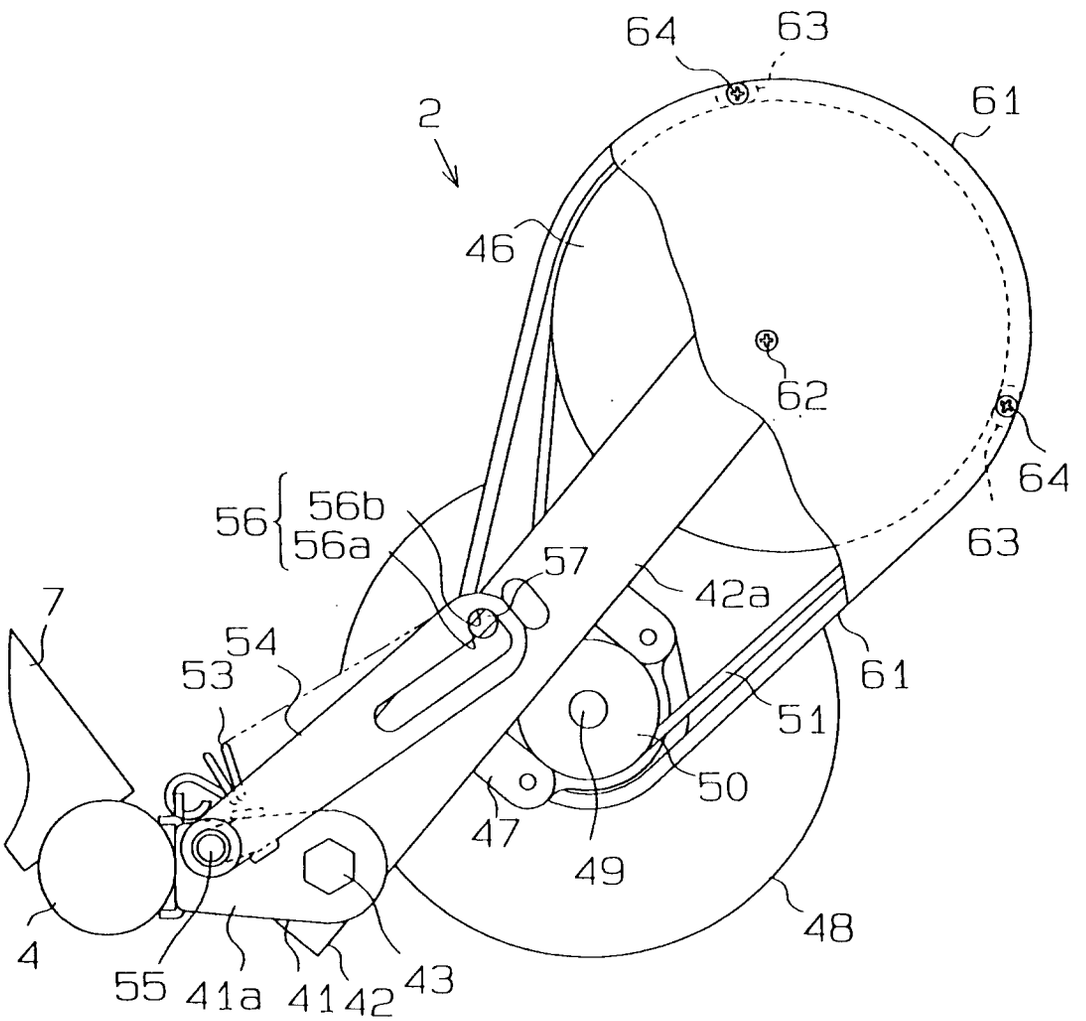
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FIG. 5

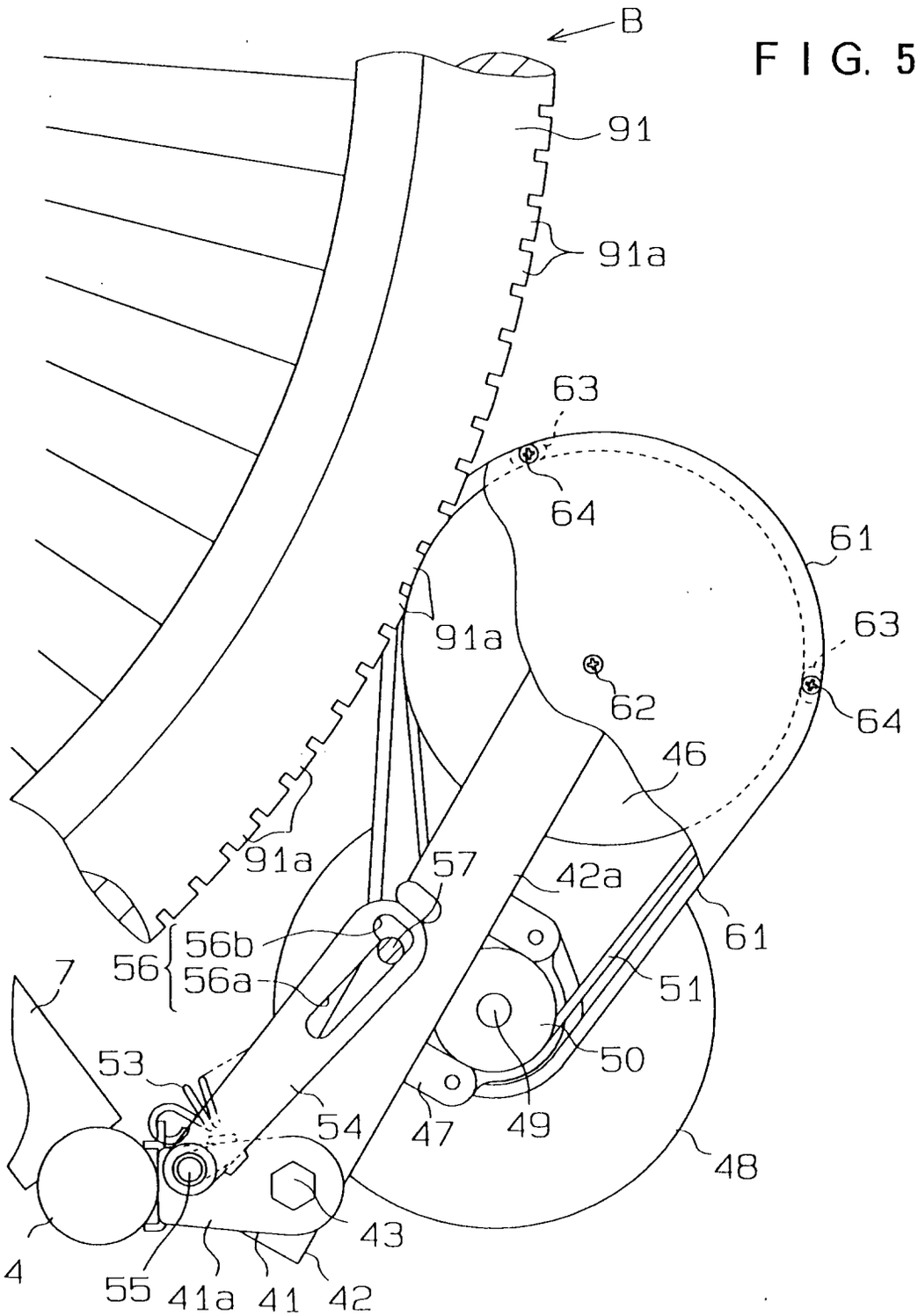
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FIG. 6

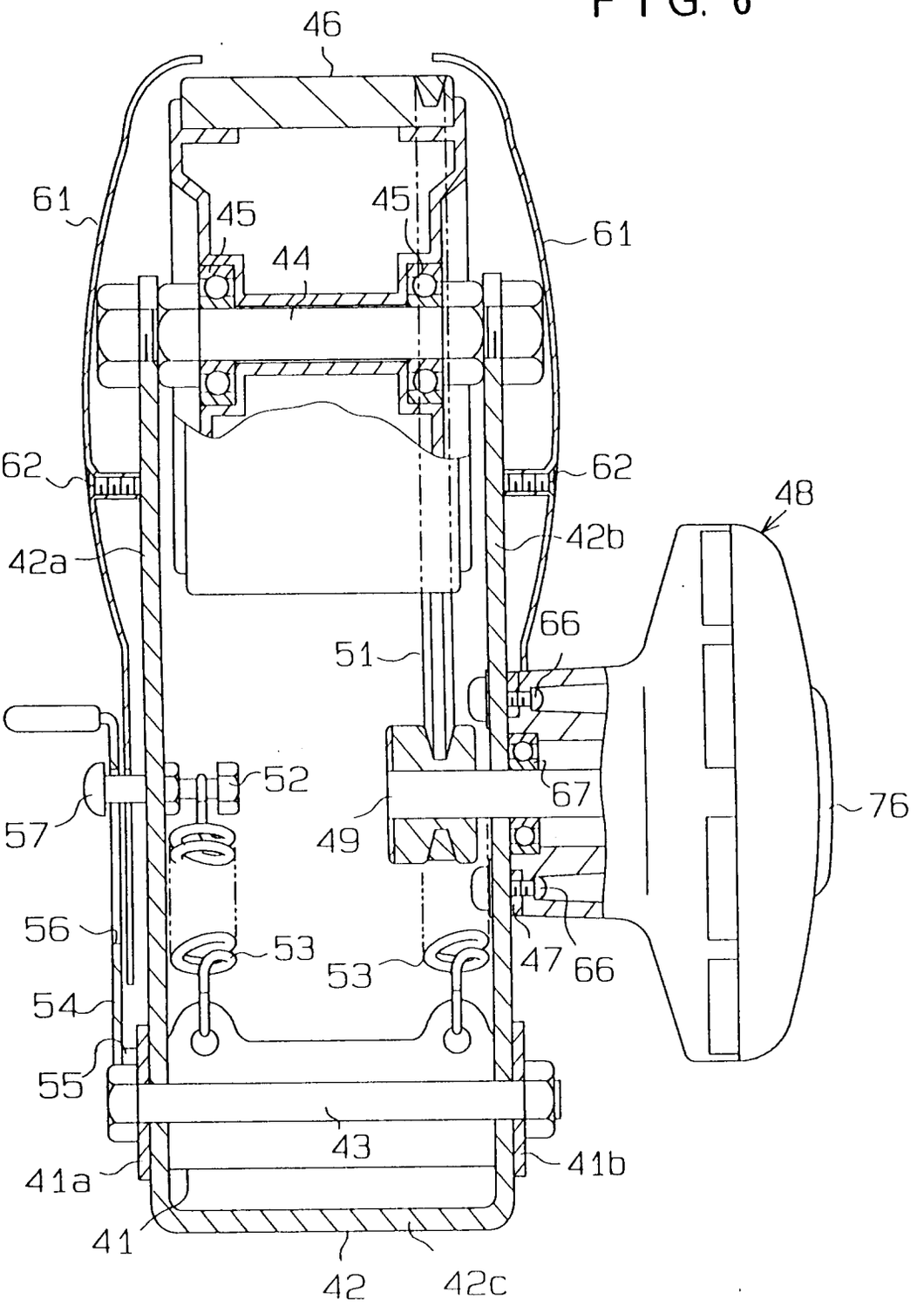
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FIG. 7

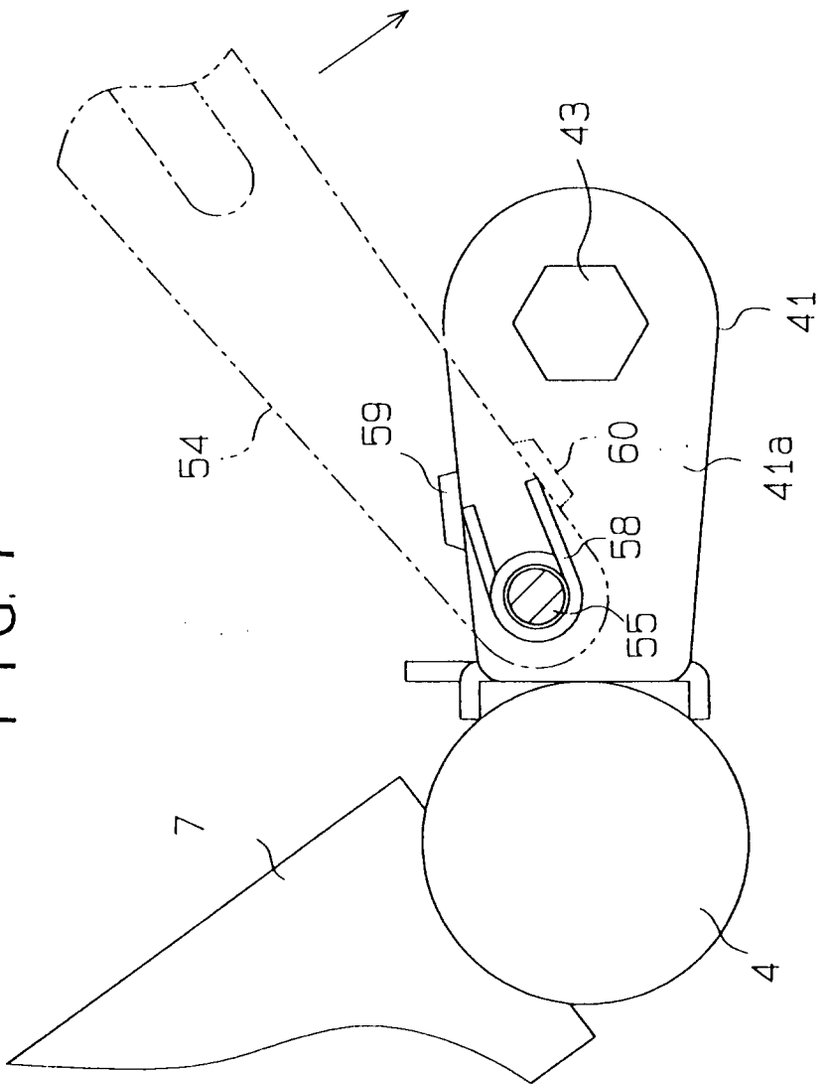

FIG. 8

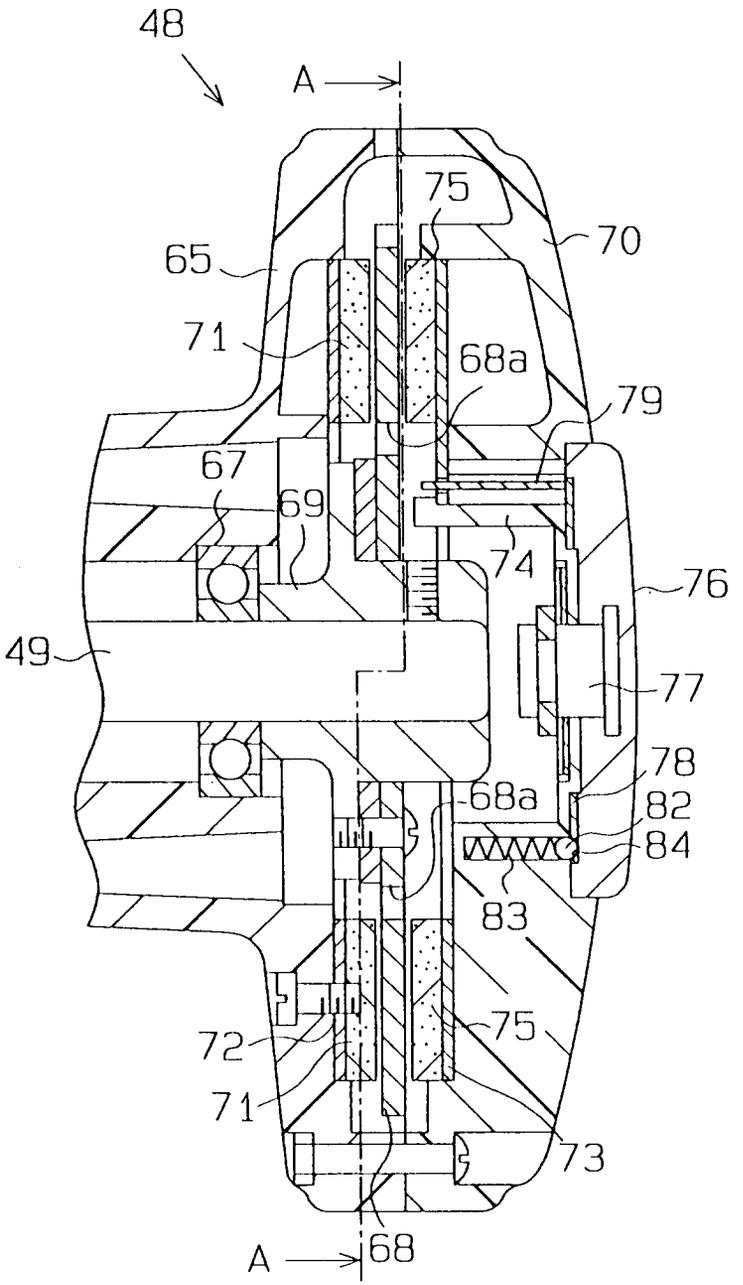
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FIG. 9

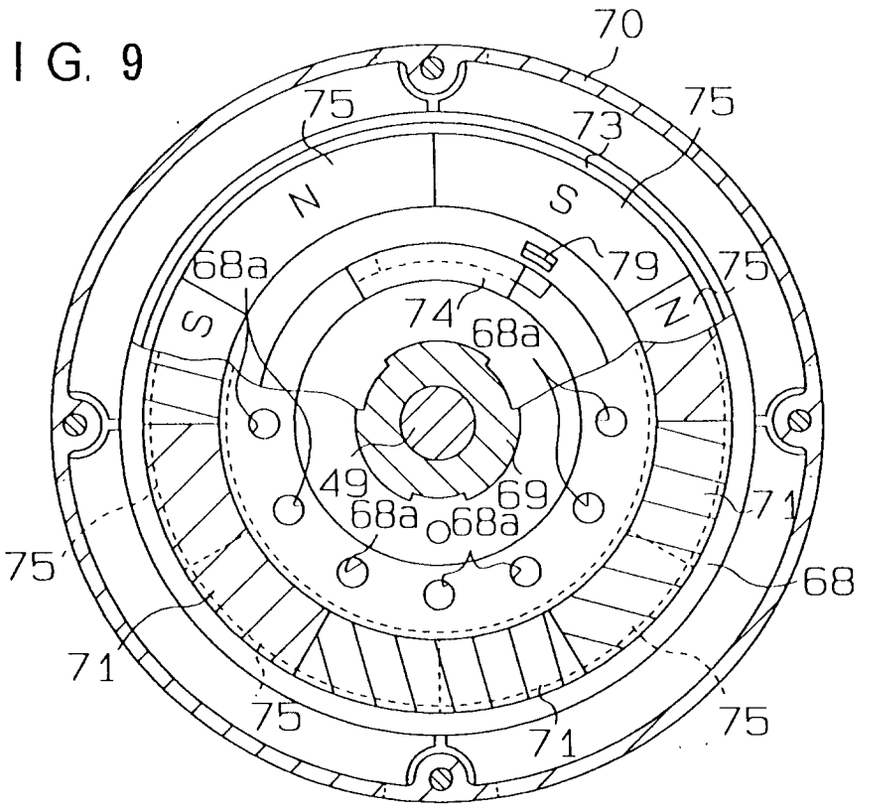
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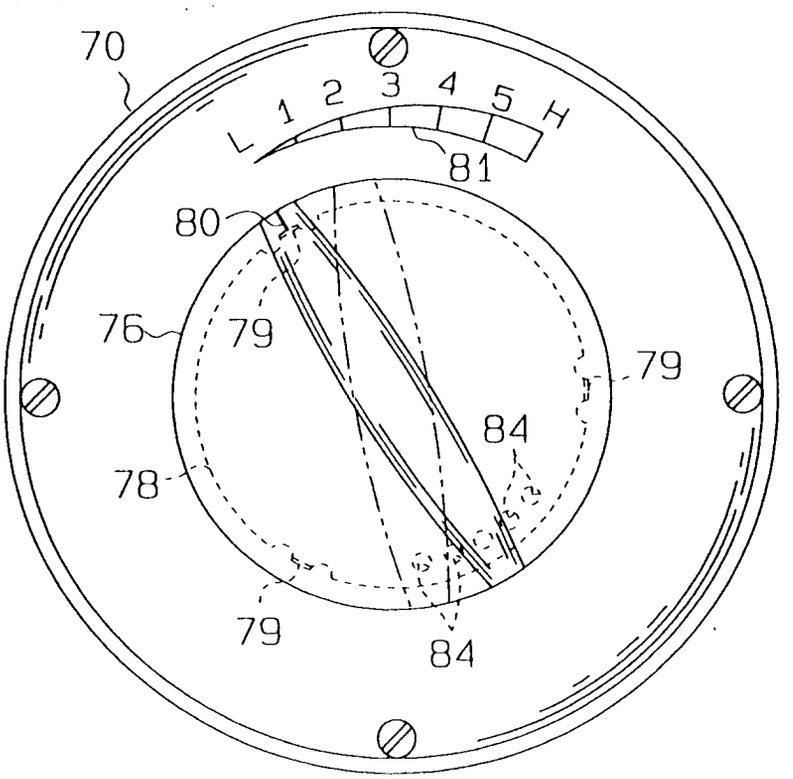
FIG. 10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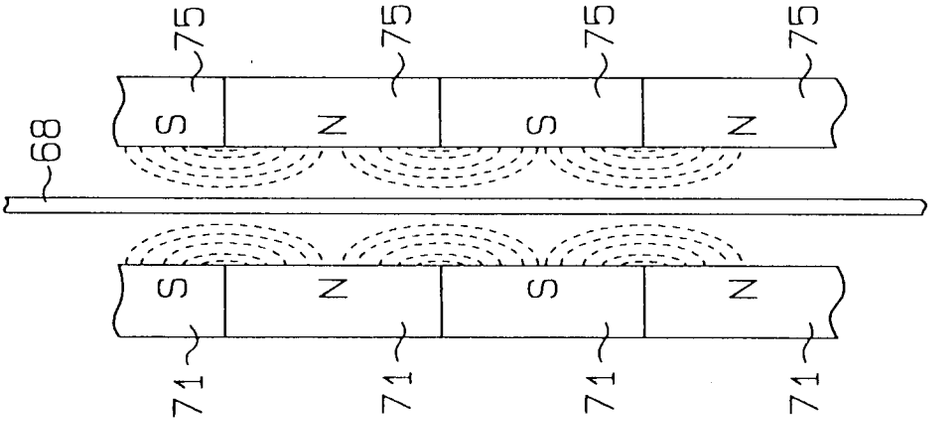


FIG. 11(a)

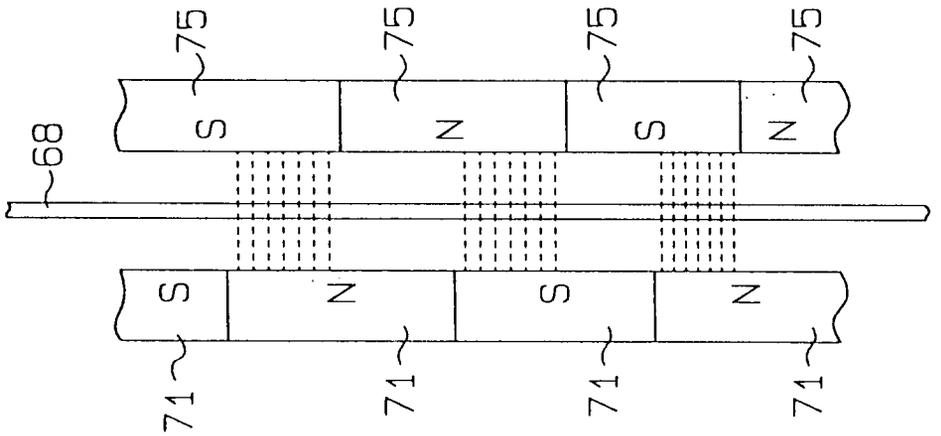


FIG. 11(b)

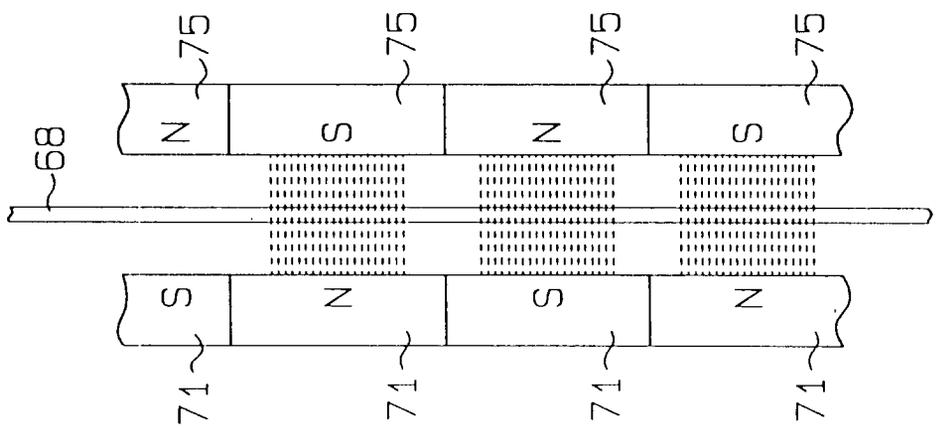


FIG. 11(c)

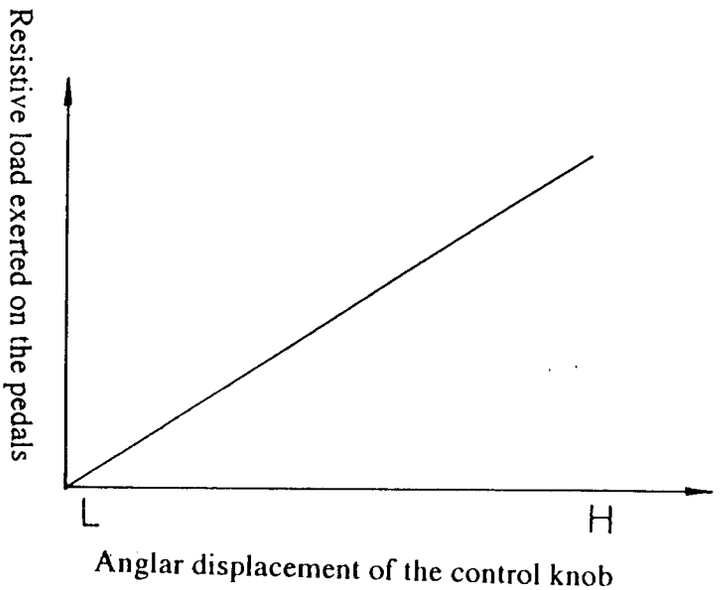

Resistive load exerted on the pedals
L
H
Anglar displacement of the control knob

FIG. 12

FIG. 13

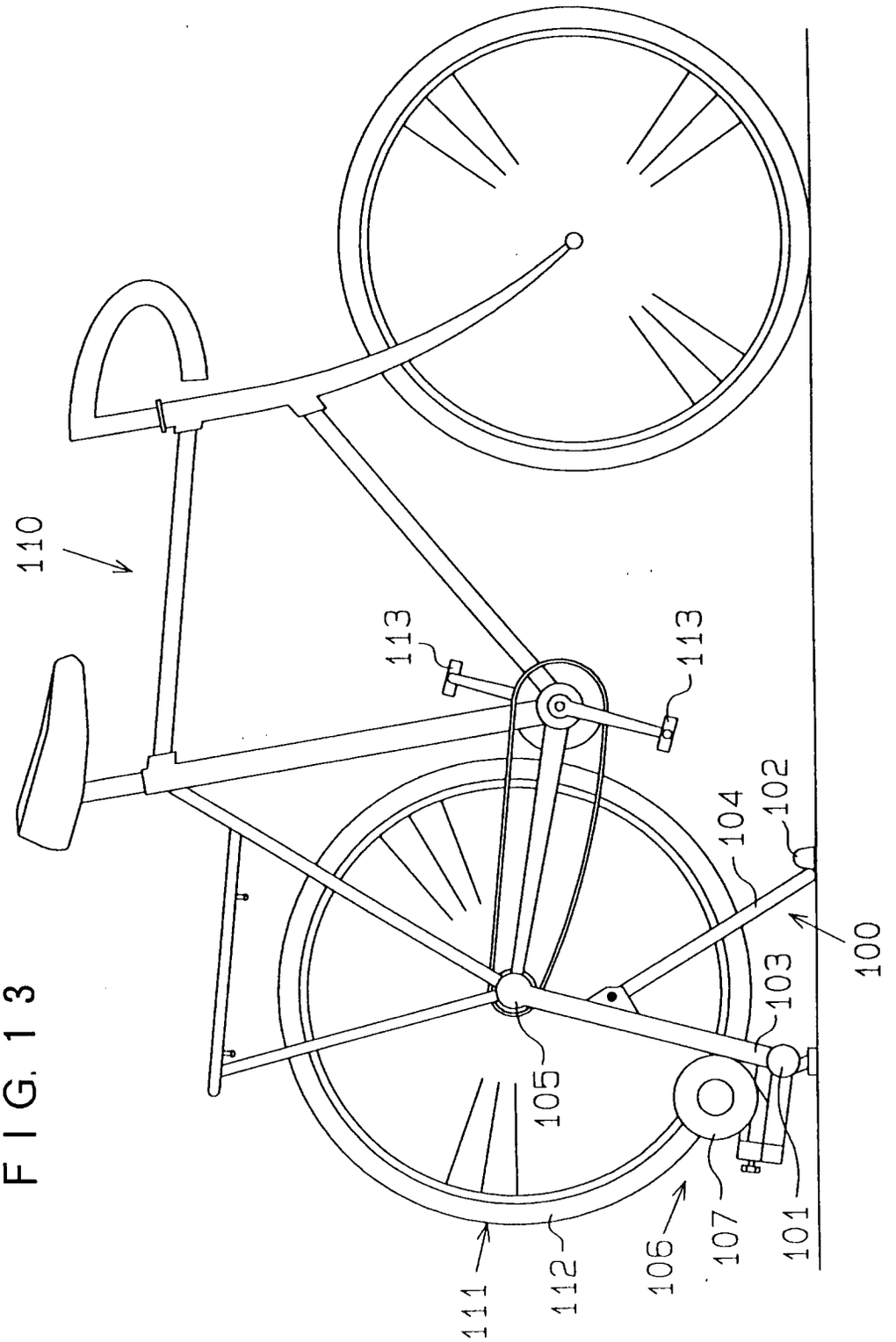
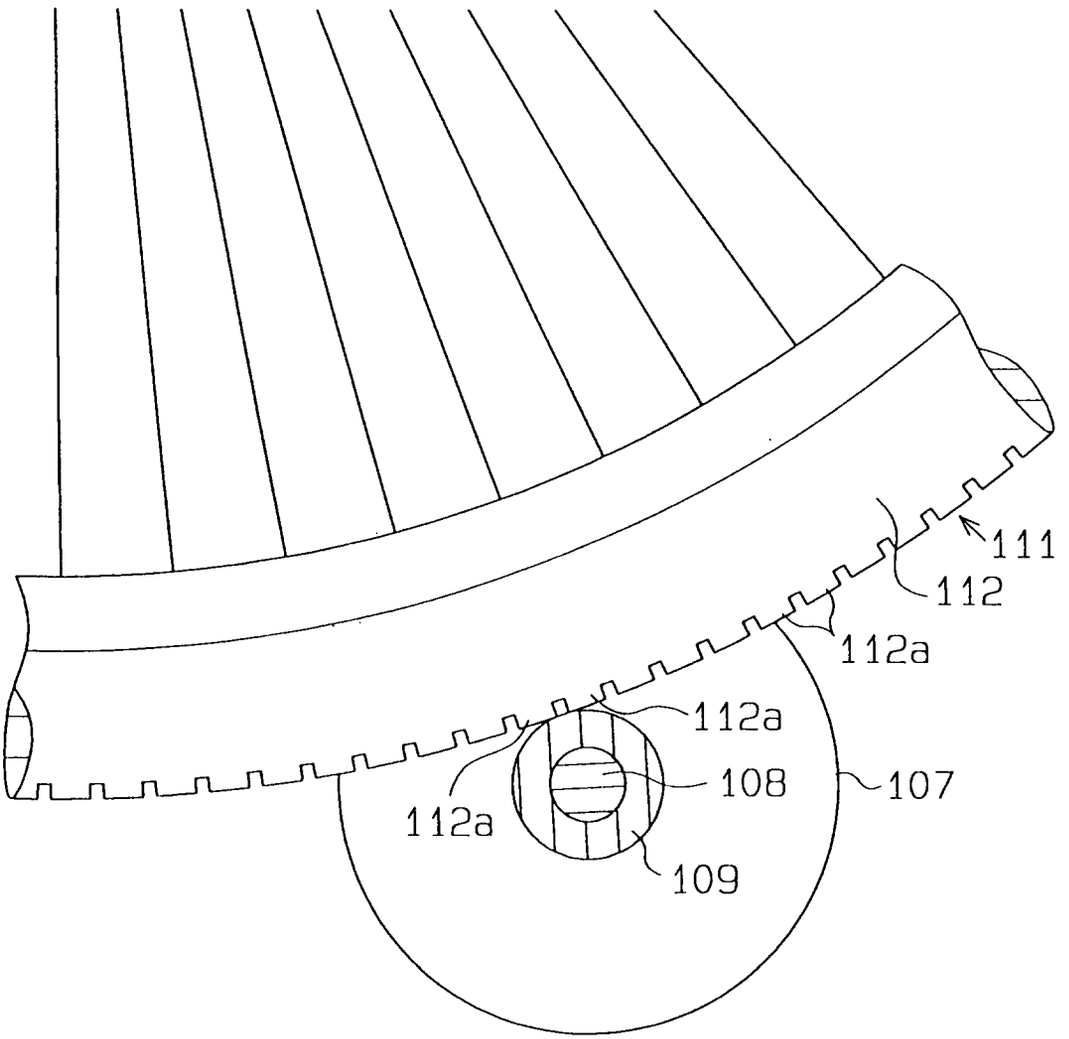


FIG. 14



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 10 0385

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X Y	US-A-5 026 047 (KOSECOFF) * column 5, line 33 - column 6, line 32; figure 1 *	1,2 3,4,9	A63B69/16
Y	US-A-5 042 795 (BURSIK) * column 1, line 42-46 * * column 3, line 5-35 *	3,4	
Y	US-A-4 826 150 (MINOURA) * claims; figures *	9	
A	US-A-4 982 953 (MAKISHI) * the whole document *	1,5	
A	EP-A-0 341 752 (ULTRA M.A.C. CORP.) * column 3, line 40-42; figures *	1,2	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

A63B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	15 March 1995	Giménez Burgos, R

CATEGORY OF CITED DOCUMENTS

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