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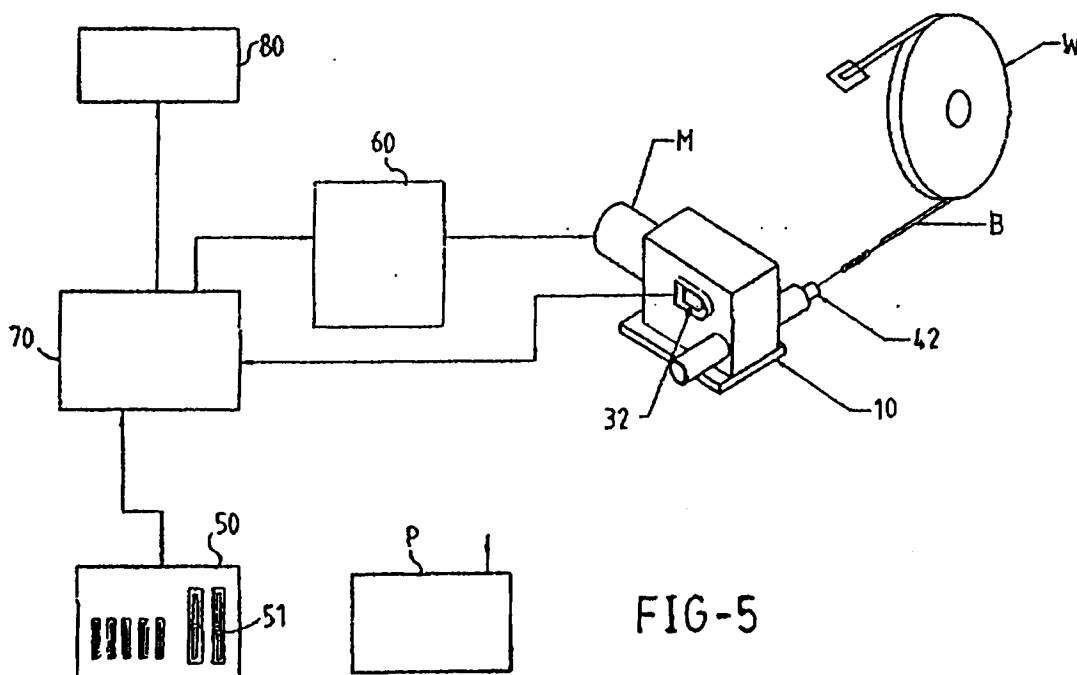
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(54) **Feedback system for a motorized brake system for an indoor exercising device.**

(57) A system for Tension Brake Motor's Brake Signal Feedback for indoor devices usually consists of a power box (10), a motor (M), a reduction gear set, a signal feedback device (70) and a tensile transmission part (42). The signal feedback device makes a comparison between resistance signal feedback (32) of the straight line displacement corresponding to tensile transmission part and the set resistance value

(50), thus forming an amplification of voltage difference which is used to drive the motor (M) to force a step-by-step adjustment of the signal feedback device and tensile transmission part for a revision until the set resistance value equals to the feedback resistance value and the motor stops. With rapid detection and with the obtaining of required belt checking tensile strength, the safety is attained.

**FIG-5****EP 0 528 066 A1**

The present invention refers to an exercise tension brake motor system in particular a tension brake motor's tension brake signal feedback system for an indoor exercise device. Using resistance signal feedback it provides for safe and convenient comparison and adjustment of checking tensile strength.

Indoor exercise devices have gradually become popular, especially with those who are busy working and have no chance to exercise outdoors. Among all indoor exercise devices, the bicycle-type exercise device is most popular. This device uses a long strip around a flywheel (corresponding to the rear wheel of a bicycle) circumference. The friction tension brake force of the belt toward the flywheel changes as the belt is strained or relaxed, and the user has to apply force for pedalling thus overcomposing the tension brake effect to attain the purpose of health through exercise. In the conventional indoor exercise device, one adjusts and sets the tension in the belt by means of flipping the tensile adjuster installed on the handle bar. This technology is similar to that for brakes in bicycles or motorcycles. The surface of the tensile adjuster is engraved with scales to indicate the tensile value, thus enabling users to change to the required tensile value.

However, as the structural strength of such early-stage adjusters is not as good as it should be, they are easily damaged or become inaccurate when the belt has been strained for long periods of time and the operation is also not convenient.

In recent years, tensile control technology for the indoor exercise devices has greatly improved with the motor taking the place of the adjuster and thus significantly improving the stability of the straining belt. However, if the power supply has not been turned off by the users after use, the belt is still being strained without being released. As the next user does not know the tensile tension brake force at that time, the motor will further strain the belt, when the power is turned on again, resulting in a strain too great for pedalling or even exceeding the belt's tensile strength and breaking it. For this, the only solution is to perform calibration or adjust the tensile strength prior to use of the exercise device. However, since it is difficult to perform such calibration, general users will find it greatly inconvenient. Such a design is still not a better design.

It is the object of the invention to provide an improved exercise tension brake motor's tension brake signal feedback system.

This object is attained by tension brake signal feedback system for indoor exercise devices comprising a rectangular power box having locked together a sideward case and a bottom case penetrated by a rear keyway sleeve and a front keyway

sleeve and a motor positioned at the outboard of the end surface of the sideward case, the output shaft of the motor is extending into the sideward case and connects with a worm gear a speed reduction device located within power box, a tension transmission part located at the front of the power box in the front of keyway sleeve and made up by a shaft sleeve and a transmission screw in connection with the speed reduction device, the transmission screw is connected with one end of the belt, the variable resistor of the signal feedback device is able to feedback the resistance value signal through wires to a control circuit with the change of the rotation of the signal feedback gear of the signal feedback device for comparison with the originally set resistance value and amplification, thus driving the motor with voltage difference and driving the signal feedback device to generate a new resistance signal feedback value and causing the tension transmission part to generate the required displacement and displacement direction and the motor will stop until the values of such two resistors are equal to each other and by means of this the rapid detection and belt checking power is obtainable.

The reduction device preferably comprises at least a first reduction gear meshed with the worm gear, a pinion connected with the same shaft of the first reduction gear, a second reduction gear meshed with the pinion, a second pinion connected with the same shaft of the second reduction gear, a third reduction gear meshed with a pinion and a pinion which is connected with the same shaft of the third reduction gear.

In the system keys K1 and K2 are provided in the rear and front keyway sleeves for guiding and limiting the displacement direction of the transmission screw and the sleeving sections of the rear and front keyway sleeves in the power box having a larger sleeving diameter to receive the shaft sleeve of the tension transmission part.

Preferably a ring gear is installed on the surface of said shaft sleeve for meshing with the gears of the third reduction gear and the outer diameter of the ring gear is larger than the inner section sleeving diameter of the keyway sleeves and the inboard of the shaft sleeve has internal threads for connection with the transmission screw.

The transmission screw or bolt has a smaller end and no thread is provided which is connected to the belt and keyways in conjunction with the keys of the rear and front keyway sleeves are provided along the axial direction of the surface of the transmission screw.

The device according to the present invention has better operability and safety by means of variable resistance with a signal feedback system for changing and amplifying the gearing rotation signal

for feeding back to the control circuits for comparison with the originally set resistance value. Hence the motor is driven to rotate with the voltage difference and drive the signal feedback device. The tensile transmission part creates a new resistance feedback signal to force the tensile transmission part to create the required displacement amount and direction to stop the motor when these two resistance values are equal. Thus rapid detection and obtaining of tensile strength of the belt result in better operation.

The technical means, elements adopted and the functions of this invention are hereby described with actual examples in conjunction with related drawings.

Detailed Description of this Invention Drawings:

- Figure 1 is the exploded drawing of the device of this invention, which indicates the layout of all component elements.
- Figure 2 is a foreview of this device.
- Figure 3 is a cross section of the device.
- Figure 4 is a control circuit of this invention.
- Figure 5 is a control flow chart of this invention.

Figure 1 shows the components of the apparatus according to the invention. The tension brake signal feedback signal of this invention generally comprises a power box 10, a DC motor M, a reduction gear set 20, a signal feedback device 30, and a tension transmission part 40, where motor M is located at the side of power box 10 with its output shaft driving reduction gear set 20 inwardly and the signal feedback device 30 and tension transmission part 40 are operated by means of voltage difference signals thus causing the gradual equality between the voltage signal of feedback device and the set voltage. Also, the tension transmission screw 40 will stop after moving to a certain distance, thus providing the users with a required tension value. The construction and functions of this invention are hereby described in detail in what follows.

Power box 10 is of rectangular shape, which is formed by locking of sideward case 11 and bottom case 12 by screws extending through the wall of bottom case 12 and cooperating with screw sockets positioned on the interior surface of the wall of case 11, where the outboard of one end of sideward case 11 is equipped with a cylindrical motor mounting frame of house motor M. This inboard of sideward case 11 has a larger round hole for the getting through and setting of a rear keyway sleeve 14. A key K1 is located inside the rear keyway sleeve 14. A front keyway sleeve 15 is installed in

the inboard of bottom case 12, which corresponds to said rear keyway sleeve 14. There is key K2 (not shown) installed inside front keyway sleeve 15, which is used to house the tension transmission part 40 and for the reciprocal movement of the transmission. The sections of keyway sleeve 14, 15 within the power box 10 have bigger diameters. The end surface of bottom case 12 has a rectangular mounting frame 16, which is installed in the bottom holder of the exercise device.

Motor M is housed in the motor frame 13 of the sideward case 11 is locked on the end surface of sideward case 11 with its output shaft 18 extending the sideward case 11 by means of screw 17 and shaft connected with a worm gear 19 for driving the reduction device 20.

Reduction device 20 is installed in power box 10, which includes 1st reduction gear 21, 2nd reduction gear 23 and 3rd reduction gear 25, all of which are connected inside the power box 10 by means of gear shafts 22, 24, 26, where the 1st reduction gear 21 is driven by worm 19, of which the central coaxial surface has a pinion 27; the 2nd reduction gear 23 is driven by pinion 27 and the 3rd reduction gear 25 is driven by the coaxial pinion 28 (not shown) on its inboard surface. After the operation of reduction device 20, the output revolution (about 2000 r.p.m.) can be reduced to required speed (about 2-4 r.p.m.) thus driving the signal feedback device 30 and tension transmission part with low speed.

A signal feedback device is installed in the power box 10, which has a signal feedback gear 31 and a rotary variable resistor 32, where the signal feedback gear 31 is driven by the pinion 29 which is installed on the same shaft of the inboard of the 3rd reduction gear 25. The front surface of gear 31 is marked with an arrow which is used for calibration and the zero setting of transmission part 40.

The variable resistor 32 is located at the outboard of front cover of case 11, with its shaft end 33 penetrating sideward case 11 for positioning washer 34 and nut 35. The VR shaft 33 of resistor 32 is connected to the feedback gear 31. Certain terminals 36 are available at the front end of resistor 32 for connecting wires to the control circuit (to be described in detail later) for feedback transmission by means of the resistance and voltage signal there, thus controlling the rotation direction or stoppage of motor M to cause the displacement of tension transmission part 40 and generate the required tensile strength.

The tension transmission part 40 is located in the rear keyway and front keyway sleeves 14, 15. It has a shaft sleeve 41 and a transmission screw 42, the shaft sleeve 41 is of cylindrical shape, with a ring gear 43 located at its outboard. Also, outer diameter of gear 43 is bigger than that of the pipe

of the inner section of keyway sleeves 14 (15) for driving the 3rd reduction gear. Its inner face has internal threads for meshing with transmission screw 42. Transmission screw 42 is meshed in shaft sleeve 41. Its length is longer than that of shaft sleeve 41, with one end having smaller diameter and having no threads for connecting with braking belt B (not shown). There is keyway 44 on transmission screw 42 for the extending of key K1 and K2 of keyway sleeves 14, 15. During assembling, shaft sleeve 41 is positioned in the section of the pipes having larger inner diameter of keyway sleeves 14, 15, while gear 43 at its top is positioned between the rear keyway sleeves 14, 15, while gear 43 at its top is positioned between the rear keyway sleeve 14 and front keyway sleeve 15. After transmission screw 42 is threaded in shaft sleeve 41, with its keys 44 aligning with the key racks K1, K2 of the shaft tubings, both ends of bolt 42 can extend in shaft tubings 14, 15. When gear 43 is driven by the 3rd reduction gear 25, as shaft sleeve 41 is positioned, it can only rotate at the same place without displacement. Its internal thread can drive transmission screw 42 and cause it to move. As the transmission screw 42 is guided and limited by racks of keys K1 and K2, it can form a straight line of reciprocal movement thus straining or releasing braking belt B to provide proper tensile strength.

Figure 2 is a front view of the device and the cooperation of the elements is more evident than from Figure 1. The motor mounting sleeve 13 extends outwardly from the casing or side wall 11. The worm gear 19 on the output shaft of the motor (not shown) cooperates with the gears of the first reduction gear 21. The gears of the second reduction gear are in contact with the pinion 27 of the first reduction gear 21. The coaxial pinion 28 of the second reduction gear 23 is in contact with the gears of the third reduction gear 25. The pinion 29 inboard of the third reduction gear 25 is in contact with the gears of the signal feedback gear 31 mounted on the shaft 33 of the variable resistor (not shown). The transmission part 40 comprises a ring gear 43 located at its outboard for driving the third reduction gear 25. The transmission part 40 also includes a shaft sleeve 41 and the transmission bolt 42 cooperating with the keys K1 and K2. The cooperation of the elements is also shown in Figure 3 which is a cross section having the side-ward case 11 and the bottom case 12 fixed together forming the power box 10. The signal feedback device 30 is positioned in the lower part of the power box 10. On the outer surface of the side-ward case 11 there is positioned the variable resistor 32 with its terminals 36. The shaft 33 of the resistor 32 extends through the power box 10 into a bearing positioned on the inner surface of the

bottom case 12. The resistor 32 is fixed with a nut 35 at a bearing on the inner surface of the side-ward case 11. A washer 34 assists the securing. The shaft 33 of the resistor extends through the centre of the signal feedback gear which is mounted on the shaft 33. In the upper part of the power box 10 there are shown the gear 43, the center of which is arranged in the center line of the keyway sleeves 14 and 15. The mounting frame 16 is positioned above a side wall of the bottom case 12 and screws (not shown) may extend into screw sockets in the side wall of the side-ward case 11. The keyway 44 for K2 is shown at the left side of said Figure 3. The transmission bolt 42 extends through the front keyway sleeve 15 into the shaft sleeve 41. The key 1 is positioned with the rear keyway sleeve 14.

From Figures 4 and 5 the control circuit and the operating device are evident. Figure 4 shows the electrical circuit of the motor control circuit 60 and its connection with the DC-motor as well as the control circuit 70 and its connections. The circuits show the common symbols for the elements of the circuits, which are well known to a person skilled in the art.

Figure 5 shows the power box 10 with the resistor 32 on the outer surface of the box. The transmission bolt 42 is in connection with the braking belt B surrounding a flywheel W. P is a power source. 50 is an operation panel having a manual slide pot 51. A control circuit 70 is electrically connected with the transmissions of the variable resistor 32 and also with the motor control circuit 60. 80 is a LED display in connection with the control circuit 70.

When the user wants to put the exercise device into use, after plugging in power P, if the user selects the manual operation mode, he (she) can operate the manual slide pot 51 on the operation panel 50 (its inside is of sliding type variable resistor) to move (or set) the desired belt tension value (such as 0 to 10 kg). If such a set resistance value is not equal to the resistance signal feedback value from variable resistor 32, it is evident that the present position of transmission screw 42 cannot provide the tension value as required by the user. At this time, just compare the set resistance value with the feedback resistance value via control circuit 70 and motor control circuit 60 with comparator U2A and U2B, and perform voltage difference amplification thus driving motor M for forward or backward rotation for gradual adjustment of transmission screw 42's moving direction and displacement. Also, step-by-step adjustment of variable resistor 32 can be made with signal feedback gear 31, and resistor 32 will feedback new resistance for comparison by the comparator until the difference value is zero and the power supply to motor M can

be stopped. At this time, the position of transmission screw 42 and the tension applied to belt B and flywheel W can meet requirements of settings by the user.

If the user selects an automatic operation mode, as the automatic department of operation panel 50 is equipped with certain groups of tension setting keys which are sued for setting the tension for use in each stage and the required tension can be adjusted by microcomputer according to the aforesaid procedures for signal feedback, comparison and operation. Also, the orginally set time value (such as 3 min.) can be immediately changed to next stage after a lapse of the time for each stage for the same amount of intime interval until all stages are completed. The panel 50 is also provided with LED display 80.

It is known from the aforesaid operation and control of this invention that there is a corresponding relationship between the signal feedback device 30 and the tension transmission part 40. Through the design of the number of teeth of the gear, the rotational displacement circumference of gear 31, the value of resistor 32 and the stroke of transmission screw 42 can make a fixed proportional relationship to facilitate circuit operation and signal comparison. Users can use such a relationship to set and use the required belt tension under any tension condition, thus avoiding the condition of over-loose and over-strain belt or the tension is beyond the using range to enhance the operational convenience and safety of such exercise devices. Therefore, this invention can be termed as the most practical and advanced invention.

Summing up the above, this invention, "Checking Motor's Tension Brake Signal Feedback System for Indoor Exercise Devices", not only is well constructed; it also provides the best and reliable operability and safety with resistance feedback signal to rapidly detect and obtain the required checking power.

List of Reference Numbers

10	power box
M	DC-motor
11	sideward case, front cover
12	bottom case
13	motor mounting sleeve, mounting frame
14	rear keyway sleeve
K1	key
15	front keyway sleeve
K2	key
16	mounting frame
17	screw
18	output shaft of the DC motor
19	worm gear
20	reduction device

21	first reduction gear
22	gear spindle or shaft
23	second reduction gear
24	gear spindle or shaft
25	third reduction gear
26	gear spindle and shaft
27	pinion
28	coaxial pinion
29	pinion inboard of third reduction gear
30	signal feedback device
31	signal feedback gear
32	variable resistor
33	shaft of resistor
34	washer
35	nut
36	terminals
37	
38	
39	
40	transmission part
41	shaft sleeve
42	transmission screw, bolt
B	braking belt
43	gear
44	keyway
W	flywheel
P	power scource
50	operation panel
51	manual slide pot
60	motor control circuit
70	control circuit
80	LED display 80

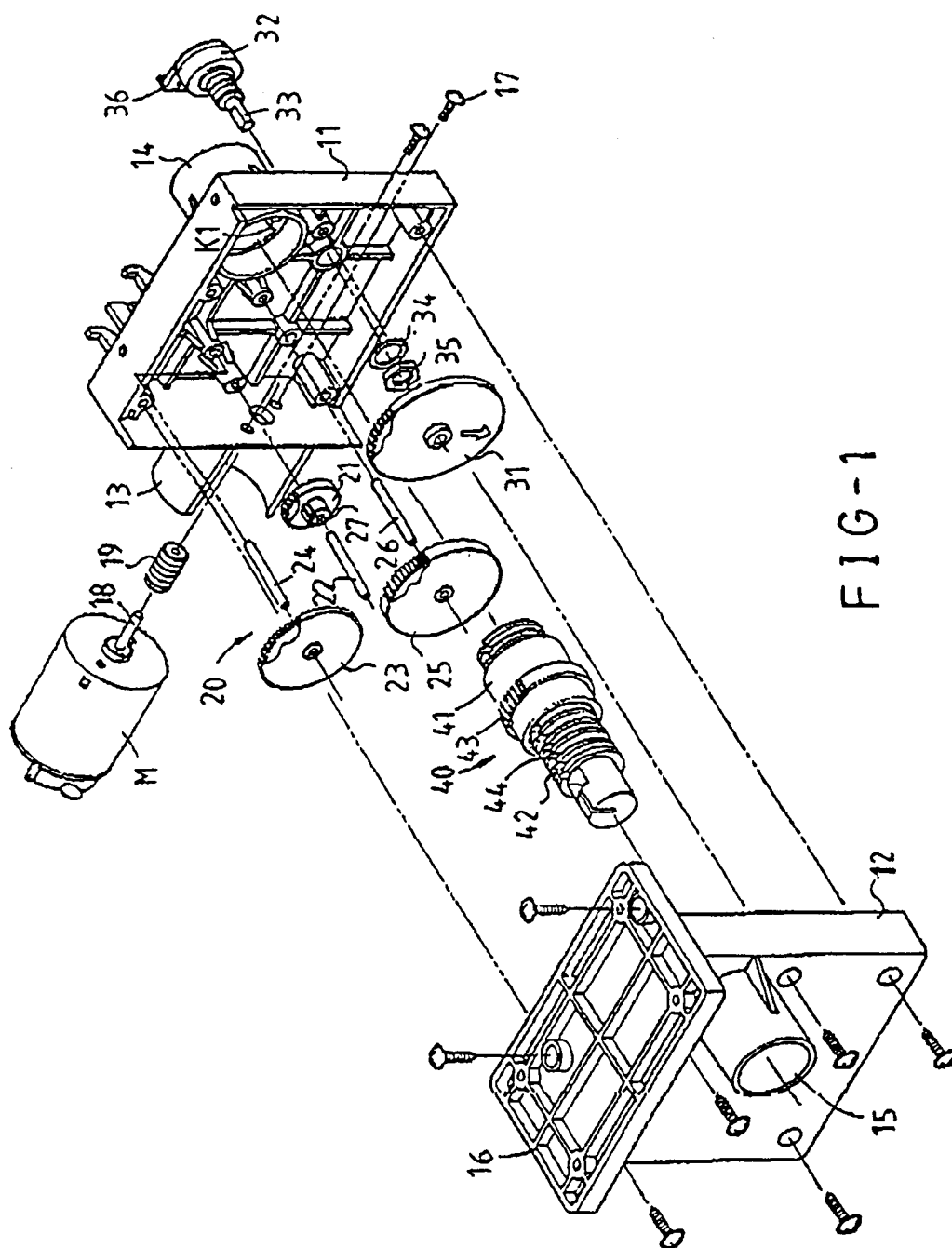
Claims

1. Tension brake motor's tension brake signal feedback system for indoor exercise devices comprising a rectangular power box (10) having locked together a sideward case (11) and a bottom case (12) penetrated by a rear keyway sleeve (14) and a front keyway sleeve (15) and a motor (M) positioned at the outboard of the end surface of the sideward case (11), the output shaft (18) of the motor (M) is extending into the sideward case (11) and connects with a worm gear (19) a speed reduction device (20) located within power box (10), a tension transmission part (40) located at the front of the power box (10) in the front of keyway sleeve (15) and made up by a shaft sleeve and a transmission screw (42) in connection with the speed reduction device (20), the transmission screw (42) is connected with one end of the belt (B), the variable resistor (32) of the signal feedback device is able to feedback the resistance value signal through wires to a control circuit (70) with the change of the rotation of the signal

feedback gear (31) of the signal feedback device (30) for comparison with the originally set resistance value and amplification thus driving the motor (M) with voltage difference and driving the signal feedback device to generate a new resistance signal feedback value and causing the tension transmission part to generate the required displacement and displacement direction and the motor will stop until the values of such two resistors are equal to each other and by means of this the rapid detection and belt checking power is obtainable.

2. System of claim 1, wherein the reduction device (20) comprises at least a first reduction gear (21) meshed with the worm gear (19), a pinion (27) connected with the same shaft (22) of the first reduction gear (21), a second reduction gear (23) meshed with the pinion (27) a second pinion (28) connected with the same shaft (24) of the second reduction gear (23), a third reduction gear (25) meshed with a pinion (29) and a pinion which is connected with the same shaft (26) of the third reduction gear (25).
3. System of claim 1, wherein the keys K1 and K2 are provided in the rear and front keyway sleeves (14, 15) for guiding and limiting the displacement direction of the transmission screw (42) and the sleeving sections of the rear and front keyway sleeves (14, 15) in the power box (10) having a larger sleeving diameter to receive the shaft sleeve (41) of the tension transmission part (40).
4. System of any of claims 1 to 3, wherein a ring gear (43) is installed on the surface of said shaft sleeve (41) for meshing with the gears of the third reduction gear (25) and the outer diameter of the ring gear (43) is larger than the inner section sleeving diameter of the keyway sleeves (14, 15) and the inboard of the shaft sleeve (41) has internal threads for connection with the transmission screw (42).
5. System of any of claims 1 to 4, wherein there is a smaller end on said transmission screw (42) and no thread is provided which is connected to the belt (B) and keyways in conjunction with the keys (K1, K2) of the rear and front keyway sleeves (14, 15) are provided along the axial direction of the surface of the transmission screw (42).

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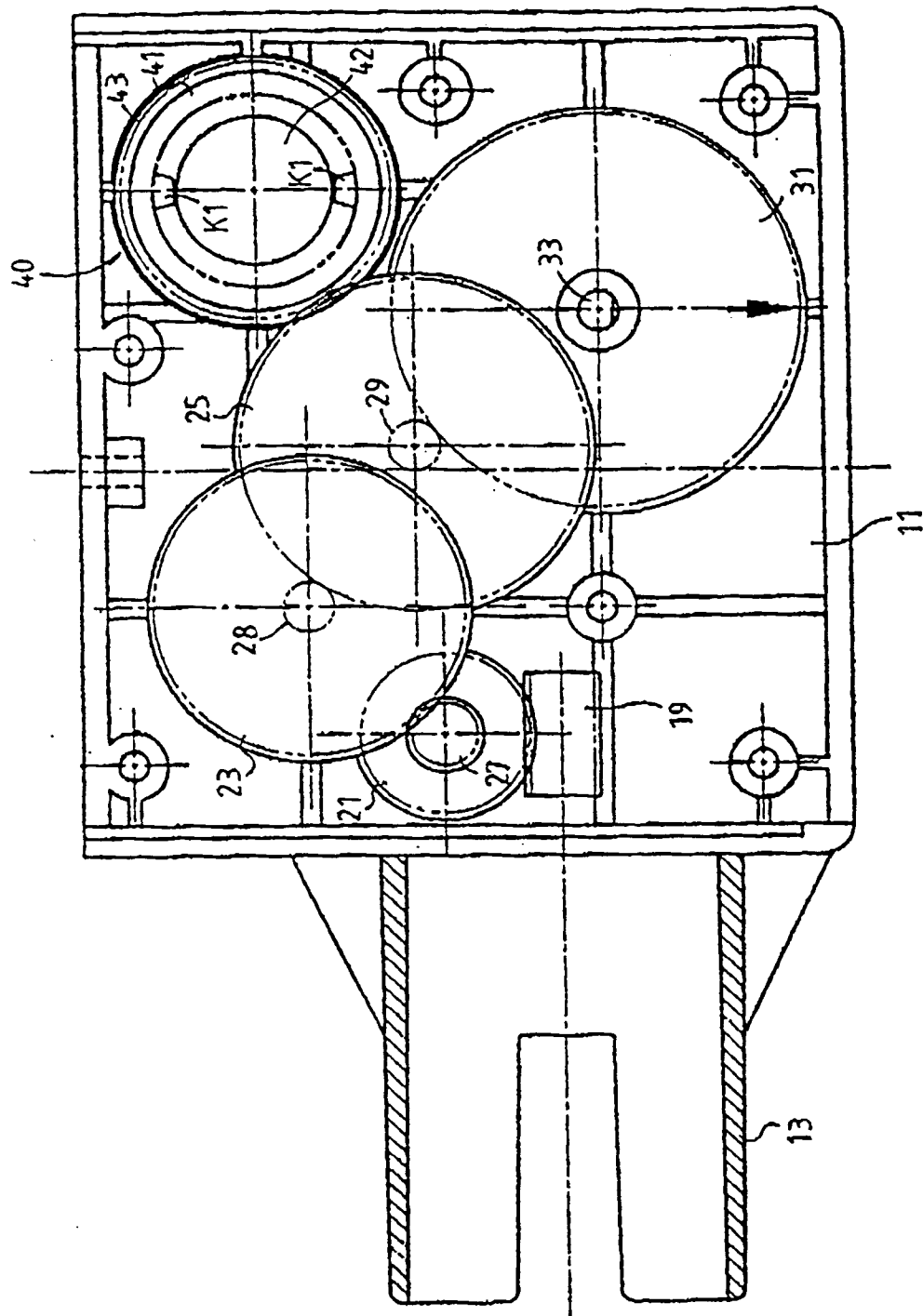


FIG-2

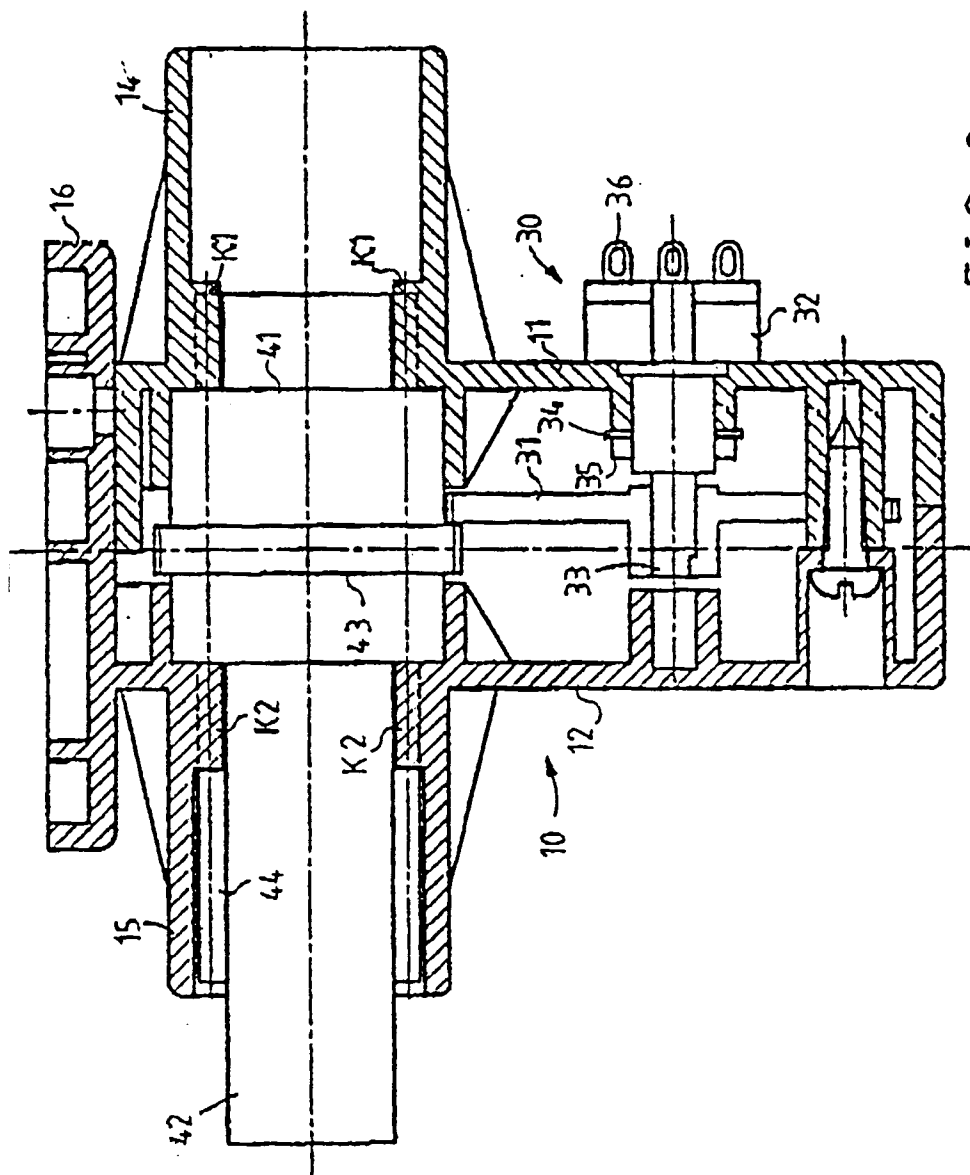
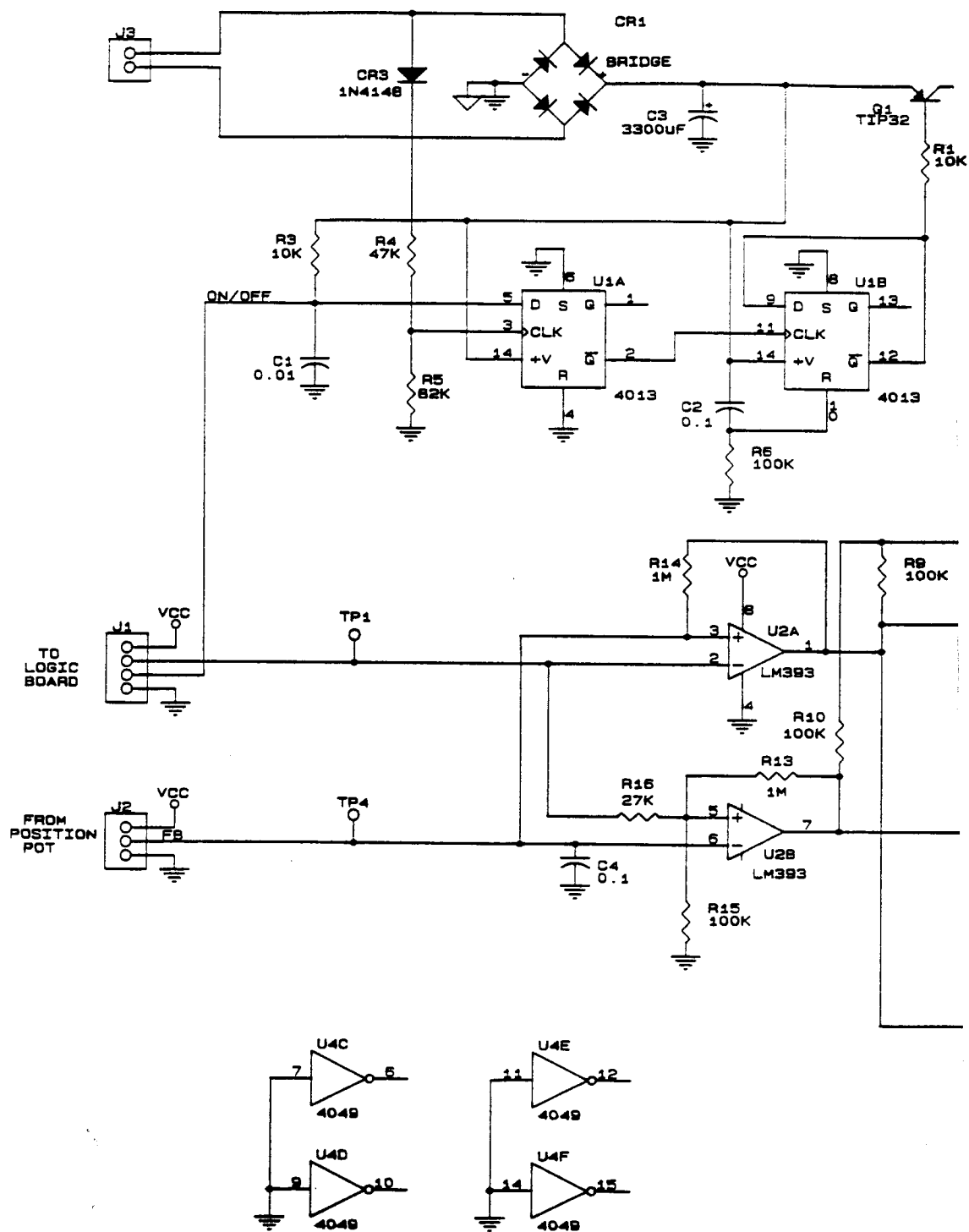


Figure 4 left side



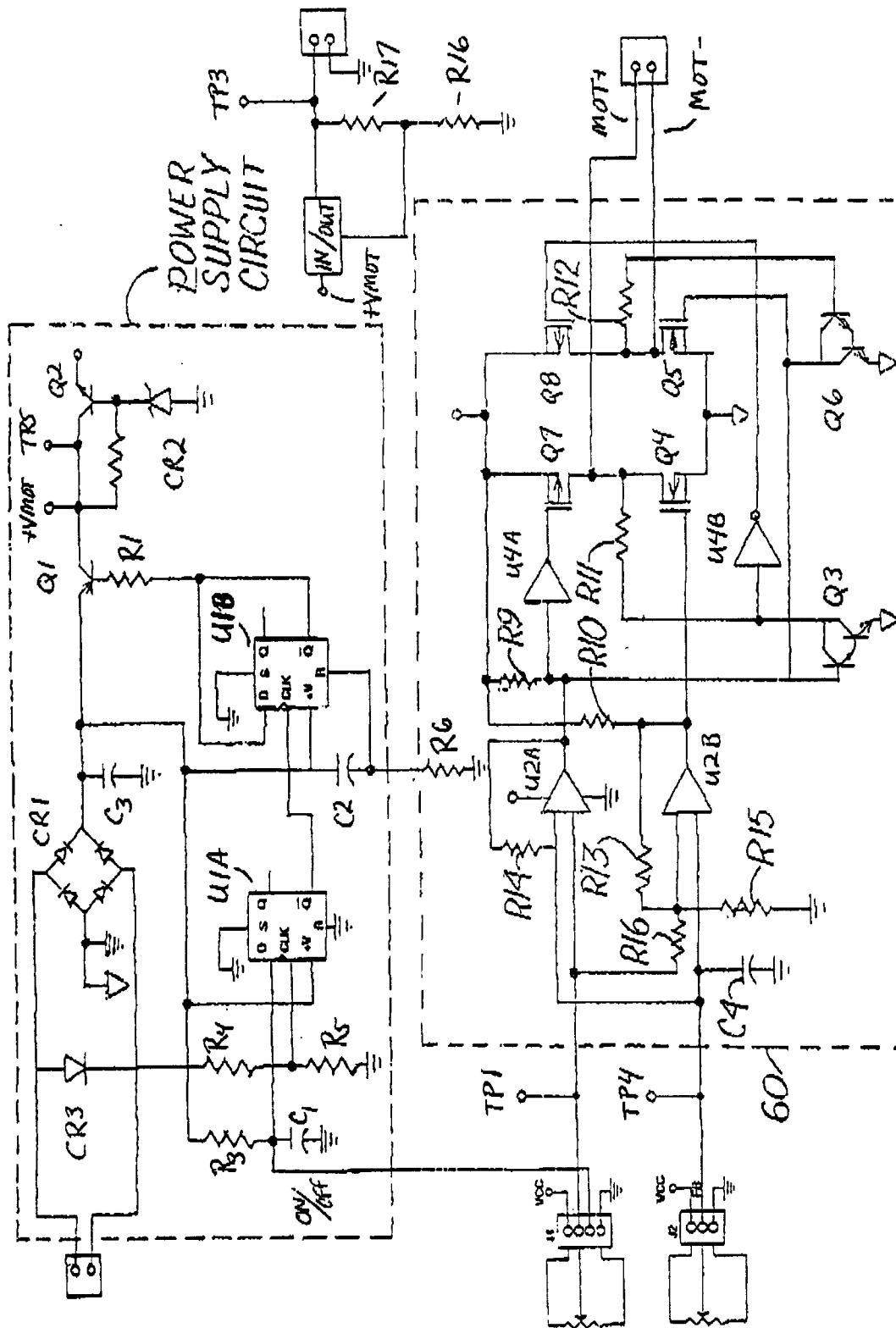
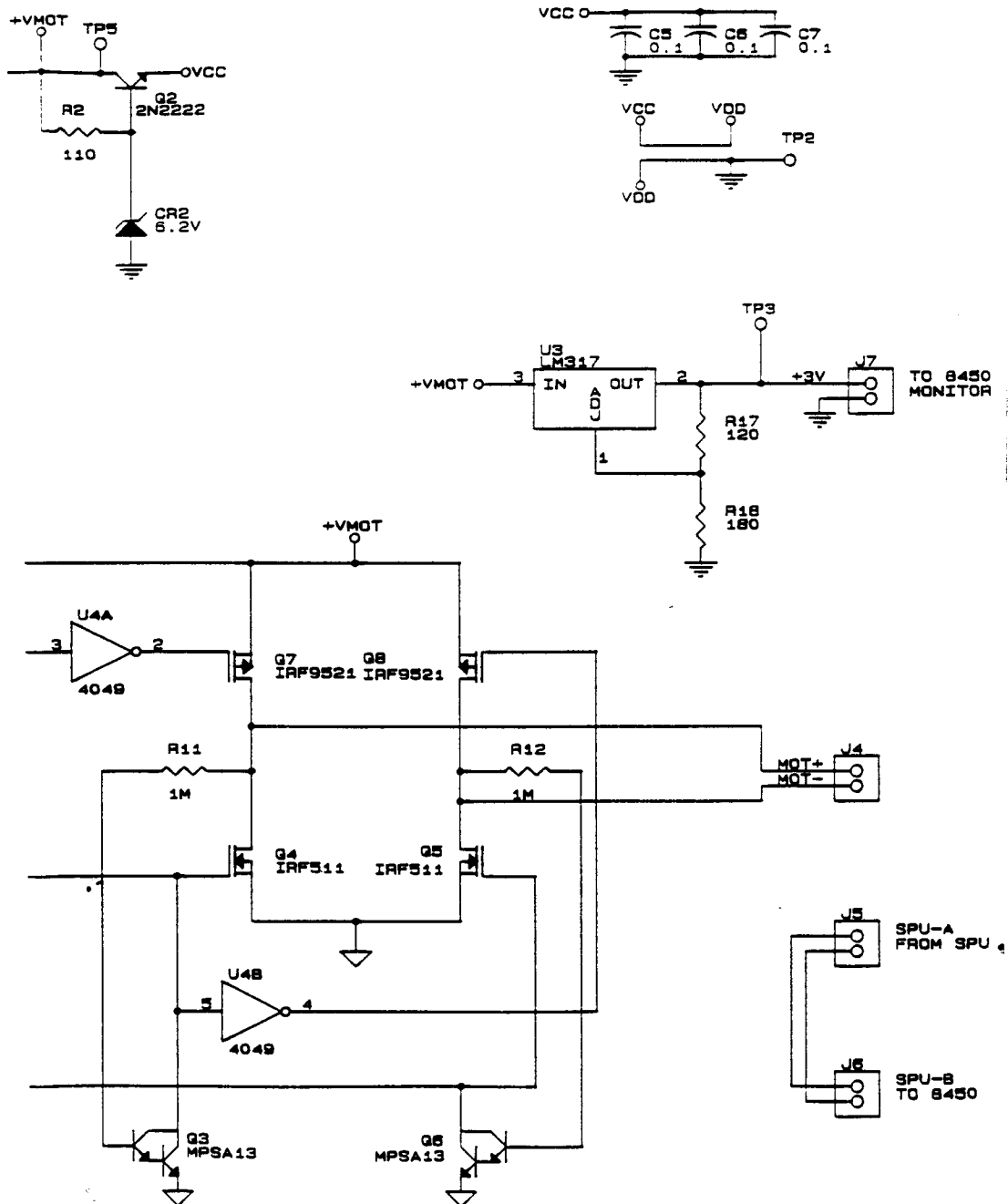
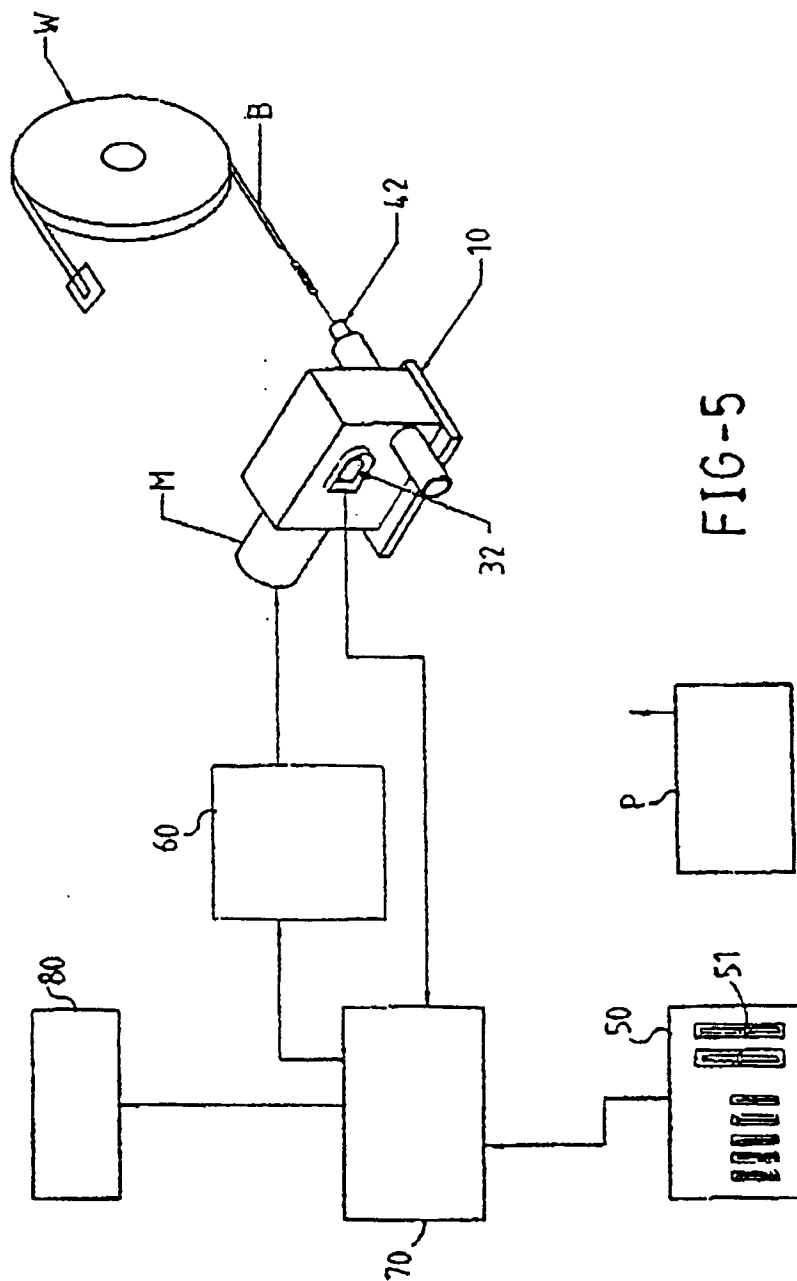


FIG-4

Figure 4 right side







European Patent
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EUROPEAN SEARCH REPORT

Application Number

EP 91 11 3896

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.5)
A	WO-A-9 108 024 (J SCHUMACHER) * page 5, line 25 - page 6, line 6 * * page 6, line 31 - page 7, line 12 * * figure 2 * ---	1	A63B21/015
A	WO-A-9 010 474 (SCHWINN BICYCLE CY) * page 20, line 30 - page 22, line 14 * * figure 3 * ---	1	
A	US-A-3 621 948 (K DIMICK) * column 2, line 67 - column 3, line 20 * * figure 2 * ---	1	
A	US-A-4 998 725 (S WATTERSON) * column 9, line 13 - line 22 * * column 9, line 44 - line 53 * * figure 5 * ---	1	
A	CH-A-627 274 (P TERRAILLON) -----		
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			A63B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 16 APRIL 1992	Examiner VEREECKE A.
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