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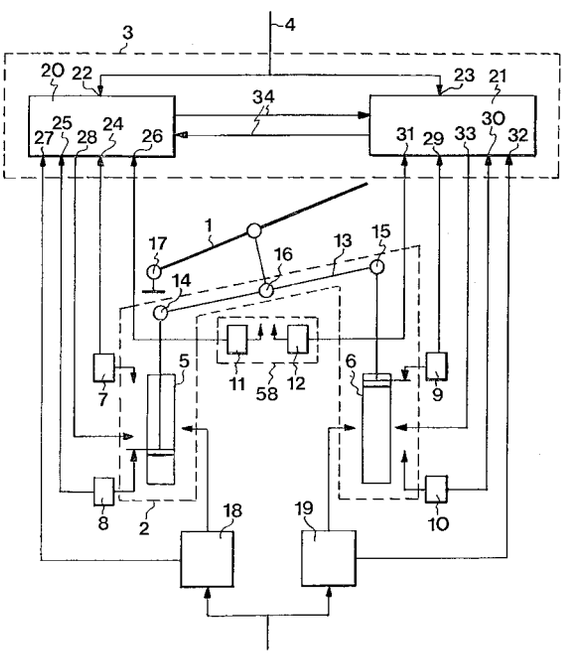
(54) Level-crossing barrier device

(57) A barrier device comprising a barrier (1), a driving device (2) for moving the barrier, an operating device (3) for operating the driving device, said operating device having an input (4) for an input signal for operating the barrier, and a barrier detecting device (58) for detecting the lowered barrier. The driving device comprises two drive means (5, 6) which can each take different positions. The drive means are arranged so that each of them can take a position in which the barrier is lowered independently of the position of the other drive means, and the detecting means are arranged on each of the drive means for detecting the position of the respective drive means. The operating device (3) operates both drive means (5, 6) to lower the barrier (1) when it receives a signal from the detecting means indicating that the drive means during a predetermined period of time have an impermissible combination of positions.

FIG 1



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Description

Field of the Invention

[0001] The present invention relates to a barrier device, preferably a level-crossing barrier device, intended to prevent road traffic at a crossing between a road and a railway.

Background Art

[0002] To prevent collisions between railway vehicles and other vehicles at level crossings, not only signal lights but also level-crossing barriers are often provided. The level-crossing barriers are driven by a driving device which is operated by a signal which gives information that a train approaches the level crossing. As a railway vehicle approaches the level crossing, the barriers are to be lowered. Defects in the driving device may, however, result in the barriers not being lowered, which may cause a collision between the railway vehicle and another vehicle.

[0003] With a view to preventing the barriers from not being lowered at level crossings, the barrier has in some cases been arranged to be disconnected from the driving device and fall down to the lowered position by its own weight. However, it has been found that, when there is a strong wind in an unfavourable direction, barriers have not fallen down to the lowered position.

[0004] Similar problems exist in connection with barriers for similar purposes, such as barriers at, for example, movable bridges.

[0005] There is thus a need for a barrier device, in which the barrier takes a lowered position in case of a defect in the driving device.

Summary of the Invention

[0006] An object of the present invention is to provide a barrier device which takes a lowered position in case of a defect in the driving device.

[0007] A further object of the invention is to provide a barrier device, which permits the safety class SIL4 according to EN50126 to be fulfilled.

[0008] These objects are achieved by a barrier device according to the claims.

[0009] A barrier device according to the invention comprises a barrier, a driving device for moving the barrier, an operating device for operating the driving device, the operating device having an input for an input signal for operating the barrier, and a barrier detecting device for detecting the lowered barrier. The barrier device is characterised in that the driving device comprises a first and a second drive means, each being capable of taking different positions, the drive means being arranged so that each of them is capable of taking a position in which the barrier is lowered independently of the position of the other drive means, and detecting means arranged on each of the drive means for detecting the position of the respective drive means, each of the detecting means being adapted to give a signal to the operating device about the position of the corresponding drive means and the operating device being adapted to operate both drive means to lower the barrier when the operating device receives a signal from the detecting means that the drive means during a certain period of time have an impermissible combination of positions.

[0010] The predetermined period of time is suitably selected in the range 1-10 s.

[0011] The fact that the barrier is lowered is detected, for example, by means of the barrier-detecting device.

[0012] A barrier device according to the invention is preferably used in connection with level crossings but may also be used in other contexts.

[0013] By the barrier device comprising two drive means which each can take a position in which the barrier is lowered independently of the position of the other drive means, a safe state can be reached, in which the barrier is lowered, even though one of the drive means stops working.

[0014] When a train approaches a level crossing equipped with a barrier device according to the present invention, an input signal is supplied to the input of the operating device with information that the barrier is to be lowered. The barrier device will then lower the barrier and keep it lowered until the input of the operating device receives an input signal indicating that the barrier is to be raised. When the operating device receives a signal from the detecting means that the drive means during a predetermined period of time have an impermissible combination of positions, both drive means are operated to lower the barrier and keep it lowered until someone resets the barrier device after having remedied the defect.

[0015] A person skilled in the art realises that there are a number of ways of arranging the drive means so that each of them can take a position in which the barrier is lowered independently of the position of the other drive means. According to a preferred embodiment of the present invention, the two drive means are pivotally connected to a rigid body in a fulcrum each, and the barrier is connected to the rigid body in a third fulcrum, but a person skilled in the art realises that the drive means can be arranged in some other manner. For example, the transmission of power between the drive means and the barrier can be effected by means of a hydraulic fluid.

[0016] According to a preferred embodiment of the invention, the third fulcrum is arranged at the same distance from the other two fulcrums. Then the drive means suitably have the same degree of motion between their respective outer positions. The fact that the barrier is fully raised signifies that both drive means are in an upper position. The fact that the barrier is fully lowered signifies that both drive means are in a lower position. If one of the drive means gets stuck in its upper position, the other drive means can take a position below the low-

er position so that the barrier will be fully lowered.

[0017] According to the invention, the operating device is adapted to operate both drive means to lower the barrier when the operating device receives a signal from the detecting means that the drive means during a predetermined period of time have an impermissible combination of positions. As a result, the barrier is lowered when one of the drive means gets stuck in a position, for instance, because it has stopped working.

[0018] According to a preferred embodiment of the present invention, the operating device is adapted to operate both drive means to lower the barrier if both drive means are in a position below their respective lower positions when the barrier detector detects that the barrier is lowered since this signifies that the rigid body has been broken.

[0019] Preferably, the operating device consists of two operating means which are each connected to a respective drive means. Each of the operating means has an input for external signals indicating that the barriers are to be lowered. The operating means also have inputs for input signals from the drive means and the barrier detecting device, and outputs for operating the drive means. The operating means are electrically interconnected so that they may continuously compare their input signals and their output signals, respectively. When the signals of one of the operating means differ from the corresponding signals of the other operating means during a predetermined period of time, the operating means operates its drive means to lower the barrier. Consequently, a defect in one of the operating means does not cause the barrier to remain in its upper position as a train passes. For the barrier to remain in its upper position as the train passes, a simultaneous defect must arise either in both operating means or in both drive means.

[0020] Preferably, the barrier detecting device consists of two barrier detecting means, in which case the operating device operates, when the signal from the barrier detecting means differs, the drive means to lower the barrier. Thus a defect in one of the barrier detecting means does not prevent the barrier from being lowered.

[0021] According to a preferred embodiment of the present invention, the detecting means of the driving device are adapted to detect whether the drive means are above their respective upper positions, which must be the case for both drive means for the barrier to be fully raised. The detecting means of the driving device are also adapted to detect whether the drive means are below their respective lower positions, which is the case only in connection with a defect in the equipment. Alternatively, the detecting means can be adapted to detect other positions of the drive means. According to the invention, the essential thing is that the detecting means of the driving device are adapted to detect positions of the drive means, thereby allowing a defect to be detected. This results in increased security not only because a defect must arise in two different components, but also since the defects must arise simultaneously. A defect in one component only results in the barrier taking its lowered position.

[0022] The drive means are preferably interconnected by means of a rigid body. According to a preferred embodiment of the present invention, the drive means consist of hydraulic drive means, but may also consist of other types of drive means. According to an alternative embodiment of the invention, at least one of the drive means consists of an electric motor which operates a gear rack. The detecting means of the driving device are adapted to detect positions of the gear rack. Alternatively, the drive means can be an electric drive means in the form of, for example, a linear motor.

[0023] With a view to preventing a failure of the energy supply to the drive means from causing the barrier to get stuck in the raised position, the barrier device according to a preferred embodiment of the invention is provided with an energy storage system for each of the drive means. Each of the energy storage systems provides the operating device with a signal containing information about the energy level in the energy storage. When the energy level in one of the energy storages is below a certain predetermined level, the operating device operates both drive means to lower the barrier.

[0024] The predetermined energy level is sufficiently high for a lowering of the barrier to be made using the energy in the energy storage.

[0025] By having according to a particularly preferred embodiment double barrier detecting means, double drive means, double operating systems and an energy storage for each drive means, it is possible to fulfil the requirements of the security class SIL4 according to EN50126, without high requirements needing be put on the individual components.

[0026] The above features may, of course, be combined in the same embodiment.

[0027] To further illustrate the invention, detailed embodiments thereof will now be described, without, however, the invention being considered to be restricted thereto.

Brief Description of the Drawings

[0028] Fig. 1 illustrates a barrier device according to a preferred embodiment of the present invention.

[0029] Fig. 2 illustrates a driving device and a barrier according to an alternative embodiment of the present invention.

[0030] Fig. 3 illustrates a driving device according to an alternative embodiment of the invention, which transmits power to the barrier by means of a hydraulic fluid.

Detailed Description of the Invention

[0031] Fig. 1 shows a barrier device according to a preferred embodiment of the present invention. The barrier device comprises a barrier 1, a driving device for moving the barrier 2 and an operating device for oper-

ating the driving device 3. The operating device has an input 4, which receives a signal from an external unit, indicating that the barrier is to be lowered. The external unit may be, for example, a detecting device which comprises a detector arranged on the rails a distance away from the level crossing at which the barrier device is positioned. The barrier device also comprises a barrier detecting device 58, which detects whether the barrier is lowered. The driving device comprises a first drive means 5, which is provided with detecting means 7, 8, and a second drive means 6 which is provided with two detecting means 9, 10. The barrier detecting device consists of two barrier detecting means 11, 12. The detecting means 7, 8, 9, 10 and the barrier detecting means 11, 12 are electrically connected to the operating device 3. A rigid body 13 is connected to the first drive means 5 in a first fulcrum 14 and to the second drive means 6 in a second fulcrum 15. The barrier 1 is connected to the rigid body 13 in a third fulcrum 16. The barrier 1 is pivotable on a pivot pin 17. Energy storages 18 and 19 are arranged for a drive means each. The energy storages are electrically connected to the operating device. The operating device consists of two operating means 20, 21, which via one input 22, 23 each receive a signal from the external unit whether the barrier is to be lowered. The first operating device 20 receives a signal from the upper detecting means of the first drive means via the input 24, from the second detecting means of the first drive means via the input 25, from the first barrier detecting means 11 via the input 26 and from the energy storage 18 of the first drive means via the input 27. The first operating means 20 operates the first drive means 5 via the output 28. The second operating means receives input signals via the corresponding inputs 29, 30, 31 and 32 and operates the second drive means via the output 33. The two operating means can compare their input signals and output signals, respectively, via the data line 34.

[0032] When a train approaches the level crossing, the operating device receives an input signal via the input 4 and the two operating means via the inputs 22 and 23. The operating means 20 and 21 operate their respective drive means 5, 6 to leave their upper position when the barrier is raised and to move downwards. As the drive means leave their upper position, this will be detected by the detecting means 7, 9 which will send signals regarding this to the operating means via the inputs 24, 29. When the barrier is lowered, the barrier detecting means 11 and 12 will detect this and send signals to the operating means via the inputs 26, 31. After the train has passed the level crossing, an input signal comes to the operating device via the input 4 and to the operating means via the inputs 22 and 23. The operating means will operate the drive means 5, 6 to move upwards until the detecting means 7 and 9 once more detect that the drive means have reached this upper position in which the barrier is raised.

[0033] If one of the drive means does not leave its upper position, this is detected by the detecting means 7 and 9, which will then not give the same signal to the operating means via the inputs 24 and 29. After the comparison of their respective input signals, the two operating means will then operate their drive means to lower the barrier so that the barrier detecting means 11 and 12 will be actuated once more. If one of the drive means gets stuck in a position below the upper position, the second drive means will have to reach below its lower position for the detecting means 11 and 12 to be actuated as the barrier is lowered. The fact that one of the drive means reaches below its lower position is detected by the detecting means 8 or 10.

[0034] If the barrier is to be raised but one of the drive means gets stuck before it has reached its uppermost position, this will be detected by the detecting means 7 and 9, which will then transmit different signals to the operating means 20, 21. If the rod 13 is broken on one side of the fulcrum 16, this will result in both drive means reaching below their lower position for the barrier detecting means 11 and 12 to be actuated.

[0035] In all the cases of defect described above, the operating means operate their respective driving devices to lower the barrier so that the barrier detecting means 11 and 12 are actuated. For the barrier to be raised once more, it is necessary for someone to manually reset the barrier device after having first examined what caused the defect and remedied this.

[0036] Fig. 2 shows an alternative embodiment of the driving device. The barrier 1 is pivotable on a pivot pin 17 and is connected to a barrier 35 in a fulcrum 36. Two drive means 37, 38 are connected to the barrier 35 in the fulcrums 39 and 40. The drive means consist of two gear racks 41 and 42, which are operated by gear wheels 43, 44 connected to electric motors 45 and 46. When the barrier is to be lowered, the second drive motor 46 drives via the second gear wheel 44 the second gear rack 38 to move downwards while at the same time the first electric motor 46 via the first gear wheel 43 drives the first gear rack 37 to move upwards. The positions of the gear racks are detected by the detecting means 47 and 48.

[0037] Fig. 3 shows one more alternative embodiment of the present invention, in which the barrier 1 is pivotable on a pivot pin 17 and is connected to a hydraulic system via a rod 49. The position of the rod 49 is changed via the two pistons 50 and 51, whose positions are detected by the detecting means 52 and 53. The pistons are moved by means of electric motors 54, 55 via a gear system 56 and 57 on each piston.

[0038] The embodiments described above are to be considered examples only. A person skilled in the art realises that these embodiments may be varied in a number of ways without departing from the inventive idea.

Claims

1. A barrier device, preferably a level-crossing barrier device, comprising

   a barrier (1),
   a driving device (2) for moving the barrier,
   an operating device (3) for operating the driving device, the operating device having an input (4) for an input signal for operating the barrier, and
   a barrier detecting device (58) for detecting the lowered barrier,

   characterised in that the driving device comprises

   a first and a second drive means (5, 6) each being capable of taking different positions, the drive means being arranged so that each of them is capable of taking a position in which the barrier is lowered independently of the position of the other drive means, and
   detecting means (7, 8, 9, 10) arranged on each of the drive means for detecting the position of the respective drive means, each of the detecting means being adapted to give a signal to the operating device about the position of the corresponding drive means and the operating device being adapted to operate both drive means (5, 6) to lower the barrier when the operating device receives a signal from the detecting means that the drive means during a certain period of time have an impermissible combination of positions.

2. A barrier device as claimed in claim 1, **characterised** in that the barrier detecting device (58) consists of two barrier detecting means (11, 12) which give a signal to the operating device (3) indicating whether the barrier is lowered, the operating device being adapted, when the barrier detecting means give different signals, to operate both drive means to lower the barrier (1).

3. A barrier device as claimed in claim 1 or 2, **characterised** in that the first and second drive means (5, 6) are pivotally connected to a rigid body (13) in a first and a second fulcrum (14, 15), and that the barrier is connected to the rigid body in a third fulcrum (16).

4. A barrier device as claimed in claim 3, **characterised** in that the third fulcrum (16) is arranged between the first and the second fulcrum (14, 15).

5. A barrier device as claimed in any one of the preceding claims, **characterised** in

   that the level-crossing barrier device comprises an energy storage (18, 19) for each drive means, each energy storages being adapted to give a signal to the operating device (3) containing information about the energy level of the energy storage, and
   that the operating device (3) operates both drive means to lower the barrier when one of the energy storages gives a signal indicating that the energy level is below a predetermined level.

6. A barrier device as claimed in any one of the preceding claims, **characterised** in

   that the operating device comprises two operating means (21, 22) which are each connected to a drive means, said operating means each having inputs for input signals from the drive means and the barrier detecting device, and outputs for operating the drive means, and
   that the operating means are adapted to continuously compare their input signals and output signals, respectively, each of the operating means being adapted to operate, when the comparison indicates that the signals are different, its associated drive means to lower the barrier.

7. A barrier device as claimed in any one of the preceding claims, **characterised** in

   that the detecting means (7, 8, 9, 10) of the driving device are adapted to detect whether the drive means are above their respective upper positions, which must be the case for both drive means for the barrier to be fully raised, and
   that the detecting means are adapted to detect whether the drive means are below their respective lower positions, which the drive means take only in case of a defect.

8. A barrier device as claimed in any one of the preceding claims, **characterised** in that at least one of the drive means of the driving device is a hydraulic drive means.

9. A barrier device as claimed in any one of the preceding claims, **characterised** in that at least one of the drive means of the driving device is an electric drive means.

10. A barrier device as claimed in any one of the preceding claims, **characterised** in that at least one of the drive means of the driving device is an electric motor (43, 44) with a gear rack (37, 38).

FIG 1

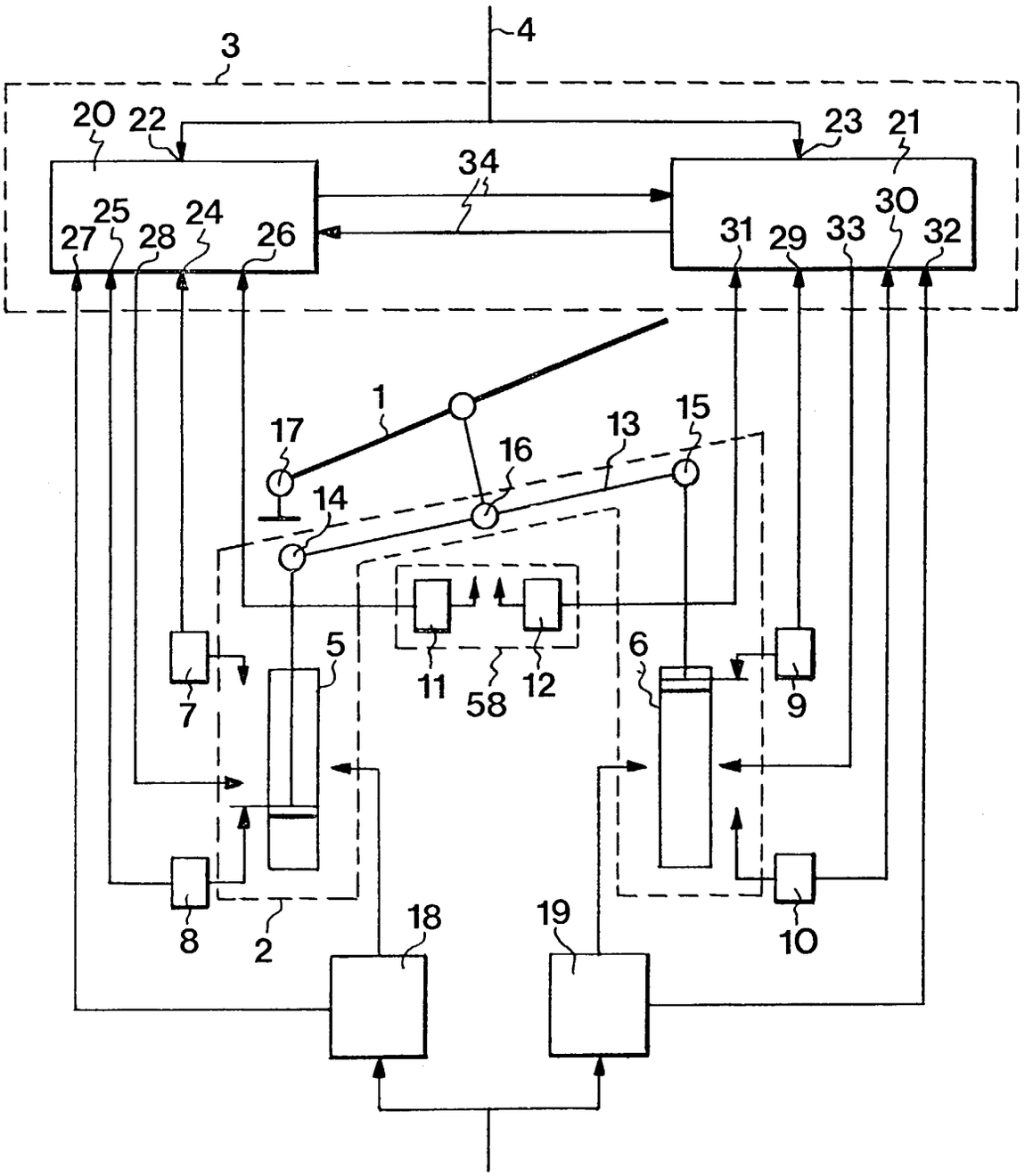
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FIG 2

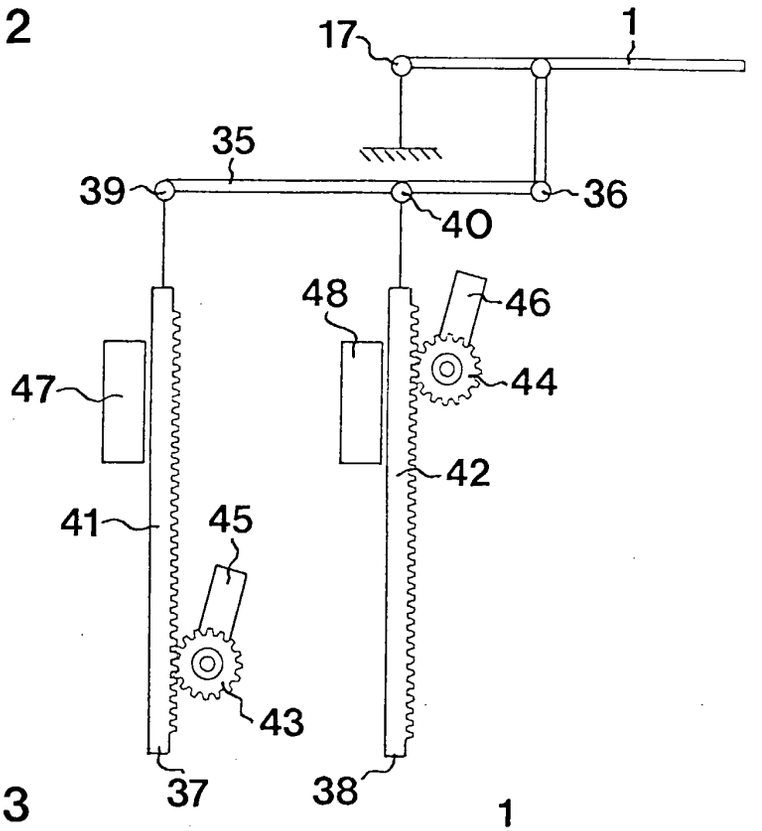
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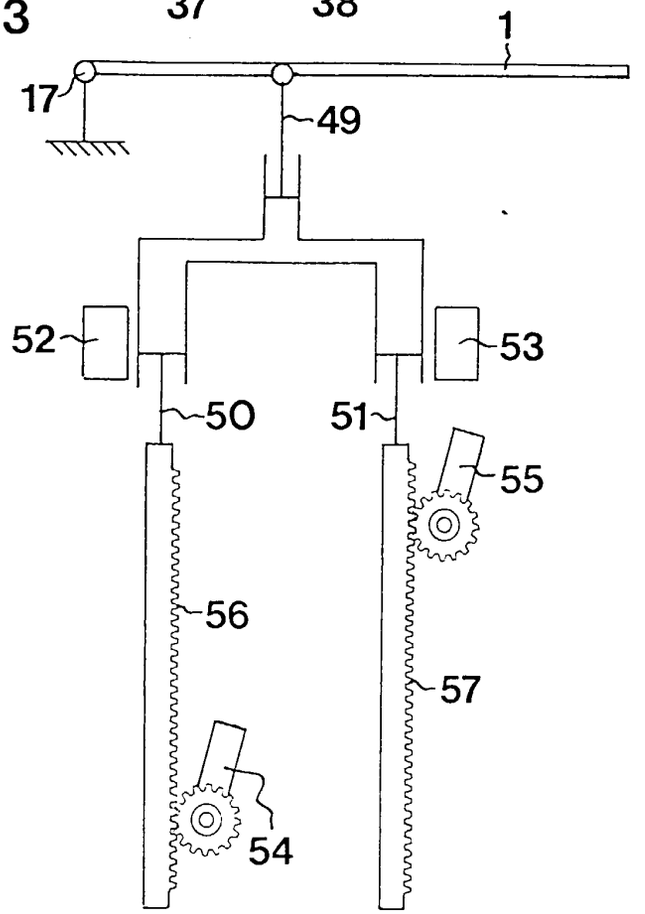
FIG 3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