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54 Roller door.

57 A roller door including an elongate, flexible closure member (12), a hollow roller (13) to which one end of said closure member is secured, and means for rotating said roller whereby said closure can be wound onto said roller to open said door and unwound from said roller to close said door, said roller in use being positioned adjacent to the upper edge of the doorway, a spindle (16) extending in said roller (13), torsion springs (21) coupling the roller and the spindle for rotation together while affording limited relative rotation of the spindle and roller accompanied by corresponding stressing of the torsion spring (21), drive chains (34) extending parallel to the direction of movement of the closure member and being in driving engagement with said spindle and idler wheels (35) positioned in use adjacent the lower edge of the doorway and the free end of the closure member being secured to said drive chains (34) at points along the length of the drive chains (34) such that said torsion springs (21) are stressed in a direction to rotate said roller (13) relative to said spindle (16) to wind said closure member (12) into said roller and thus apply tension to the closure member between the roller and its point of anchorage on the drive chains (34), and a motor arrangement (27,28) for rotating the roller and thereby the spindle to wind or to unwind the closure member.

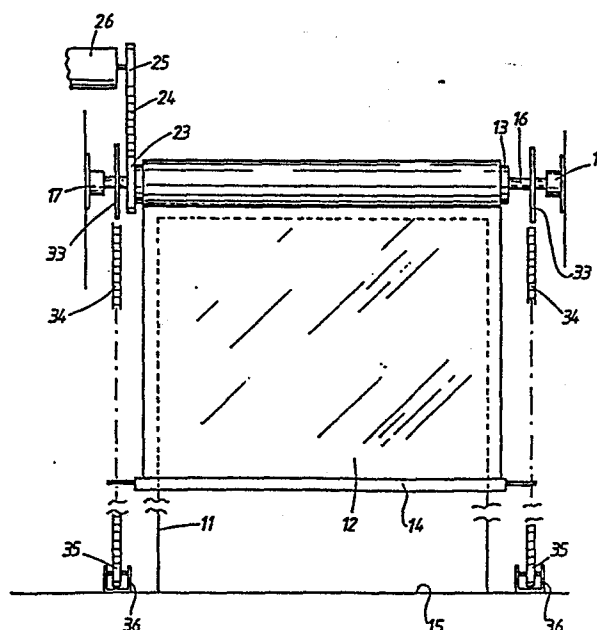


Fig. 1.

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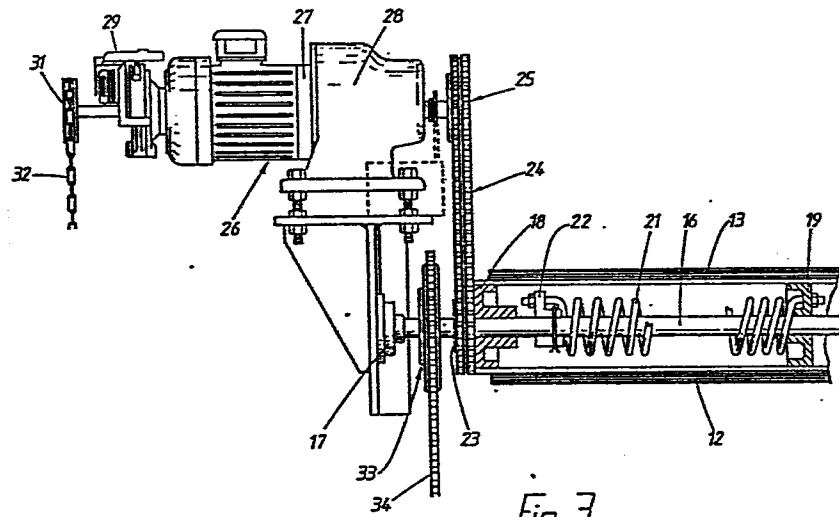


Fig. 3.

This invention relates to roller doors, the term roller door being intended herein to mean doors of the type wherein the doorway closure member is a flexible element which is rolled onto and unrolled from a roller to open and close the doorway.

It is usual to form the doorway closure member of a roller door from a flexible material such as a polyester fabric so that the closure member is similar to a roller blind. However in order to ensure that wind pressure does not displace the closure member within the doorway when the door is closed it has been found necessary to ensure that in the closed position the closure member is subject to tension. British Patent Specification No. 1444017 illustrates a known mechanism whereby such tension is applied to the closure member and involves a complex arrangement of cables, pulleys, and weights. It is an object of the present invention to provide a roller door wherein the complexity of cables, pulleys and weights is avoided.

A roller door according to the invention comprises an elongate, flexible closure member, a hollow roller to which one end of said closure member is secured whereby said closure member can be wound onto said roller to open said door and unwound from said roller to close said door, said roller in use being positioned adjacent one peripheral edge of the doorway, a spindle extending in said roller, torsion spring means coupling the roller and the spindle for rotation together while affording limited relative rotation of the spindle and roller accompanied by corresponding stressing of the torsion spring means, an endless, non-extensible, drive member extending parallel to the direction of movement of the closure member and being in driving engagement with said spindle and an idler wheel positioned in use adjacent

the end of the doorway which is opposite the roller end of the doorway, means anchoring the free end of the closure member to said drive member at a point along the length of the drive member such that said torsion spring means is stressed in a direction to rotate said roller relative to said spindle to wind said closure member onto said roller and thus apply tension to the closure member between the roller and its point of anchorage on the drive member, and means for rotating the roller and thereby the spindle to wind or unwind the closure member.

Preferably said spindle extends through said roller and a second endless non-extensible drive member is provided, the two drive members being positioned adjacent the opposite parallel edges of the closure member, both drive members being drivingly engaged with the spindle and with respective idler wheels and the free end of the closure member being anchored to equivalent points along the length of the drive members.

Preferably the or each drive member is a roller chain drivingly engaged with the spindle by way of a toothed sprocket wheel fixed to the spindle.

Desirably said torsion spring means is housed within the hollow roller.

Preferably the torsion spring means comprises a pair of helical torsion springs encircling said spindle, the two springs being adjacent opposite ends of the roller respectively.

Desirably the free end of the closure member carries a relatively rigid bar which is anchored at its ends to the drive members respectively.

Conveniently the roller drive means is an electric motor.

One example of the invention is illustrated in the accompanying drawings, wherein:-

- 5 Figure 1 is a diagrammatic rear elevational view of a roller door;
Figure 2 is a plan view, to an enlarged scale, of a practical embodiment of the door;
Figure 3 is a sectional view of part of the left-hand
10 side of the door illustrated in Figure 2; and
Figure 4 is a view similar to Figure 3 but of the right-hand side of the door illustrated in Figure 2.

Referring to the drawings, the roller door is arranged to open and close a rectangular doorway 11 (shown
15 partly in broken lines in Figure 1). The roller door comprises a doorway closure member 12 in the form of a rectangular sheet of flexible, high strength, coated, polyester fabric, the coating rendering the fabric waterproof.

- 20 The closure member 12 is intended to be moved in a vertical direction to open and close the doorway 11, and the upper edge of the closure member 12 is rigidly secured to a hollow metal roller 13. The lower free
edge of the closure member 12 has affixed thereto a
25 relatively rigid metal bar 14 extending horizontally across the width of the doorway 11. The roller 13 is positioned horizontally above the top edge of the doorway 11 and thus extends parallel to the plane of the floor 15. The roller 13 is supported for rotation
30 in the horizontal plane by means of a solid elongate spindle 16 which is in turn freely rotatable in bearings 17 secured to the wall within which the

doorway 11 is formed. The spindle 16 extends coaxially through the roller 13, and is supported at its ends on the spindle 16 through the intermediary of bearing bushes 18 secured to the roller and running freely on the spindle. Additional support for the roller 13 on the spindle 16 is provided intermediate the ends of the roller 13 by a pair of spaced, spring anchor bushes 19 which are secured to the roller 13 and can rotate on the spindle 16.

Housed within the roller 13 and encircling the spindle 16 between each bush 18 and its adjacent bush 19 is a helically wound torsion spring 21. The innermost end of each of the torsion springs 21 is anchored to its respective bush 19, and is thus connected to the roller 13. The opposite, outermost ends of the springs 21 are connected to respective anchor collars 22 which in turn are rigidly secured to the spindle 16. Thus at one end each spring 21 is connected to the roller 13 and at its other end is connected to the spindle 16. It will be recognised therefore that the springs 21 couple the spindle 16 to the roller 13 so that the two rotate as a unit, while at the same time affording the possibility of limited relative rotation between the roller 13 and the spindle 16. Such relative rotation between the roller 13 and spindle 16 will be accompanied by a corresponding stressing of the torsion springs 21.

Concentric with, and anchored to, the left-hand bush 18 is a double sprocket wheel 23 which is drivingly coupled, by means of a duplex roller chain 24, to a double output sprocket 25 of an electric drive unit 26. The drive unit 26 comprises an electric motor 27 and a reduction gear box 28, the gear box 28 having the sprocket 25 on its output shaft. The rotor shaft of the motor 27 is extended at its end remote from the gear

box 28 and carries an electrically operated brake unit 29 and a chain sheave 31 over which extends a chain loop 32. The lower end of the chain loop 32 is accessible near ground level so that in the event of a power failure the pinion 25 can be rotated manually. The brake 29 is provided to effect rapid stopping of the rotation of the pinion 25 when necessary, notwithstanding the relatively high inertia of the door mechanism.

It will be recognised that when the motor 27 is operated the pinion 25 rotates, and by virtue of the duplex roller chain 24 the roller 13 is rotated in a direction determined by the direction of rotation of the motor shaft. Thus the fabric closure member 12 is either wound onto the roller 13 opening the doorway, or unwound from the roller to close the doorway.

As the roller 13 rotates the spindle 16 rotates with it. At each end of the spring 16, between the bush 18 and the bearing 17, the spindle carries a pinion gear wheel 33 in driving engagement with a roller chain 34. Each roller chain 34 extends vertically, parallel to the direction of movement of the closure member 12, the two chains 34 being spaced on opposite sides respectively of the closure member 12. Each chain 34 extends downwardly from its respective sprocket 33 and passes around a small idler sprocket 35 carried in a floor mounting bearing arrangement 36. The two roller chains 34 constitute endless, flexible, non-extensible drive members in driving engagement with the spindle 16. The bottom bar 14 of the closure member 12 is extended at both ends to engage in respect anchor members rigidly fixed to the rearmost runs of the two chains 34. Thus when the motor 27 is energised, then irrespective of the direction of rotation of the pinion 25 the closure

member 12 is driven positively either upwardly or downwardly. The positive motion arises from the fact that not only is the top region of the closure member 12 being moved by being wound onto or from the roller 13, but the lower part of the closure member 12 is also moved by virtue of being anchored to the chains 34 which of course move in accordance with rotation of the spindle 16.

The bar 14 is arranged to hold the closure member 12 in tension in a lateral direction, that is to say widthwise of the doorway 11, and in order to provide adequate tension along the length of the closure member 12 the bar 14 is pulled downwardly relative to the chains 34 prior to anchoring the bar 14 to the chains 34. Thus the downward movement of the bar 14 and the closure member 12 causes the roller 13 to be rotated relative to the spindle 16 stressing the springs 21. Once the bar 14 is anchored to the chains 34 then the stressing of the springs 21 remains and the springs 21 continually provide a tensioning force along the length of the closure member 12 by attempting to rotate the roller 13 in the "wind-up" direction relative to the spindle 16. In practice the stressing of the springs 21, and thus the tension along the length of the closure member 12, will vary during movement of the closure member between its open and closed positions. This variation results from the change in diameter of the roller 13 as closure member 12 is wound thereon to, or therefrom. However, the initial stressing of the springs 21 during setting up of the door is so chosen that the variation which occurs in use neither over-tensions the closure member 12, nor reduces the tension to a point at which the closure member could become slack.

It will be recognised that in theory provided a sufficiently rigid connection could be achieved between one of the chains 34 and the bar 14 then the second chain and its associated sprockets could be dispensed with. However, for most applications this would be impractical since it would almost inevitably result in tension being maintained along one side of the closure member 12 with a lesser tension along the opposite side. For this reason it is preferred to use chains 34 acting in unison at the opposite edges of the closure member 12.

While it is preferred to use sprockets and roller chains 34 it will be recognised that other endless non-extensible drive arrangements could be provided. Furthermore a drive connection other than the duplex chain arrangement could be used to couple the drive unit 26 to the roller 13.

In a practical embodiment a casing arrangement will be provided at each side of the doorway within which the chains 34 are housed. Moreover, the casing arrangement will include vertically extending brushes or other sealing devices which engage the front and rear faces of the closure member 12 to effect a draughtproof seal at the edges of the closure member. Similarly the bar 14 may include a compressible rubber sealing strip on its lower face to provide a sealed engagement with a strip fitted across the threshold of the doorway 11. The door mechanism can be arranged to be fitted to the inner or outer faces of the wall containing the doorway 11, or, in some instances, can be fitted actually within the thickness of the doorway.

The tension which is produced along the length of the closure member 12 by the springs 21 will normally be sufficient to prevent displacement of the closure member 12 by wind pressure, when the closure member 12 is in its closed position. However, where the door is to accommodate extreme pressure differences it may be desirable to provide one or more wind bars which support the fabric of the closure member 12 in its closed position. The wind bars are simply transversely extending equivalents of the bottom bar 14 which are not attached to the closure member 12, and merely slide in vertically extending channels attached to the side casings of the door. Where a single wind bar is utilized then the channels will have an abutment half-way along their length so that as the door is moved to its closed position the wind bar follows the bar 14 downwardly until the bar 14 passes the abutments in the channels, whereupon the wind bar rests against the abutments and thus in the closed position of the door supports the closure member 12 half-way between ground and the top of the doorway. Where more than one wind bar is necessary then a form of latching is provided which allows each wind bar to descend with the bottom bar 14 of the closure member to its appropriate position. As the closure member is wound back onto the roller the wind bar or wind bars are picked up by the bottom bar 14 and lie at the upper end of their guide channels when the door is in its open condition.

It will be recognised that the supporting and driving arrangements may be modified to suit different applications, for example, the drive arrangement 23 and 28 could be provided at the opposite end of the roller 13 if desired. Furthermore, if desired the bearing 17 and the drive end could be positioned between the roller 13 and the gear wheels 23, 33 so that the gear

wheels are on the "outside" of the spindle bearing 17. While the drive arrangement 23, 24, 25 is described above as a duplex arrangement it will be understood that if desired a simplex arrangement can be used.

- 5 Moreover, while a vertically moving door has been described above it is to be understood that with relatively minor modifications a horizontally moving arrangement could be provided. Basically the whole arrangement described above would be rotated through
10 90° so that the closure member effects an action more similar to a curtain rather than a roller blind as is the case with the vertically moving arrangement.

CLAIMS:

1. A roller door comprising an elongate, flexible closure member, a roller to which one end of said closure member is secured, and means for rotating said roller whereby said closure member can be wound onto said roller to open said door and unwound from said roller to close said door, said roller in use being positioned adjacent one peripheral edge of the doorway, characterized in that said roller (13) is hollow, and there is provided a spindle (16) extending in said roller, torsion spring means (21) coupling the roller (13) and the spindle (16) for rotation together while affording limited relative rotation of the spindle and roller accompanied by corresponding stressing of the torsion spring means (21), an endless, non-extensible, drive member (34) extending parallel to the direction of movement of the closure member (12) and being in driving engagement with said spindle (16) and an idler wheel (35) positioned in use adjacent the end of the doorway which is opposite the roller end of the doorway, and means (14) anchoring the free end of the closure member (12) to said drive member (34) at a point along the length of the drive member such that said torsion spring means (21) is stressed in a direction to rotate said roller (13) relative to said spindle (16) to wind said closure member (12) onto said roller and thus apply tension to the closure member between the roller and its point of anchorage on the drive member.

2. A roller door as claimed in claim 1, characterized in that said spindle (16) extends through said roller (13) and a second endless non-extensible drive member (34) is provided, the two drive members being positioned adjacent the opposite parallel edges of the closure member (21), both drive members (34) being drivingly engaged with the spindle (16) and with respective idler wheels (12) and the free end of the closure member being anchored to equivalent points along the length of the drive members.

3. A roller door as claimed in claim 1 or claim 2 characterized in that the or each drive member (34) is a roller chain drivingly engaged with the spindle (16) by way of a toothed sprocket wheel (33) fixed to the spindle (16).

4. A roller door as claimed in any one of the preceding claims, characterized in that said torsion spring means (21) is housed within the hollow roller (13).

5. A roller door as claimed in any one of the preceding claims, characterized in that the torsion spring means comprises a pair of helical torsion springs (21) encircling said spindle (16), the two springs being adjacent opposite ends of the roller (13) respectively.

6. A roller door as claimed in any one of the preceding claims, characterized in that the free end of the closure member (12) carries a relatively rigid bar (14) which is anchored to the or each drive member (35).

7. A roller door as claimed in any one of the preceding claims characterized in that said means for rotating the roller (13) includes an electric motor (26).

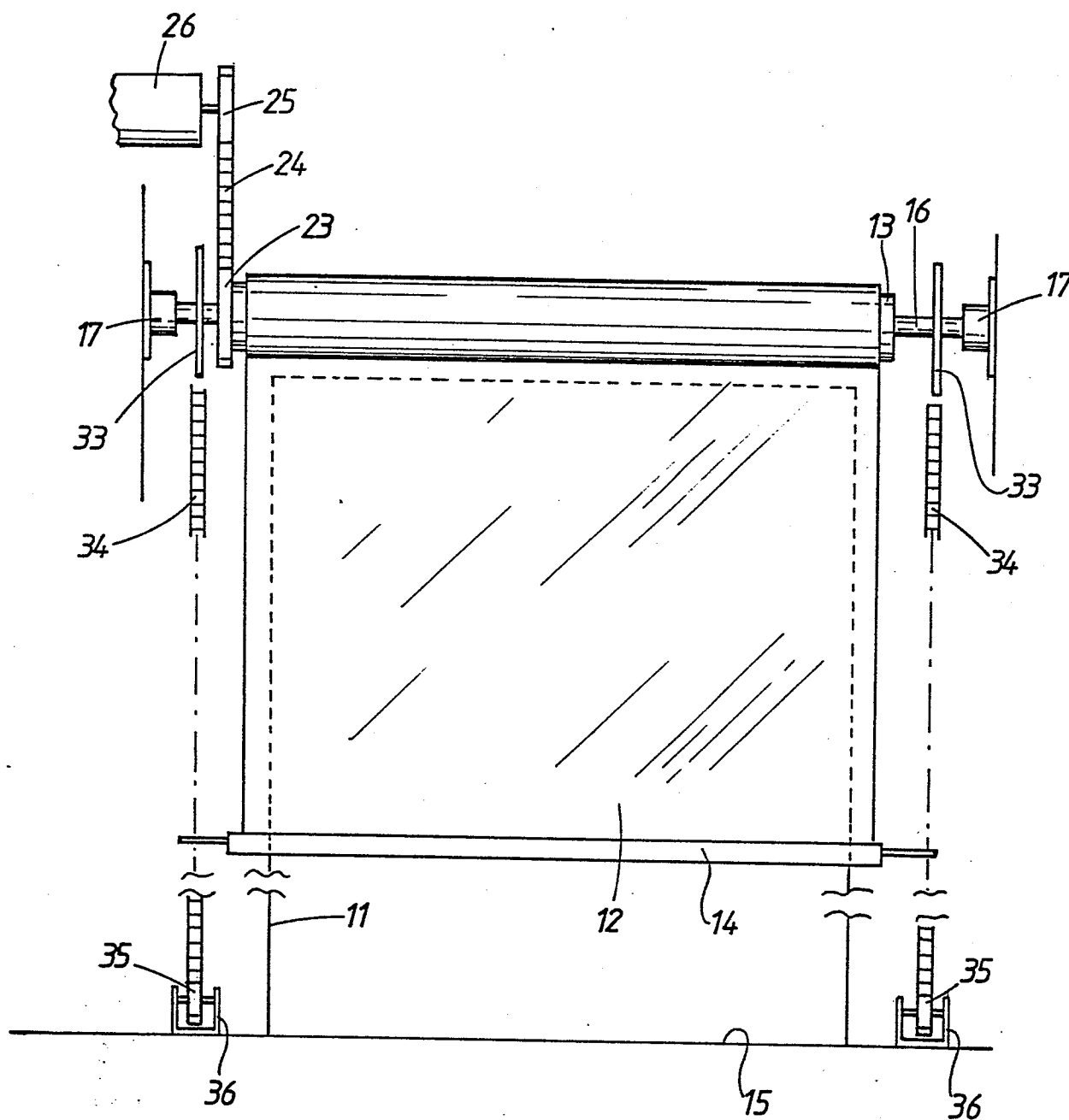


Fig. 1.

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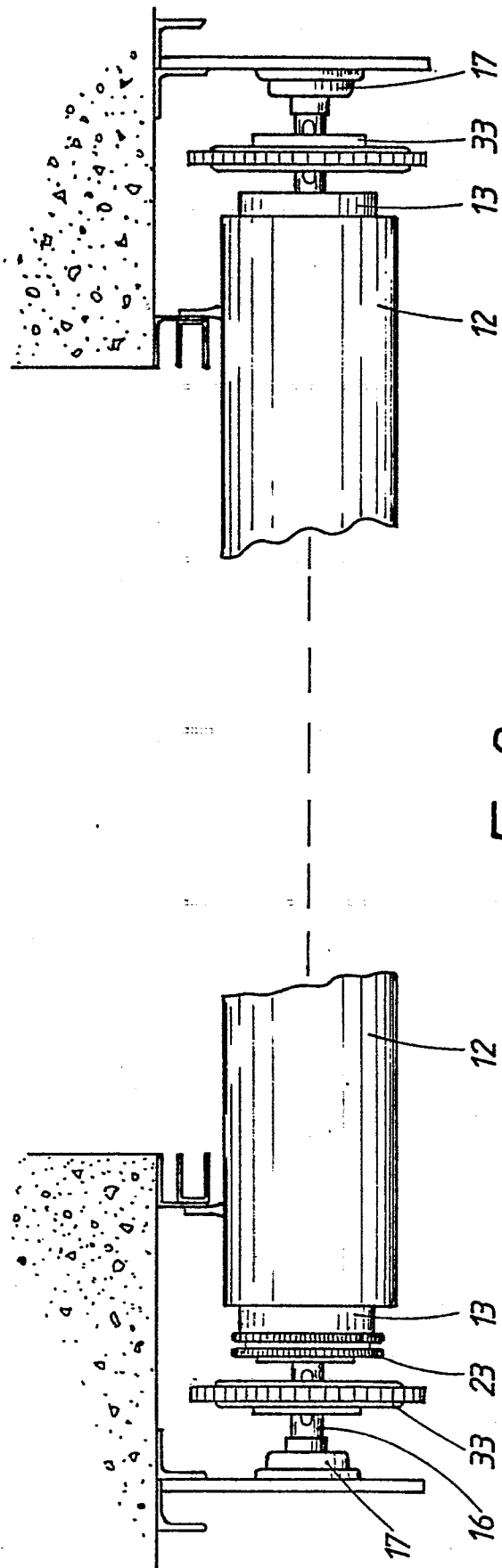


Fig. 2.

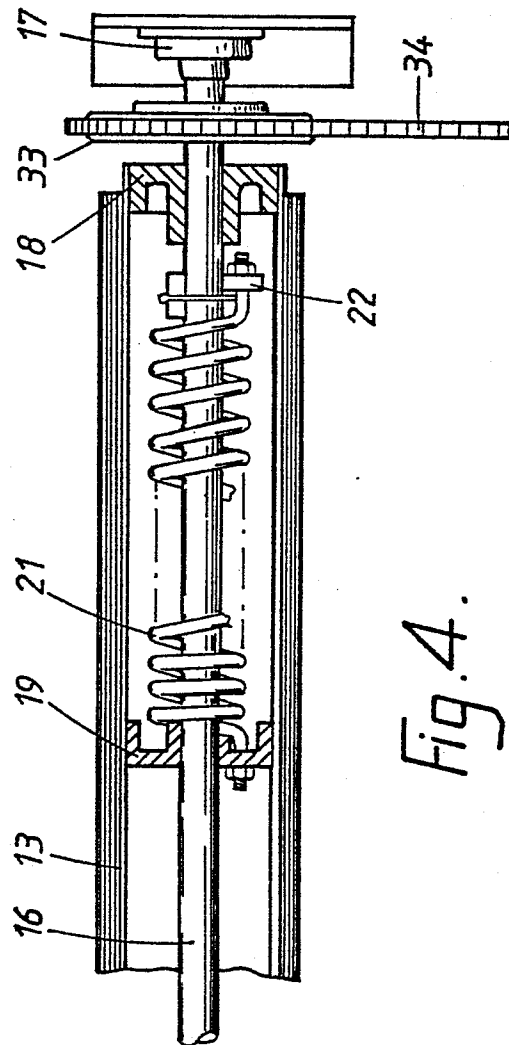


Fig. 4.

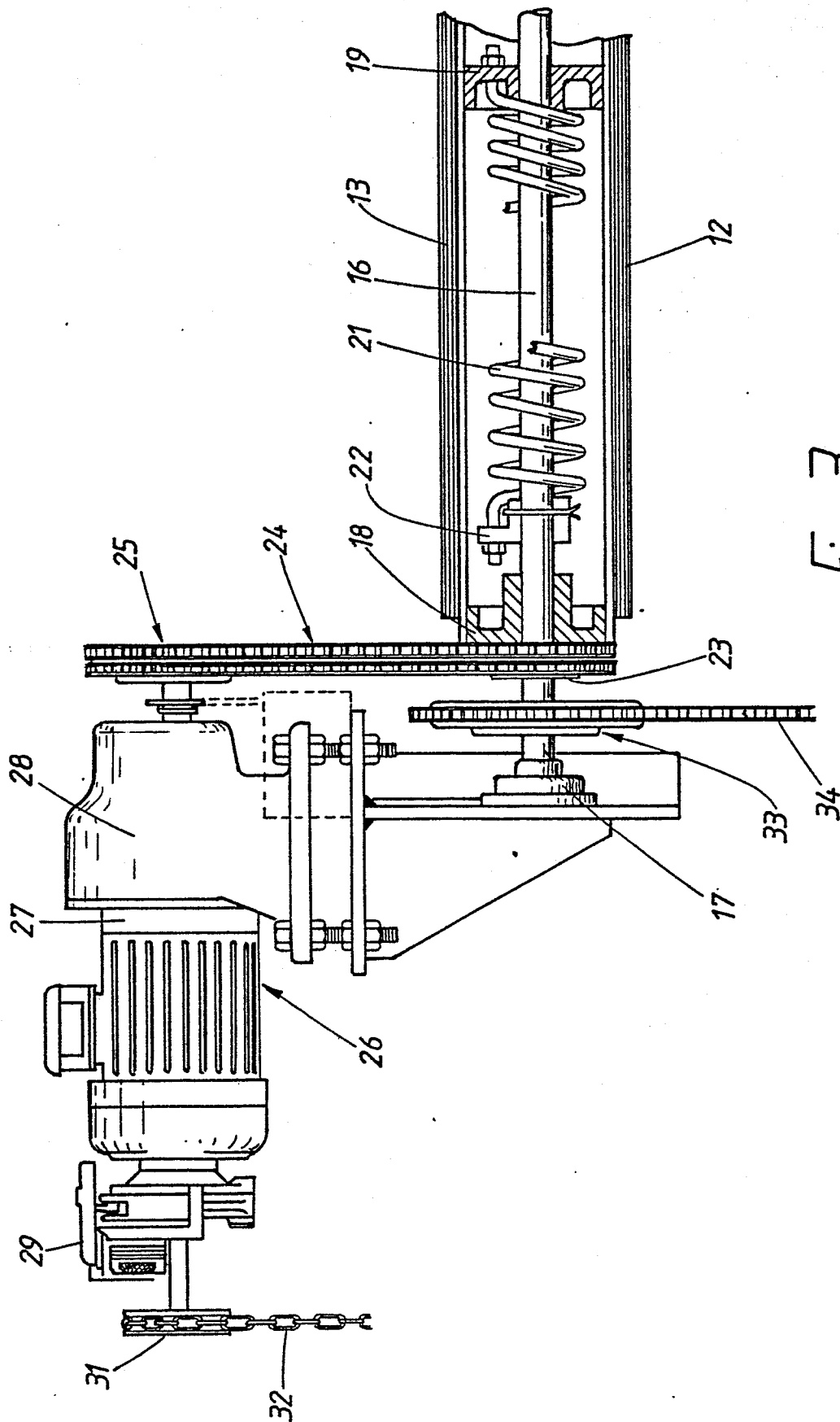


Fig. 3.