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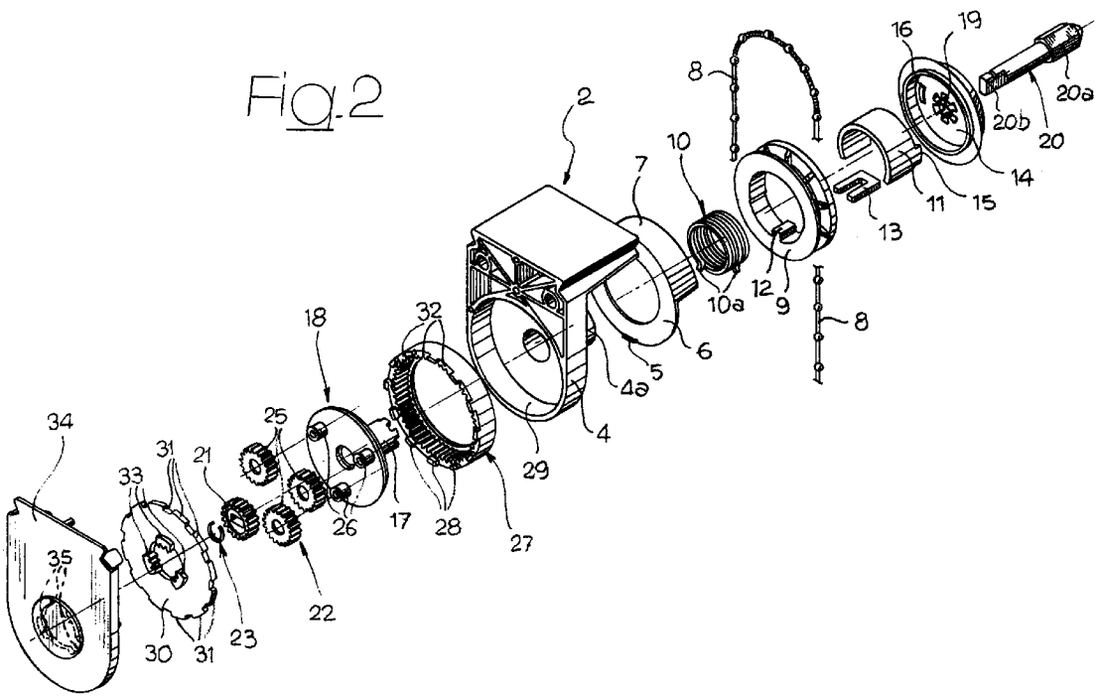
(54) Device for actuating a roller blind

(57) An actuating device for a roller blind comprises an auxiliary element (30) which can be mounted in two different operative conditions in order to enable an operation of the device with a reducing transmission or, respectively, with a direct drive.

Fig.2



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Description

[0001] The present invention relates to devices for actuating roller blinds, of the type comprising:

- a supporting structure, which is to be secured to a ceiling or a wall,
- a blind roller, on which a blind web is wound, rotatably supported around a horizontal axis by said supporting structure,
- a blind driving pulley, rotatably mounted on the supporting structure coaxially with the blind roller and engaged by an actuating member, such as a ball chain, for actuating the blind, and
- a driving transmission interposed between said driving pulley and the blind roller.

[0002] In the devices of the above indicated type, on one hand there is the problem to enable the user to raise the blind without applying a high force and on the other hand there is the need to achieve full upward movement of the blind in a relatively reduced time.

[0003] The object of the present invention is that of providing a device for actuating roller blinds of the above indicated type which is able to satisfy both the above indicated needs in the best possible way.

[0004] In view of achieving this object, the device according to the invention is characterized in that said driving transmission includes an epicyclic gear train comprising:

- a solar sprocket connected in rotation to the blind roller,
- a plurality of planet sprockets meshing with the solar sprocket and freely rotatably supported on a planet carrying wheel driven by said driving pulley,
- a peripheral crown having inner teeth, meshing with said planets and adapted to selectively assume two operative conditions, a first operative condition in which said crown is rigidly connected to said fixed supporting structure, so that the epicyclic gear train acts as a reducing unit in order to decrease the force requested for raising the blind, and a second operative condition, in which said toothed crown is free to rotate with respect to the fixed structure and is rigidly connected to said solar sprocket and said planets, so as to transmit the rotation of the driving pulley directly to the blind roller with a 1:1 transmission ratio.

[0005] In a preferred embodiment, the device according to the invention has an auxiliary element which can be mounted in two different conditions for providing the two above mentioned operative conditions of the toothed crown of the epicyclic gear unit. This auxiliary element is constituted by a disk which in both of its operative conditions is rigidly connected to the above mentioned toothed crown by means of mating shaped surfaces. In a first operative condition of said disk, the latter has one of its front faces having respective engaging elements fitted within cooperating seats of the fixed supporting structure, so that in this condition the toothed crown is in its operative condition corresponding to the activation of the reducing unit. Alternatively, the above mentioned auxiliary disk can be mounted with its front face facing towards the opposite direction, but still being engaged with the toothed crown, with the above mentioned engaging elements fitted between the solar sprocket and the planets, so that the toothed crown is free to rotate, but forms a whole unit with the solar sprocket and the planets, so that the direct drive transmission is activated.

[0006] Due to the above mentioned features, the device according to the invention can be used both with very heavy blinds, in which it is paramount to make actuation by the user easier, and with blinds of reduced weight, in which it is most important to render the raising operation of the blind as much rapid as possible. The operator which mounts the blind can adapt the device to the two above mentioned conditions simply by assembling the above mentioned auxiliary disk with said front face facing towards one direction or the other, thus obtaining the actuation either of the reducing unit or the direct drive transmission. Therefore, the manufacturer can put a single type of device into production, with clear advantages from the point of view of rationalisation of production and storing.

[0007] According to a further preferred feature of the invention, the above mentioned driving transmission is provided with a pair of gears, one of which is connected in rotation to the blind roller, said two gears having a number of teeth different from each other and being provided with two respective engaging elements which come into contact with each other after a predetermined number of turns of the above mentioned gears, so as to prevent a further rotation thereof, these engaging elements being arranged so as to stop the movement of the blind roller when the blind web is in a lowered predetermined condition. Preferably, this condition is predetermined as corresponding to a not fully unwound condition of the blind web from the roller, so as to avoid that the user, when driving lowering of the web, may cause a new winding of the web in the opposite direction or even separation of the web from the roller. As a matter of fact, the experience has shown that it is preferable that when the blind web is lowered there at least two-three turns of web be still on the roller, which ensure the subsequent proper winding of the web, as well as the safe connection between the web and the roller. This problem is solved in the best possible way by the present invention, due to the provision of the stop means which have been described above. These means are particularly advantageous in the case of a blind actuated by a reducing unit, since in this case it is not possible to rely on the conventional stop means associated with the driving ball chain which come into

contact with the winding mechanism. In the case of operation with reducing gear, indeed, the ball chain makes more than one turn in order to lower the blind completely and therefore it is not possible to rely on the above mentioned conventional device.

[0008] Further features and advantages of the invention will become apparent from the description which follows, with reference to the annexed drawings, given purely by way of non limiting example, in which:

figure **1** is a perspective diagrammatic view of a roller blind according to the invention,
figure **2** is an exploded view of the driving device of the blind of figure 1,
figure **3** is a cross-sectional view taken along line III-III of figure 1,
figure **4** shows the detail of figure 3 in a different operative condition,
figure **5** is a view taken along arrow V of figure 3, with the element 14 removed,
figure **6** is a variant of figure 2,
figure **7** is a cross-sectional view of a detail of figure 6, and
figure **8** is a front view of the detail of figure 7.

[0009] In figure 1, reference numeral 1 generally designates a roller blind, comprising a fixed supporting structure which, in the illustrated example, is constituted by two end brackets 2, 3 which are to be fixed to a ceiling or a wall, for instance adjacent to a window.

[0010] With reference also to figures 2-5, the supporting bracket 2 has a body of plastic material including a vertical wall 4 to which there is secured, by tight fit of teeth 5 into respective seats of wall 4, an annular plate 6 including a roof-like element 7 which is to prevent a ball chain 8 from coming out of a driving pulley 9, which will be described in detail in the following. The ball chain 8 hanks downwardly to a height which can be easily reached by the user to enable him to actuate the blind. From wall 4 there projects a hub 4a on which there is fitted a helical spring 10 having end radial tails 10a. Spring 10 in its undeformed condition has an inner diameter lower than the outer diameter of the fixed hub 4a, so that once it is mounted around hub 4a it is held tightened on this hub by its proper elasticity. On spring 10 there is fitted ring section 11, which in the illustrated example is made of zama, around which there is rotatably mounted the driving pulley 9 actuated by the ball chain 8. The driving pulley 9 has an inner tooth 12 projecting radially inwardly on which there is fitted a U-shaped element 13 which extends axially at least throughout the whole axial dimension of spring 10 and is arranged circumferentially within the space between the two end tails 10a of spring 10, as clearly shown in figure 5.

[0011] The ring section 11 is rigidly connected to a wheel 14 by engagement of two front teeth 15 into cooperating notches 16 of wheel 14. On its turn, wheel 14 is rigidly connected to hub 17 of a planet carrying wheel 18, which will be described in detail in the following, by coupling of front teeth of hub 17 into cooperating seats 19 of wheel 14.

[0012] A blind web W is wound around a roller R which is rigidly mounted onto one end 20a of a shaft 20. Shaft 20 is freely rotatable within the hub 17 of wheel 18 and has an opposite end 20b on which there is fitted a solar sprocket 21 of an epicyclic gear unit 22 which will be described in the following, the above mentioned unit being held axially by means of an elastic ring 23 fitted onto the end 20b of shaft 20. The hub 17 of wheel 18 is rotatably mounted within the fixed hub 4a by interposition of a bush of plastic material 24 (see figure 3).

[0013] The epicyclic gear train 22 comprises the solar sprocket 21 connected in rotation to shaft 20, a plurality of planet gears 25 meshing with solar sprocket 21 and freely rotatably mounted on pins 26 of the planet carrying wheel 18 which is connected in rotation to wheel 14 and which, as it will be clearly apparent, is to be driven by pulley 9. Finally, the epicyclic gear train 22 has an outer crown 27, having inner teeth 28, which in the illustrated example has a cylindrical annular body. The crown 27 is freely rotatable within seat 29 of the fixed structure 2 and is rigidly connected to an auxiliary disk 30 by mating shaped elements, namely by engagement of radial teeth 31 distributed along the peripheral disk 30 within cooperating front notches 32 of crown 27.

[0014] In the condition illustrated in figure 2, the auxiliary disk 30 has one of its front faces having engaging elements 33 facing towards a lid 34 which is fitted on the vertical wall 4 of the fixed structure 2. The engaging elements 33 are received within cooperating seats 35, so that the auxiliary disk 30 is rigidly connected to the fixed structure 2 and therefore rigidly connects also the outer crown 27 to this structure. Therefore, in this condition the epicyclic gear train 22 is able to act as a reducing gear unit by transmitting rotation from the planet carrying wheel 18 to the solar sprocket 21 rigidly connected to the shaft 20 of the blind roller (see also figure 4).

[0015] When the user actuates the chain 8, the latter causes the driving pulley 9 to rotate. The tooth 12 with the associated U-shaped element 13 carried by the driving pulley 9 presses against one of the two end tails 10a of spring 10 (depending upon the direction of rotation applied by the user to the chain) so as to cause the turns of spring 10 to expand so that the spring can rotate around the fixed hub 4a, thus enabling the rotation of the mechanism. The rotation applied is transmitted by one of the tails 10a of spring 10 to ring section 11 which as a consequence causes a rotation of wheel 14. The latter will then cause rotation of hub 17 and planet carrying wheel 18 which will transmit the rotation to the shaft 20 of the blind roller with a reduction ratio determined by the epicyclic gear train 22. In the illustrated example, this transmission ratio is about 4:1. The rotation of shaft 20 is transmitted to roller R which causes blind winding an unwinding. When the chain 8 is not

actuated, the blind is held locked at any position it has been previously left because spring 10 is tightened over the fixed hub 4a preventing rotation of driving pulley 9 as well as the ring section 1 and wheel 14 connected to the epicyclic gear train 22.

[0016] If one desires to change the above described device into a device in which the rotation of the driving pulley 9 is transmitted to the blind roller with a direct drive, it is sufficient to mount the auxiliary disk 30 in the opposite orientation, i.e. as shown in figure 3 rather than as shown in figures 2, 4. In this case, the front face having the engaging element 33 of disk 30 faces away from lid 34. Therefore, the engaging elements 33 are disengaged from seats 35 and lid 34, so that the casing constituted by crown 27 and disk 30 secured thereto is free to rotate within seat 29 of the fixed supporting structure 2. At the same time, in this different operative condition the engaging elements 33 snugly fit between the solar sprocket 21 and the planets 25 (see figure 3), so that the crown 27 forms a single unit with the planet carrying wheel 18, the planets 25 and the solar sprocket 21. In this manner, the rotation transmitted to the planet carrying wheel 18 by the driving pulley 9 is transmitted with direct drive to solar sprocket 21 and shaft 20 of roller R of the blind.

[0017] Figures 6, 8 refer to a variant in which the device comprises additional stop means for the blind web in the position of maximum lowering. In this case, the seats 35 for the engaging elements 33 of the auxiliary disk 30 are formed, rather than in lid 34, in an intermediate plate 36 interposed between the disk 30 and the lid 34. The latter further supports a pair of freely rotatable gears 37, 38. Gear 38 is fitted on the end 20b of shaft 20 of the blind roller, so that it always rotates along with the blind roller. The two gears 37, 38 have numbers of teeth different from each other by 1 and are provided with two respective locking elements 39, 40 (figure 8) which collide with each other when the web reaches the lowermost position, so as to stop it. The two locking elements 39, 40 can be arranged so as to stop the blind web when it has not been fully unwound from the roller, so as to leave at least two-three turns of cloth around the roller which ensure both the subsequent proper winding back of the web, and the impossibility of a separation of the web from the roller.

[0018] As it will be clearly apparent from the foregoing description, the device according to the invention is characterized by a relatively simple and inexpensive structure, which at the same time is able to be adapted easily and rapidly at the time of installation so as to allow either actuation through a reducing gear unit (when it is necessary to decrease the effort for the user, with heavy blinds) or the actuation with direct drive (when it is necessary to favour rapidity of operation). The stop means constituted by the two gears 37, 38 further improve the device.

[0019] Naturally, while the principle of the invention remains the same, the details of construction and the embodiments may widely vary with respect to what has been described and illustrated purely by way of example, without departing from the scope of the present invention.

Claims

1. Device for actuating a roller blind, comprising:
   - a fixed supporting structure (2), which is to be secured to a ceiling or a wall,
   - a blind roller (R), on which a blind web (W) is wound, rotatably supported around a horizontal axis by said supporting structure (2),
   - a blind driving pulley (9), rotatably mounted on the supporting structure (2) coaxially to the blind roller (R) and engaged by a driving member (8), such as a ball chain, for actuating the blind, and
   - a driving transmission interposed between said driving pulley (9) and the blind roller (R),

   characterized in that said driving transmission includes an epicyclic gear train (22) comprising:
   - a solar sprocket (21) connected in rotation to the blind roller (R),
   - a plurality of planet sprockets (25) meshing with the solar sprocket (21) and freely rotatably supported on a planet carrying wheel (18) driven by said driving pulley (9),
   - an outer crown (27) having inner teeth (28), meshing with planets (25) and adapted to assume selectively two different operative conditions, a first operative condition in which said crown (27) is rigidly connected to the fixed supporting structure (2), so that the epicyclic gear train (22) acts as a reducing gear unit in order to decrease the force required for raising the blind, and a second operative condition, in which said crown (27) is free to rotate relative to the fixed supporting structure (2) and is rigidly connected to the solar sprocket (21) and the planets (25), so as to transmit rotation of driving pulley (9) to blind roller (R) with a direct drive.

2. Device according to claim 1, characterized in that it comprises means for selecting the two said operative conditions of said crown (27), said selecting means comprising an auxiliary element (30) which can be mounted on said crown (27) in two different operative conditions.

3. Device according to claim 2, characterized in that said auxiliary element is in form of a disk (30) which can be connected to said crown (27) with one of its front faces having engaging elements (33) facing towards one direction or the opposite direction, so

that in said first condition said engaging elements (33) are received within cooperating seats (35) of the fixed supporting structure (2), so as to rigidly connect said disk (30) and the crown (27) to the fixed supporting structure, whereas in the second operative condition said engaging elements (33) are disengaged from said seats (35) and are rather engaged between said solar sprocket (21) and said planets (25) so as to connect the latter to the crown (27).

4. Device according to any of the previous claims, characterized in that is comprises stop means for the blind web in the position of maximum lowering constituted by a pair of gears (37, 38) one of which is connected in rotation to the blind roller (R), said gears (37, 38) having numbers of teeth different from each other and carrying respective locking elements (39, 40) which collide with each other when the blind web reaches a predetermined lowered position.

Fig 1

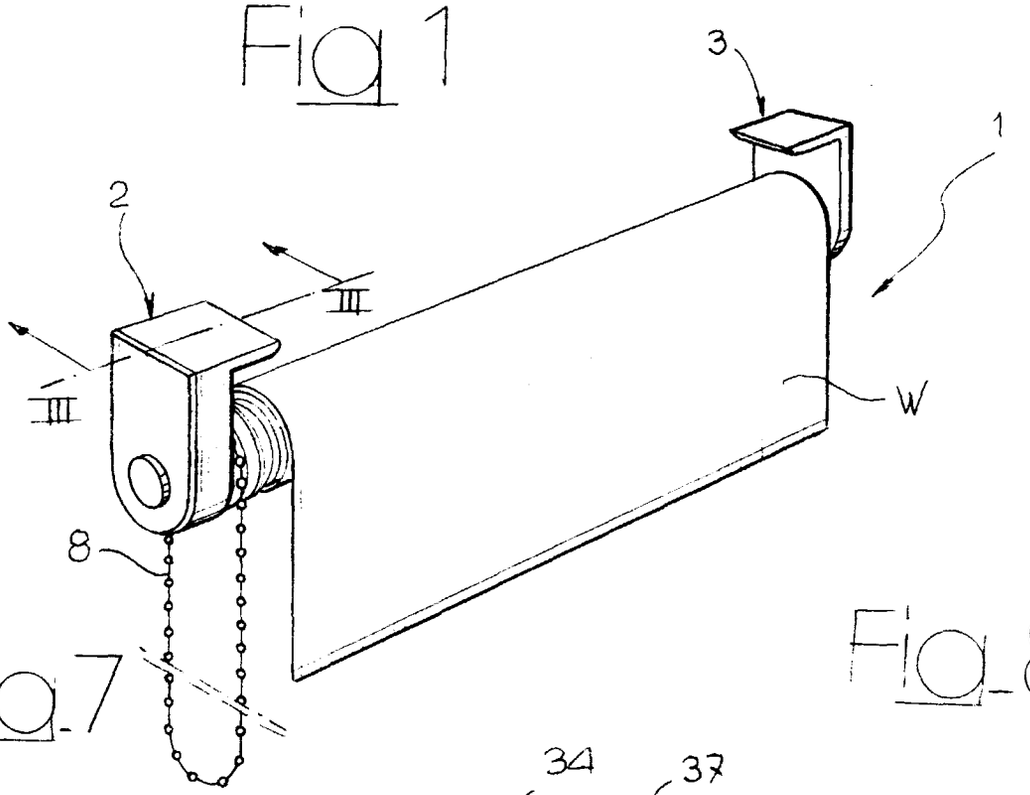


Fig 7

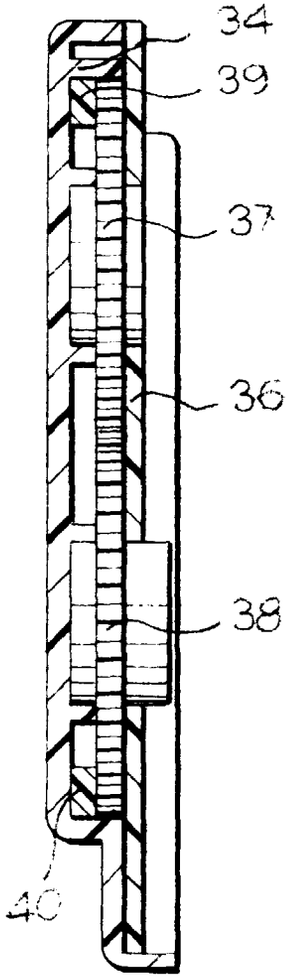
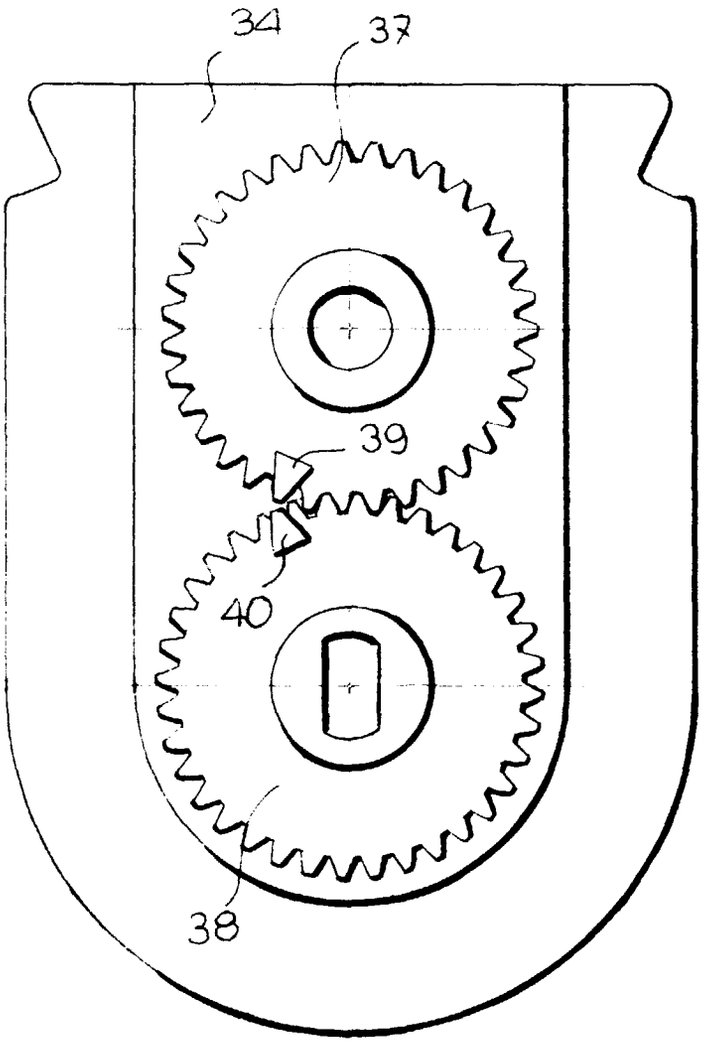
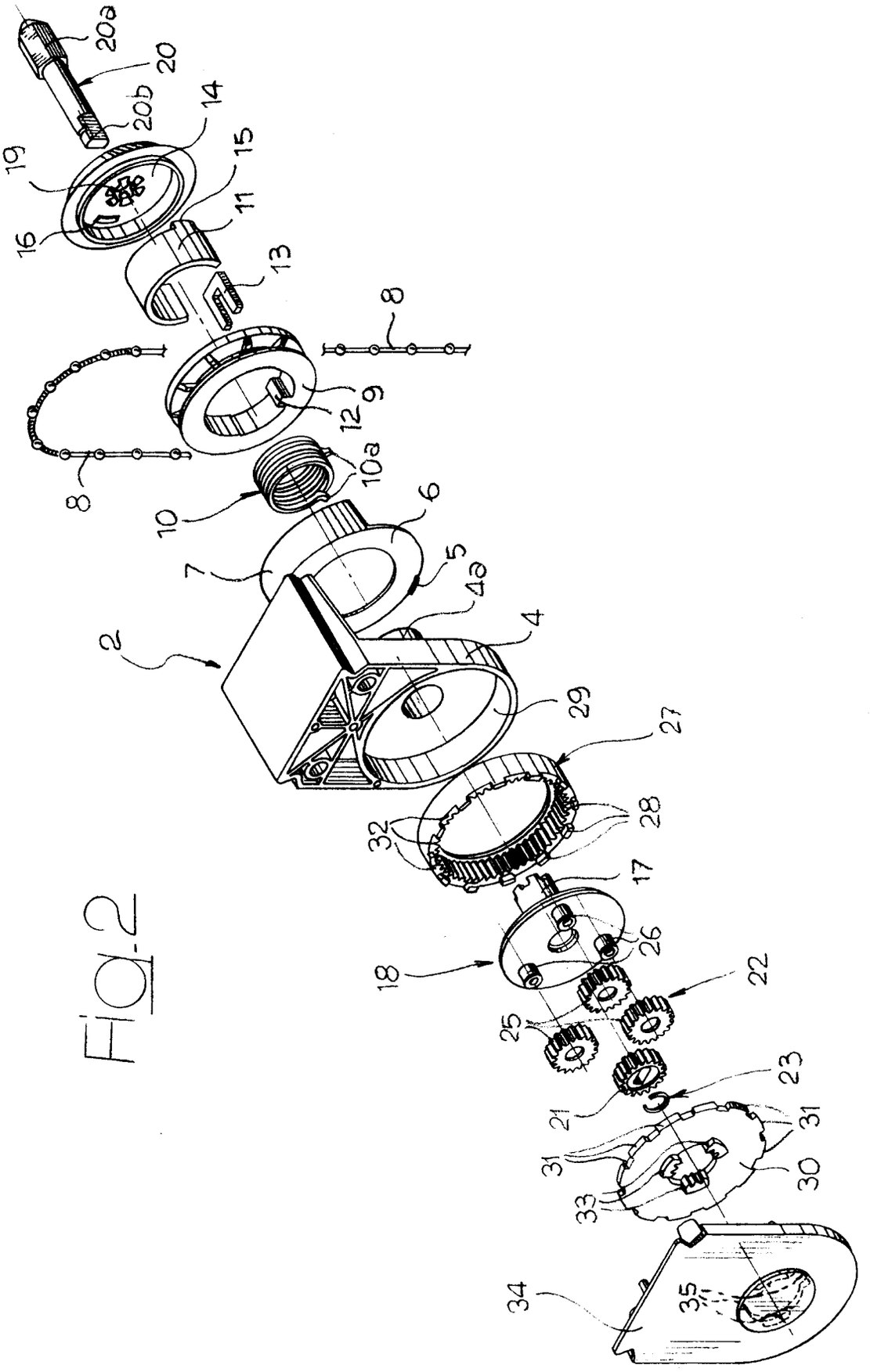


Fig 8




20a
20
20b
14
19
15
16
11
13
8
12
9
8
10a
10
6
7
5
4a
4
2
29
27
32
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17
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23
21
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30
33
34
35

FIG.2

Fig. 5

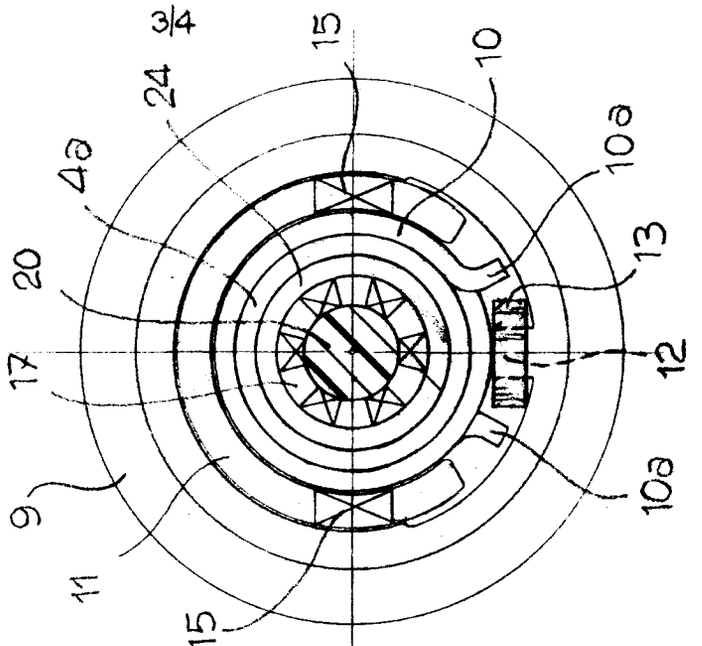


Fig. 3

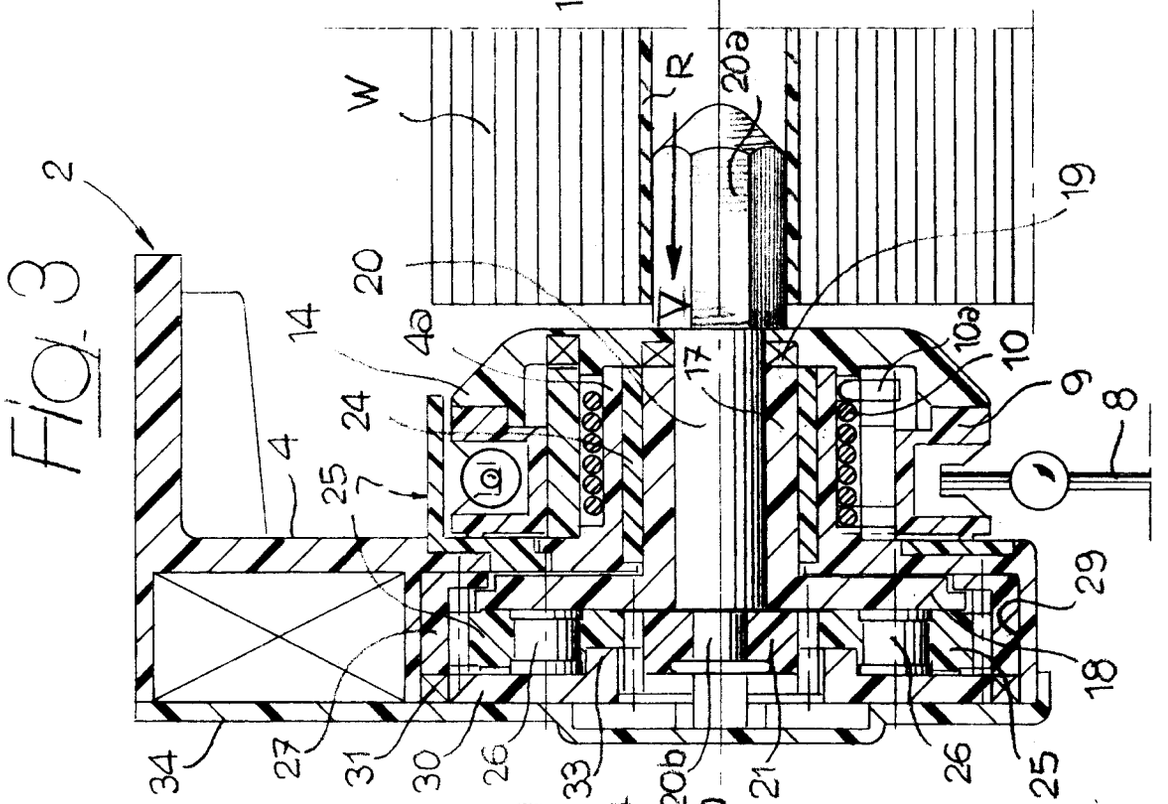
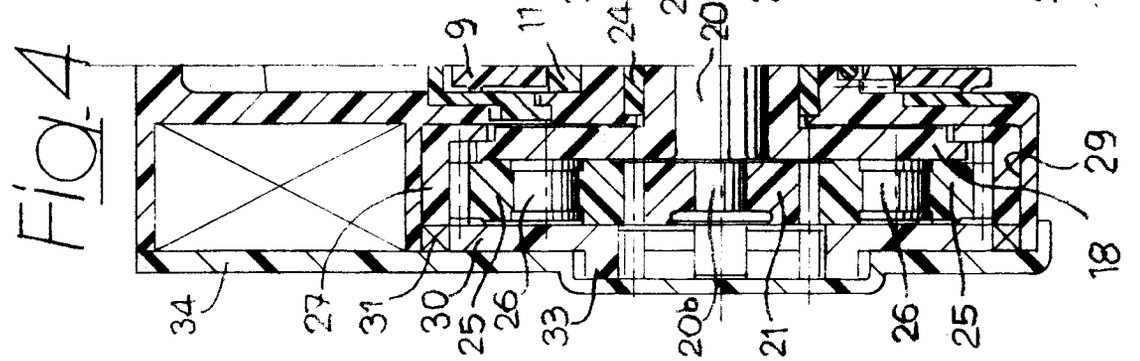


Fig. 4



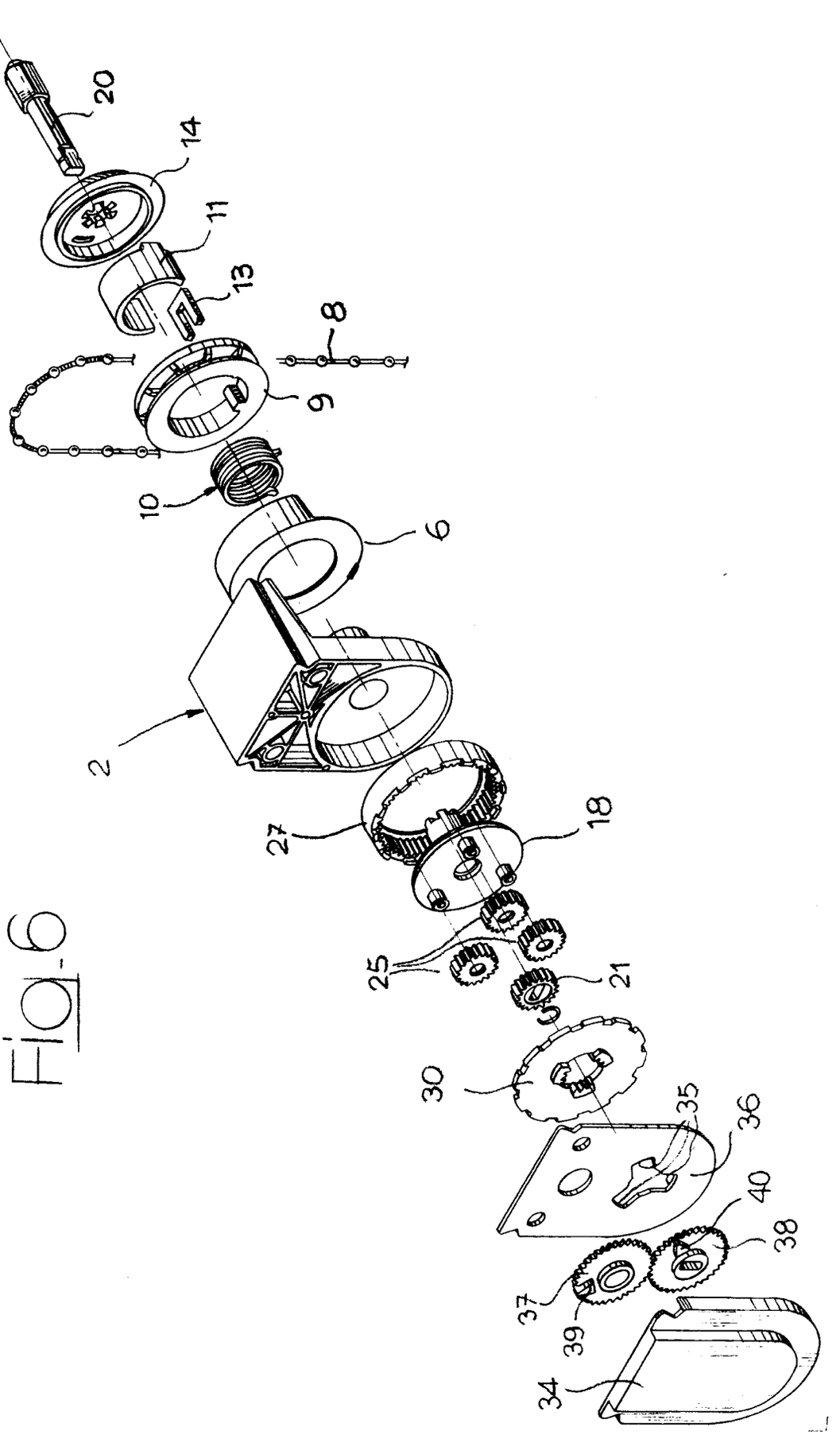


Fig.6