(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 757 204 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
05.02.1997 Bulletin 1997/06

(51) Int. Cl.[6]: **F21V 21/38**

(21) Application number: **95108926.7**

(22) Date of filing: **09.06.1995**

(84) Designated Contracting States:
DE GB NL

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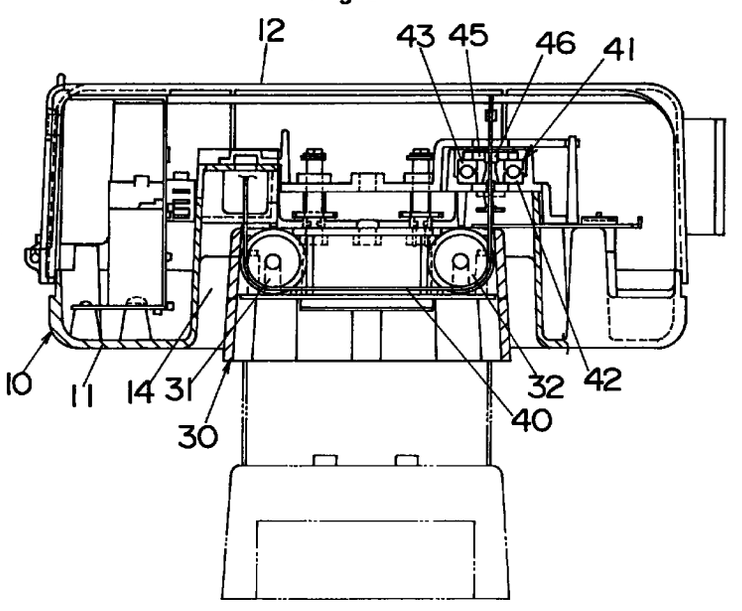
(54) Hoisting device for lighting fixture

(57) A device for mounting a lighting fixture to a high ceiling comprises a casing (**10**) incorporating an electric motor with a rotating drum. A loader (**30**) carrying the lighting fixture is suspended from the casing (**10**) by means of a wire (**40**) having a first end fixed to the drum and a second end fixed to the casing (**10**). The wire extends from the drum to pass round first and second pulleys within the casing, descends from the second pulley to pass round pulleys (**31**, **32**) in loader (**30**), and ascends back to the casing (**10**) to terminate at the second end such that winding and unwinding of the wire (**40**) on and from the drum lifts and lowers the loader (**30**) together with the lighting fixture. The casing (**10**) is provided in its bottom with a recess (**14**) which receives the loader (**30**) and which has an electrical connector for feeding electricity to the lighting fixture. The second end of the wire (**40**) is anchored to the casing (**10**) by means of a bearing (**41**) which comprises a first member (**42**) mounted to the casing and a second member (**43**) rotatable relative to the first member (**42**) and holding the second end of the wire (**40**) to release any twisting of the wire (**40**).

Fig.6



EP 0 757 204 A1

Description

TECHNICAL FIELD

The present invention is directed to a hoisting device, and more particularly to a device for mounting the lighting fixture to a ceiling of a building and capable of lifting and lowering the lighting fixture.

BACKGROUND ART

When the lighting fixture is mounted on a high ceiling of a building such as a gymnasium or the like, a stepladder or ladder scaffold is necessary for maintenance of the lighting fixture including the replacement of the lamp. Such maintenance operation at a high elevation is difficult and dangerous. Therefore, it is desired to suspend the lighting fixture by the use of a wire such that the lighting fixture can be lowered to a floor for easy and safe maintenance. However, the use of the wire gives a problem to be solved when successfully and safely lifting and lowering the light fixture. The problem involves that the wire may twist during the operation of lifting and lowering the lighting fixture to such an extent to impede the winding and unwinding of the wire and eventually cause jamming of the wire as well as to wrongly orient the lighting fixture.

The above problem is avoided in the present invention which provides a device capable of avoiding the wire and the lighting fixture from twisting during the movement of the lifting and lowering the lighting fixture. The device in accordance with the present invention comprises a casing incorporating an electric motor with a rotating drum. The casing is adapted to be mounted to a ceiling of a building by means of a support member. A loader carrying the lighting fixture is suspended from the casing by means of a wire having a first end fixed to the drum and a second end fixed to the casing. The wire extends from the drum to pass round first and second pulleys within the casing, descends from the second pulley to pass round a pulley in loader, and ascends back to the casing to terminate at the second end such that winding and unwinding of the wire on and from the drum lifts and lower the loader together with the lighting fixture towards and away from the casing. The casing is provided in its bottom with a recess which receives the loader and which has an electrical connector for feeding electricity to the lighting fixture. The device is characterized in that the second end of the wire is anchored to the casing by means of a bearing which comprises a first member mounted to the casing and a second member rotatable relative to the first member and holding the second end of the wire. With the use of the bearing, the twisting of the wire can be released by rotation of the second member relative to the first member of the bearing.

Accordingly, it is a primary object of the present invention to provide a device which is capable of eliminating the twisting of the wire and the lighting fixture for successfully lifting and lowering the lighting fixture.

In a preferred embodiment, the device of the present invention provides additional features for easy installation and safe operation of the device.

The above object and the other advantageous features of the present invention will become more apparent from the following detailed description of the invention when taken in conjunction with the attached drawings.

BRIEF DESCRIPTION OF THE INVENTION

FIG. 1 is a front view illustrating a hoisting device for a lighting fixture in accordance with a preferred embodiment of the present invention;
FIG. 2 is a side view of the device;
FIG. 3 is a top view of the device;
FIG. 4 is a plan view illustrating the interior of a casing of the device;
FIG. 5 is a sectional view taken along line 5-5 of FIG. 4;
FIG. 6 is a sectional view taken along line 6-6 of FIG. 4;
FIG. 7 is a sectional view illustrating a structure of supporting a free end of a wire utilized to suspend a loader in the above device;
FIGS. 8A and 8B are explanatory views, respectively for installation of the device;
FIG. 9 is a view illustrating a drum employed in the device;
FIG. 10 is a sketch illustrating a manner in which a wire is wound around the drum;
FIG. 11 is a plan view illustrating a relation between the drum and an associated pulley;
FIG. 12 is a sectional view of the device illustrating a limit sensor for a loader carrying a lighting fixture;
FIG. 13 is a perspective view of an electrical connector employed in the device for feeding electricity to the lighting fixture;
FIG. 14 is a top view illustrating a mechanism of sensing slackening of the wire around the pulley;
FIG. 15 is a view illustrating a mechanism of sensing a reverse winding of the wire;
FIG. 16 is a view illustrating a mechanism of sensing a torsion of the lighting fixture about a vertical axis;
FIGS. 17A and 17B are views illustrating the lighting fixture in a normal position and the associated operation of the mechanism, respectively;
FIGS. 18A and 18B are views illustrating the lighting fixture in a twisted position and the associated operation of the mechanism, respectively;
FIGS. 19A and 19B are views illustrating the lighting fixture in a half-turned position and the associated operation of the mechanism, respectively;
FIGS.20A and 20B are views illustrating an overload sensing mechanism operating in a normal condition and in an overloaded condition, respectively; and

FIG. 21 is a partial view illustrating another overload sensing mechanism.

DESCRIPTION OF THE EMBODIMENT

FIG. 1 illustrates a hoisting device of a lighting fixture in accordance with a preferred embodiment of the present invention. The device comprises a casing **10** installed on a building ceiling by a generally U-shaped support member **20**, and a loader **30** carrying the lighting fixture **1** and suspended from the casing **10** by means of a wire **40**. The lighting fixture **1** has an top attachment **2** by which it is held to the loader **30**. Accommodated in the casing **10** is an electric motor **50** for lifting and lowering the loader **30** together with the lighting fixture **1**. The casing **10** is of a flat rectangular configuration composed of a base **11** and a cover **12**. The support member **20** is of a generally U-shaped configuration with a web **21** and a pair of legs **23**. The web **21** has mount holes **22** through which screws (not shown) extends into the ceiling to secure the support member **20** to the ceiling. The leg **23** has an vertically elongate hole **24** through which bolts **25** extends into a hole in a bracket **13** at the opposite sides of the casing base **11** for supporting the casing **10** to the ceiling. As shown in FIGS. 8A and 8B, the casing **10** can be held horizontally even when installed to an inclined ceiling since the casing **10** can adjusts its position relative to the support member **20** by shifting the bolts **25** within the length of the elongate holes **24** and by pivoting the casing **10** about an axis of the bolts **25**.

The base **11** is formed in its center with a recess **14** into which the loader **30** fits, as shown in FIG. 5. The motor **50** is mounted on the base **11** in a space on one side of a convex formed by the recess **14**. The motor **50** has an output shaft connected to rotate a drum **51** so as to wind and unwind the wire **40** on and from the drum. The drum **51** is rotatively fixed upon deenergization of the motor by a gear mechanism (not shown) in a motor housing to stop unwinding the wire **40**. The wire **40** extends generally horizontally from the drum **51** to pass round an end pulley **53** and a center pulley **55**, as shown in FIGS. 4 and 5, then goes down to the loader **30** in which the wire **40** passes round a spaced pair of pulleys **31** and **32**, as shown in FIG. 6, and returns into the casing where the wire **40** has its free end fixed to the base **11** by means of a thrust ball bearing **41**. As shown in FIG. 7, the bearing **41** comprises a lower race **42** mounted on the base **11** and an upper race **43** held rotatable relative to the lower race **42**. A tubular bushing **45** is inserted in a center opening of the bearing with a flange of the bushing **45** resting upon the upper race **43** so that the bushing **45** is rotatable together with the upper race **43** relative to the base **11** of the casing **10**. The wire **40** is provided at its free end with an anchor sleeve **46** which is clamped to the wire **40** and rests on the bushing **45** so that the free end of the wire **40** is anchored to the casing **10**. With this arrangement, the bearing **41** can absorb any twisting movement of the wire which appears during the operation of winding and unwinding the wire for lifting and lowering the lighting fixture **1**.

As shown in FIGS. 9 and 10, a hub of the drum **51** is formed with a groove **52** for tightly winding the wire in rows and in a closely stacked manner. The end pulley **53** is supported about a shaft **54**, as shown in FIG. 11, and is movable in the axial direction of the shaft to give a minimum fleet angle α for guiding the wire **40** smoothly in and out of the groove **52** of the drum **51** when winding and unwinding the wire.

The device includes a limit sensor **60** for the lifting movement of the loader **30**. The limit sensor **60** comprises a flat spring **62** of which one end projects into the recess **14** for abutment against the upper end of the loader **30** when the loader **30** is fully received in the recess **14**. When abutting against the upper end of the loader **30**, as shown in FIG. 12, the flat spring **62** resiliently deform so as to actuate an adjacent miniature switch **61**, which disconnects the motor **50** from a power source, thereby stop rotating the drum, i.e., winding the wire **40**. To this end, the miniature switch **61** is connected to give an output to a control circuit formed on a circuit board **56** which deenergize the motor **50** upon sensing that the loader **30** is lifted into the recess **14**. The casing **10** is provided in the bottom of the recess **14** with a set of electrical connectors **15** which come into contact with corresponding pins **33** on the upper end of the loader **30** when the loader **30** is fully received in the recess **14**, for feeding electricity to the lighting fixture **1**. The electrical connectors **15** are wired to a terminal **16** to which an external cable is connected for feeding the electricity to the electrical connectors. Another terminal **17** is provided to be connected to an external cable for energizing the motor **50**. The pins **33** of the loader **30** are connected to leads (not shown) routed through within the loader **30** for feeding electricity to the lighting fixture **1**. As shown in FIG. 12, the pin **33** is formed to have a ring contact for engagement with the connector **15** of the casing **10**. The ring contact is provided for the purpose of preventing the contact from being spoiled due to an arc developing upon disengaging the pin from the connector **15**, thereby avoiding conduction failure between the pin **33** and the connector **15**.

Also included in the device is a loose sensor **70** which comprises, as shown in FIG. 14, the shaft **54** and a miniature switch **71**. The shaft **54** is supported between yokes **72** and **73** integrally upstanding from the base **11** of the casing **10** in a manner to extend through a round hole **74** in the yoke **72** and through an elongate hole **75** in the other yoke **73**. One end of the shaft **54** projecting out of the round hole **74** is connected to a coil spring **76** to be pulled towards the drum **51**, while the other end of the shaft **54** is freely movable in the elongate hole **75** so that the shaft **54** can pivot generally about the connection to the round hole **74**. The movable end of the shaft **54** projecting out of the elongate hole **75** is formed with an actuator **77** located in proximity to the miniature switch **71**. Due to the tension force applied to

the wire **40** and therefore to the end pulley **53**, the shaft **54** is normally held in parallel with an axis of the drum **51** against the bias of the spring **76** in which condition the actuator **77** engages a button (not shown) of the miniature switch **71**. When the wire **40** is slackened as a result of that the loader **30** is lowered to reach the floor of the building or to be caught by a personnel, the shaft **54** is caused to pivot under the action of the coil spring **76** so as to be inclined with respect to the axis of the drum **51**, thereby releasing the actuator **77** from the button of the miniature switch **71**. Upon this occurrence, the miniature switch **71** outputs a signal to the control circuit which responds to stop rotating the motor **50**, i.e., stop unwinding the drum **51**, allowing the personnel to handle the lighting fixture **1** for maintenance thereof. The control circuit holds this condition until the personnel operates to lift the lighting fixture **1**.

The device also includes a mechanism for avoiding reverse winding of the wire **40**. As shown in FIG. 15, the mechanism comprises a miniature switch **81** with an actuator **82** disposed between the drum **51** and the end pulley **53**. The actuator **82** is positioned in a path extending from the circumference of the hub of the drum **51** and the circumference of the end pulley **53** such that when the drum **51** still rotates after fully unwinding the wire, the wire **40** just starting to be wound in the opposite direction engages the actuator **82** to operate the miniature switch **81**. Upon this occurrence, the switch **81** outputs a signal to the control circuit to stop the motor **50**, thus preventing the reverse winding of the wire **40** and therefore holding the lighting fixture **1** at a lowermost position where wire **40** is fully unwound until the control circuit is instructed to lift the lighting fixture **1**.

Further included in the device is a mechanism for sensing the twisting of the loader **30** relative to the casing **10**. As shown in FIG. 16, the mechanism includes a lever **93** which is inserted loosely through a hole **19** in a wall member **18** surrounding the recess **14** to be movable horizontally. The lever **93** is formed at its one end with an arcuate guide **94** engageable with an actuator **92** of a miniature switch **91** fixed to the wall member **18**. The wire **40** extends loosely through a hole **95** in the other end of the lever **93** such that when the horizontal movement of the wire cause the lever **93** to displace horizontally. In a normal condition where the loader **30**, i.e., the lighting fixture is suspended regularly as shown in FIG. 17A, the lever **93** is in a position, as shown in FIG. 17B, that the guide **94** is kept disengaged from the actuator **92** so as not to actuate the switch **91**. When the loader **30** becomes twisted as shown in FIG. 18A, the wire **40** displaces correspondingly as indicated by an arrow in the figure to cause the lever **93** to pivot about the connection to the wall member **18**, as shown in FIG. 18B, thereby engaging the guide **94** with the actuator **92** in a direction of actuating the switch **91**. In this response, the switch **91** outputs a signal to the control circuit that stop operating the motor **50**. Further, when the loader **30** becomes largely twisted, for example, to such an extent to cross the wire, as shown in FIG. 19A, the wire **40** displaces largely to pull the lever **93** in a direction as indicated by an arrow in FIG. 19B, engaging the guide **94** with the actuator **92** to actuate the switch **91** for stopping the motor **50**. In this manner, the motor **50** can stop when the lighting fixture **1** swing or twist during the operation of lifting and lowering the lighting fixture.

Besides, the device has an overload sensor which comprises, as shown in FIG. 20A, a sensor sleeve **47** fixed to the wire **40** between the bearing **41** and a link **97** through which the wire **40** extends. The link is a generally L-shaped configuration and is supported to the wall member **18** with its corner engaged loosely in a hole **99** in the wall member **18** and with one arm thereof engaged with the flat spring **62** of the limit sensor **60**. The anchor sleeve **46** responsible for fixing the one end of the wire **40** to the casing **10** is clamped to the wire **40** at a clamping strength which is sufficient to bear a limited load of suspending the lighting fixture **1** but fails to bear an overload applied to the loader **30**. That is, when the overload is applied to the loader **30**, the wire **40** slips out of the anchor sleeve **46** to be thereby lowered until an end sleeve **48** at the distal end of the wire **40** abuts against the bearing **41**, as shown in FIG. 20B. Upon this occurrence, the sensor sleeve **47** pushes the arm of the link **97** which in turn to resiliently deform the flat spring **62** to thereby actuate the associated switch **61**, thus stopping the motor **50**. In order to protect the end of wire **40** from entirely slipping out of the bearing **41**, the end sleeve **48** is tightly or permanently secured to the wire **40**. At this moment, the loader **30** is lowered to disengage the pins **33** from the connector **15** so as to stop feeding electricity to the lighting fixture, thereby alerting the overload condition. Although the overload sensor utilizes the flat spring **62** and the switch **61** common to the limit sensor **60**, separate flat spring and switch may be provided for the overload sensor. Instead of providing the anchor sleeve **46**, a coil spring **49** may be provided between the end sleeve **48** and the bearing **41**, as shown in FIG. 21. The coil spring **49** is chosen to have a stiffness great enough to bear the normal load of suspending the lighting fixture and is compressed only when the overload is applied to the wire **40**. Thus, upon the wire seeing the overload condition, the coil spring is compressed to lower the sensor sleeve **47** together with the end sleeve **48**, thereby actuating the link **97** to actuate the switch **61** for stopping the motor.

In order to reduce the thickness of the casing **10**, the interior space around the convex formed by the recess **14** is effectively utilized to accommodate the motor **50** in a space on one side of the convex and accommodate the end pulley **53** and the circuit board **56** on the opposite side of the convex.

Claims

1. A device for mounting a lighting fixture to a ceiling, said device having a capability of lifting and lowering the lighting fixture and comprising:

a casing (**10**) for mounting at the ceiling and incorporating an electric motor (**50**) with a rotating drum (**51**),

a loader (**30**) carrying said lighting fixture (**1**), and

a wire (**40**) extending from said drum (**51**) descending from casing (**10**) to pass round a pulley (**31**, **32**) in said loader (**30**), and ascending back to said casing (**10**) to terminate at a second end fixed to said casing (**10**), such that winding and unwinding of the wire (**40**) on and from said drum (**51**) lifts and lowers said loader (**30**) together with the lighting fixture (**1**),

characterised in that said second end of said wire (**40**) is anchored to said casing (**10**) by means of a bearing (**41**), said bearing comprising a first member (**42**) mounted to said casing (**10**) and a second member (**43**) rotatable relative to said first member and holding said second end of said wire (**40**).

2. The device of claim 1, wherein said wire (**40**) passes from said drum (**51**) round first and second pulleys (**53**, **55**) provided within said casing (**10**) and descends from the second pulley (**55**) towards said loader (**30**).

3. the device of claim 1 or 2, wherein said casing (**10**) is provided in its bottom with a recess (**14**) to receive said loader (**30**), the recess being provided with an electrical connector (**15**) for supplying electricity to said lighting fixture (**1**).

4. The device of any preceding claim, including:

a fit sensor (**61**, **62**) which outputs a fit signal upon sensing that said loader (**30**) fits into the recess (**14**) of said casing (**10**),

a torsion sensor (**91**, **93**) which outputs a torsion signal upon sensing that said loader (**30**) is twisted relative to said casing (**10**),

a loose sensor (**54**, **71**) which outputs a loose signal upon sensing that said wire (**40**) is slackened around said first pulley (**53**),

a reverse-winding sensor (**81**, **82**) which outputs a reverse-winding signal upon sensing that said wire (**40**) is wound reversibly around said drum (**51**),

a load sensor (**47**, **97**, **62**, **61**) which outputs an over-load signal upon sensing that said loader (**30**) receives an overload, and

a controller which stops said motor (**50**) in response to any of said signals.

5. The device of claim 4, wherein said casing (**10**) accommodates said motor (**50**) and electrical components for said controller, respectively on opposite sides of a convex portion formed in the interior of said casing (**10**) by said recess (**14**).

6. The device of any preceding claim, wherein said casing (**10**) is suspended from the ceiling by means of a support member (**20**), said casing (**10**) being articulated to said support member (**20**) so as to extend horizontally when suspending from an inclined ceiling.

Fig.1

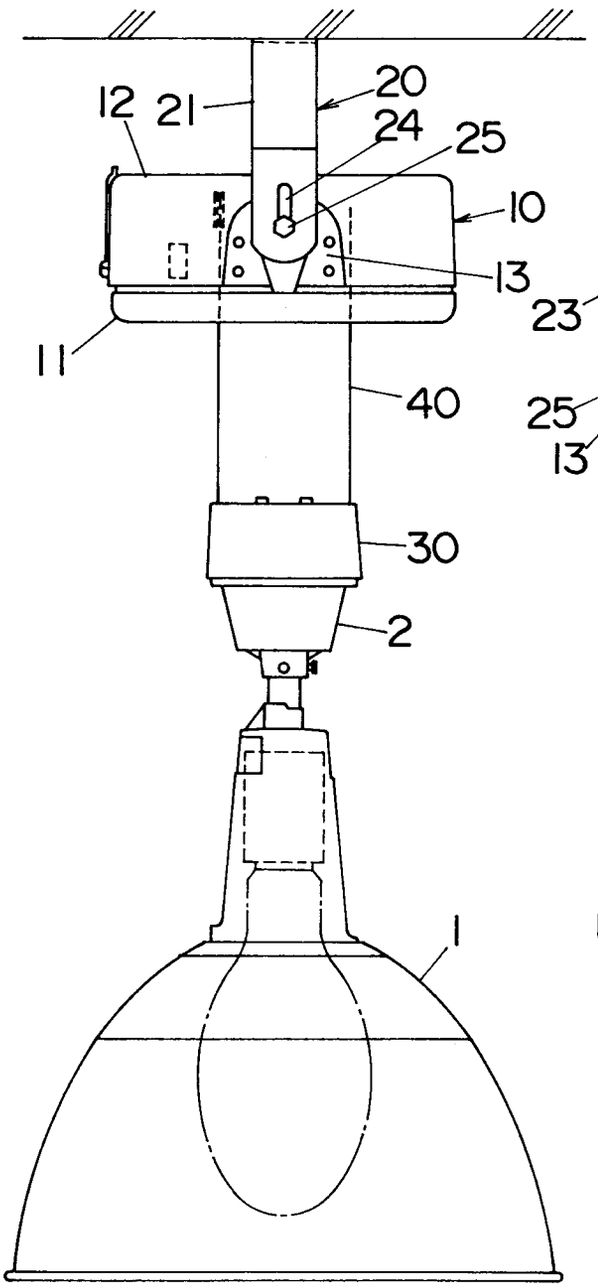


Fig.2

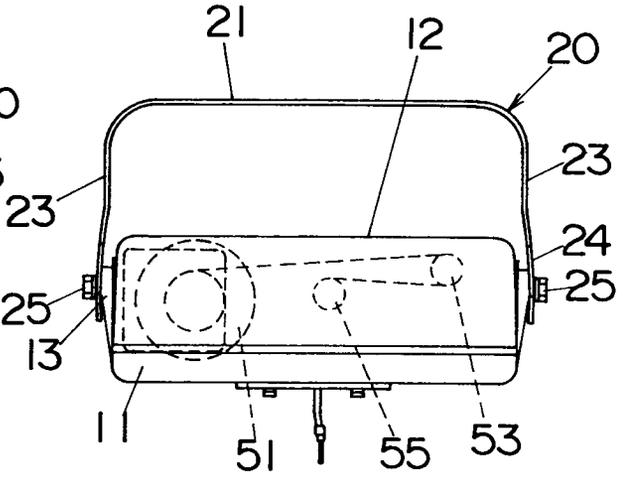


Fig.3

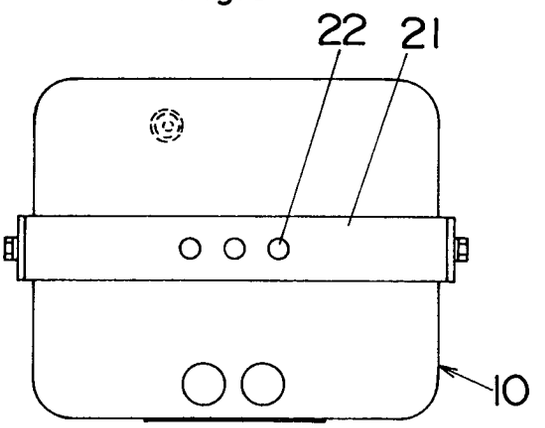


Fig.4

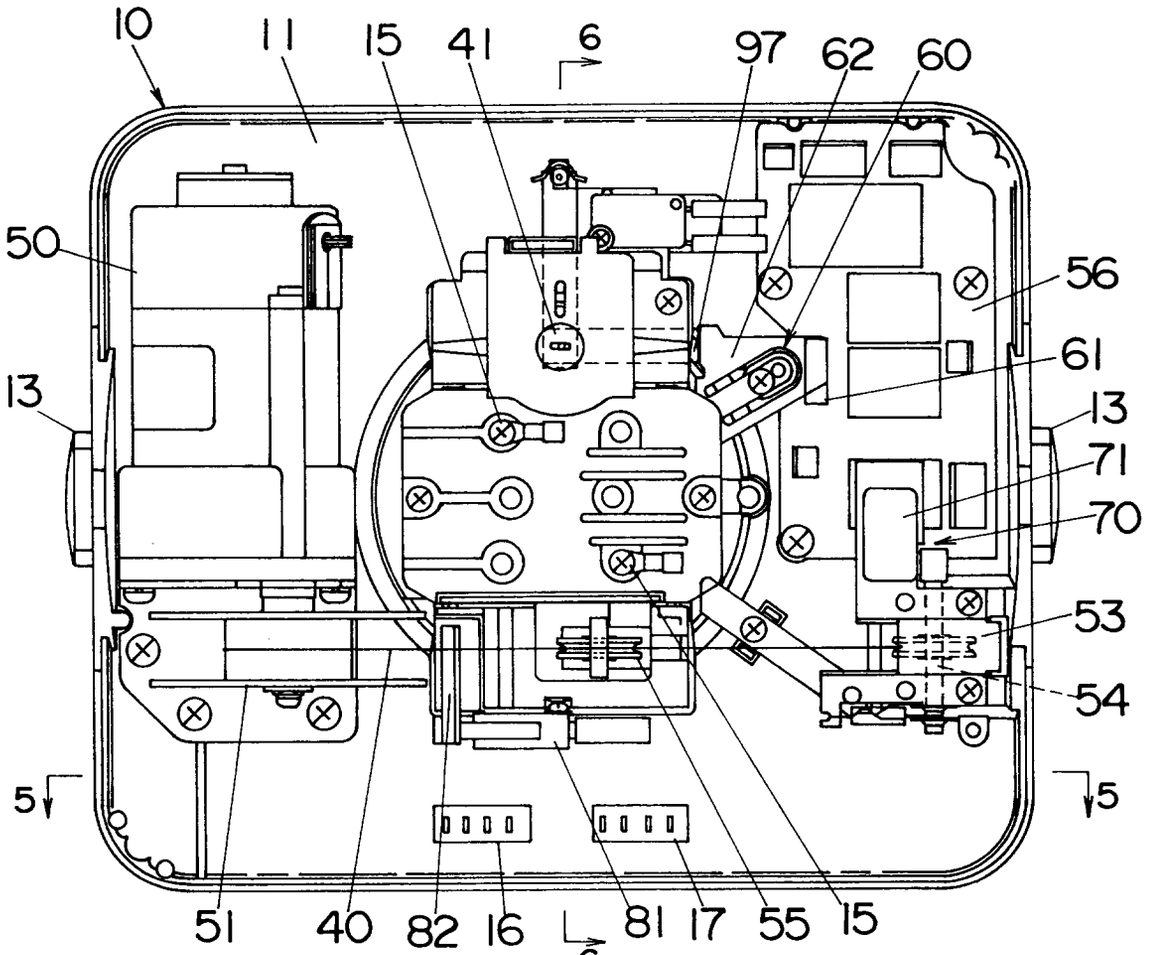

10
11
15
41
6
97
62
60
50
56
61
13
13
71
70
53
54
5
5
51
40
82
16
6
81
17
55
15

Fig.5

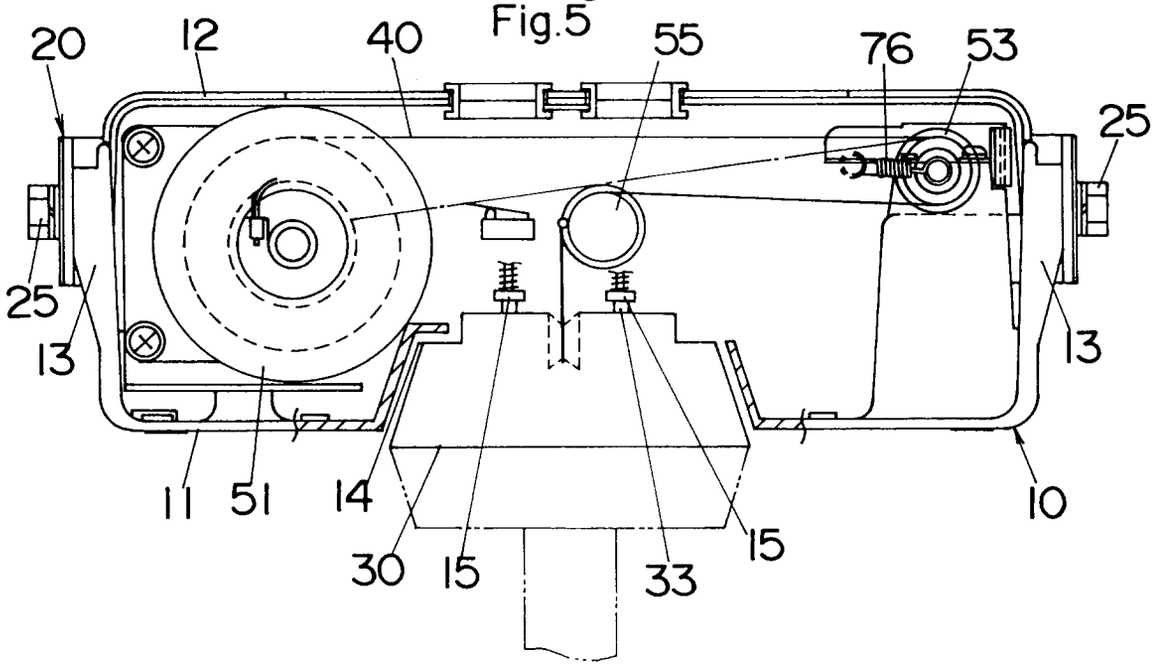

20
12
40
55
76
53
25
25
13
13
11
51
14
10
30
15
33
15

Fig.6

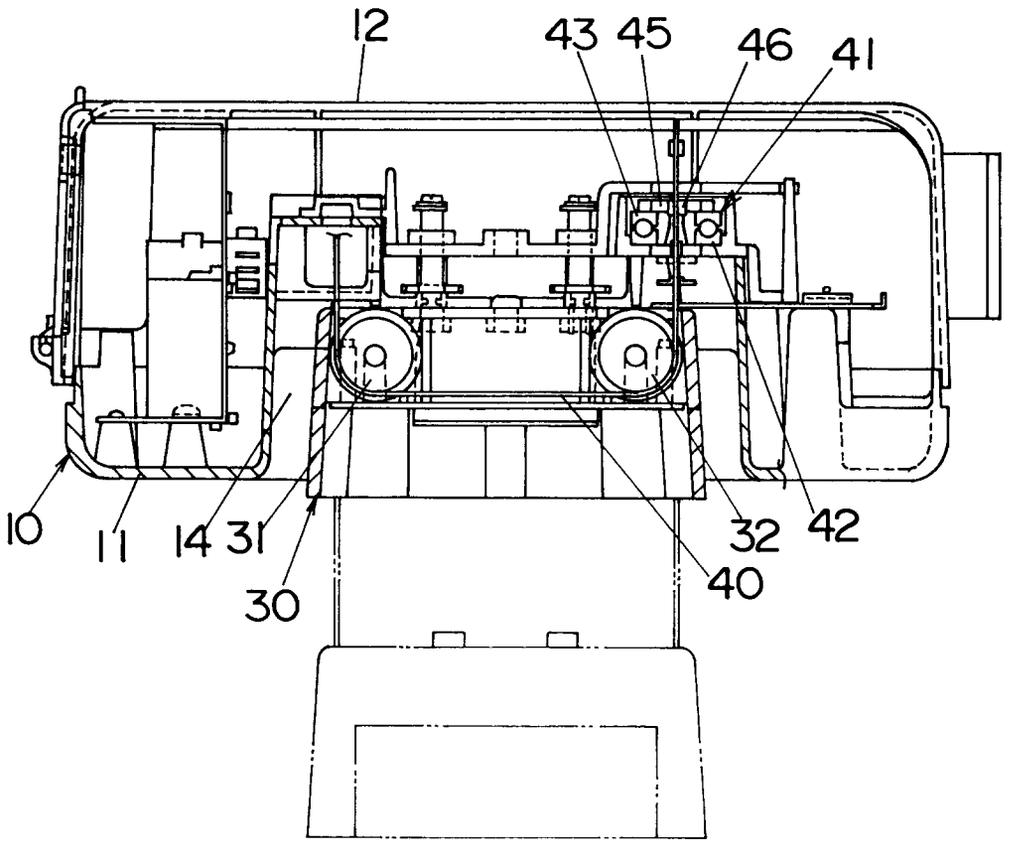


Fig.7

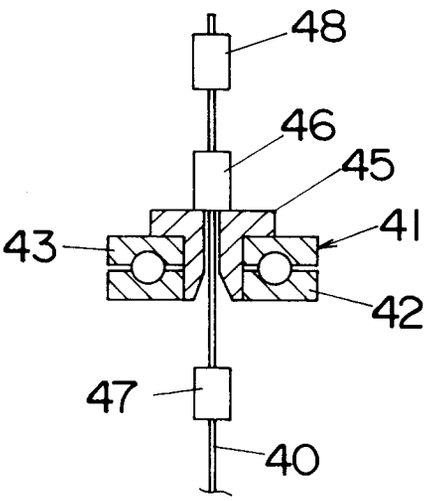


Fig.8A

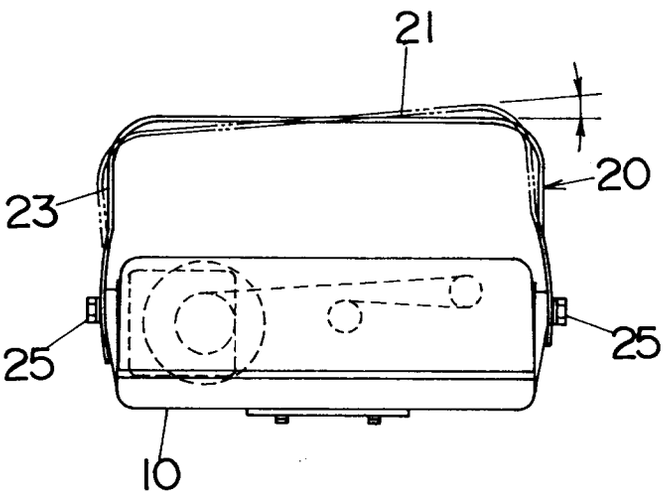


Fig.8B

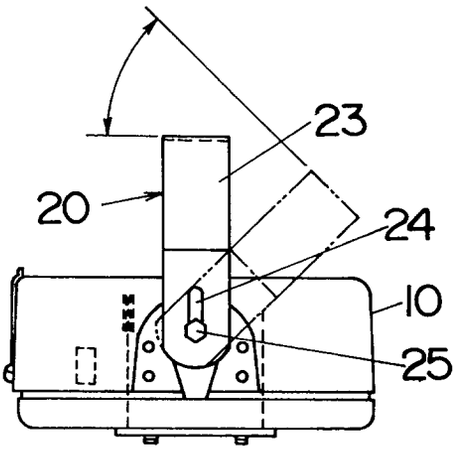


Fig.9

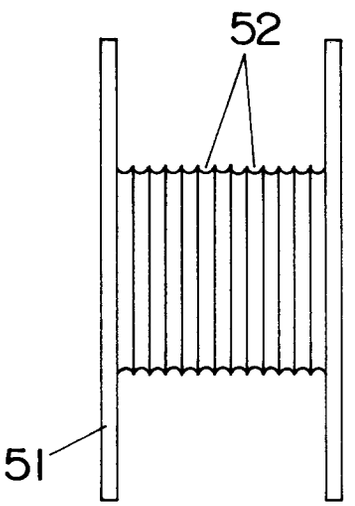


Fig.10

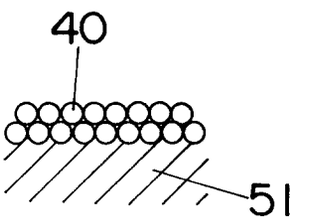


Fig.11

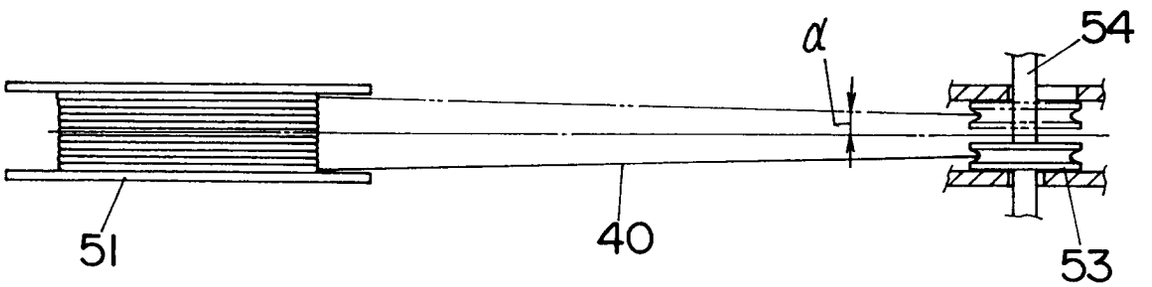


Fig.12

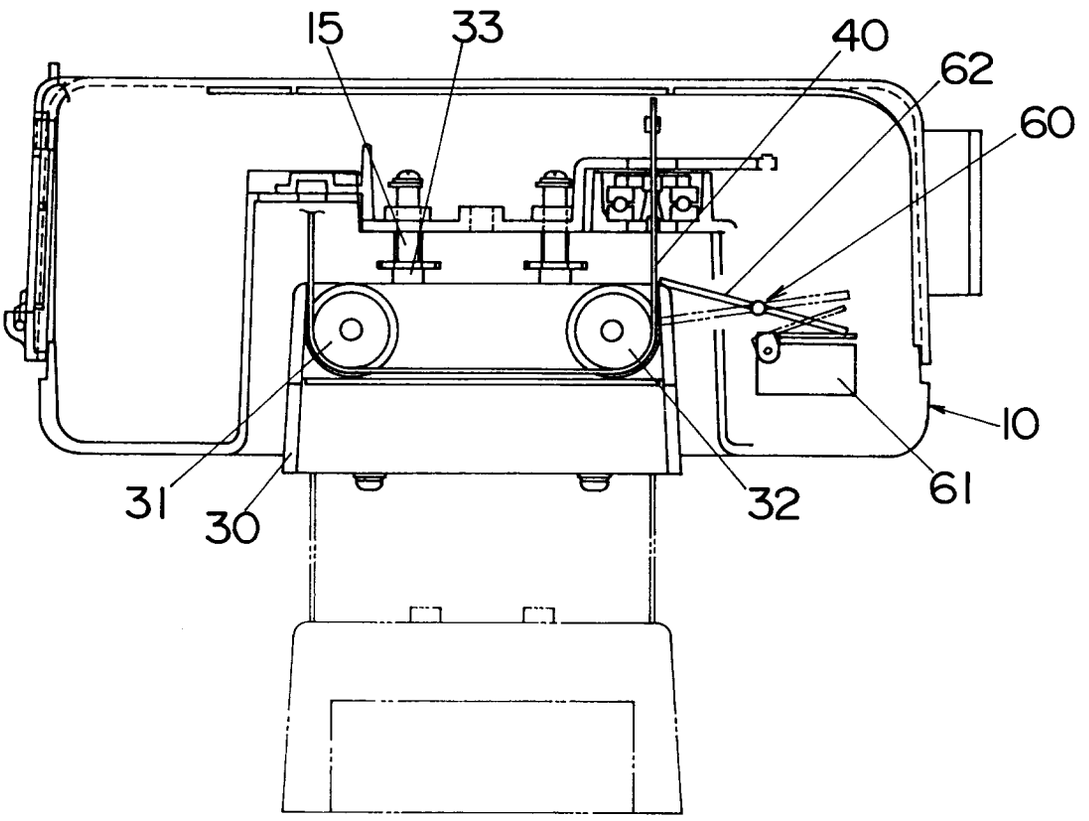


Fig.13

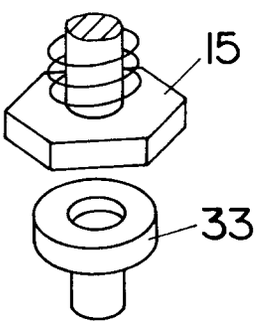


Fig.14

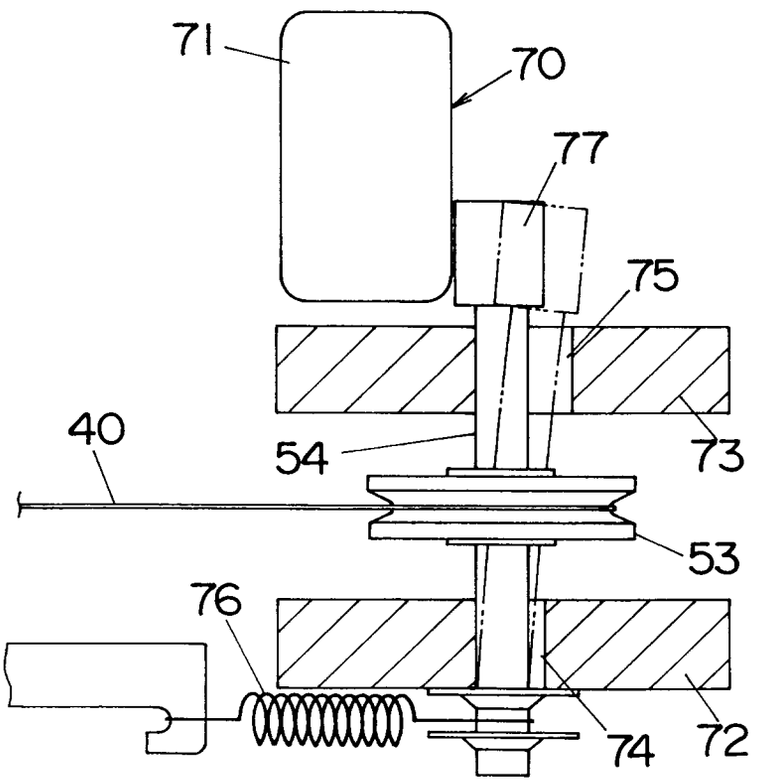


Fig.15

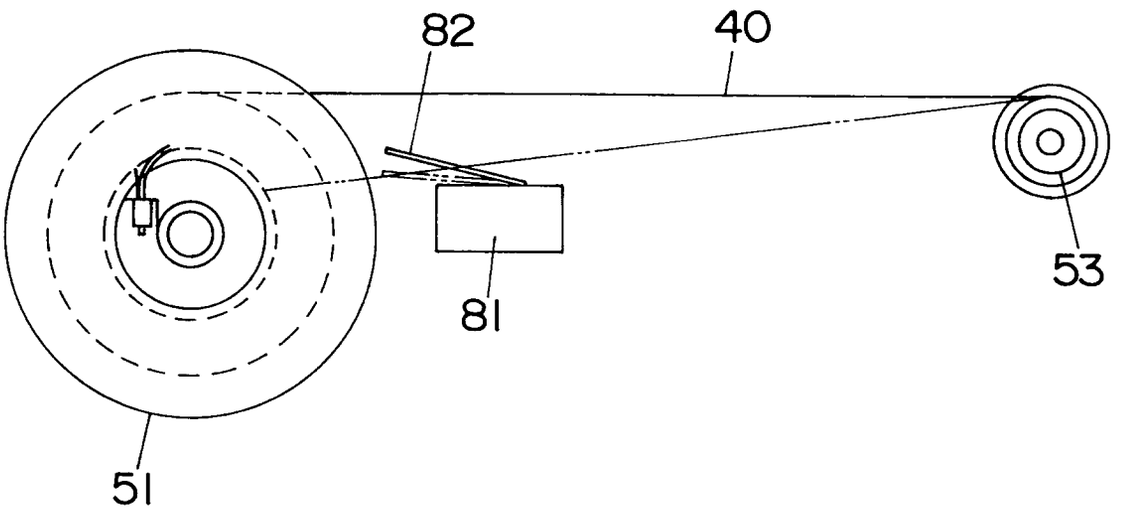


Fig.16

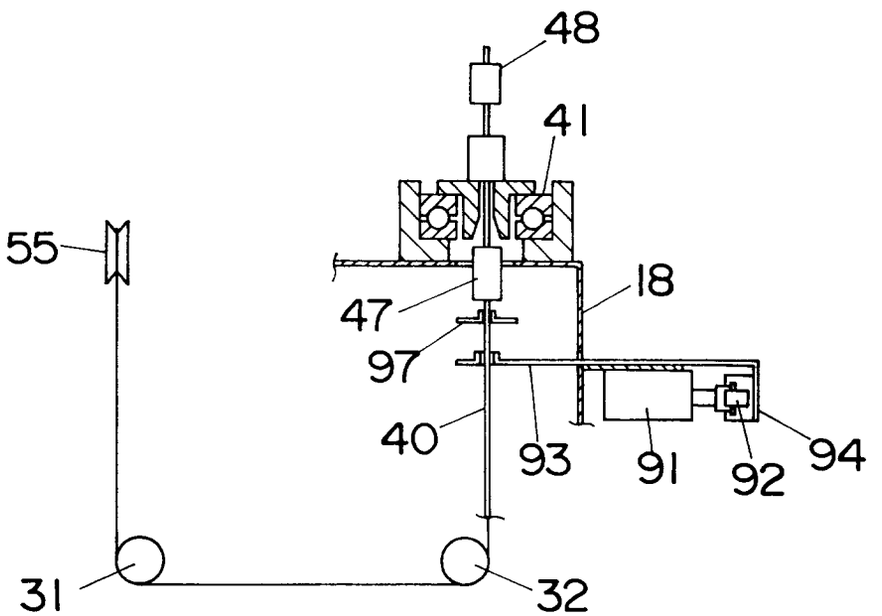


Fig.17B

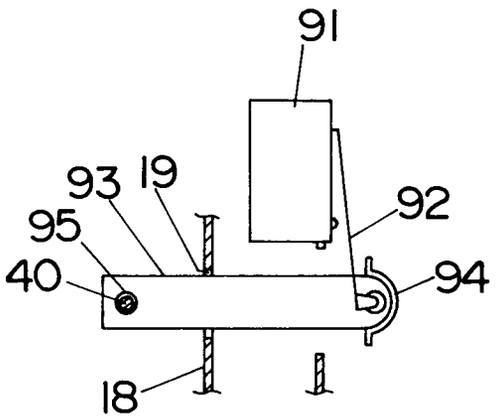


Fig.17A

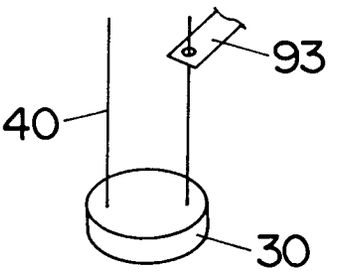


Fig.18B

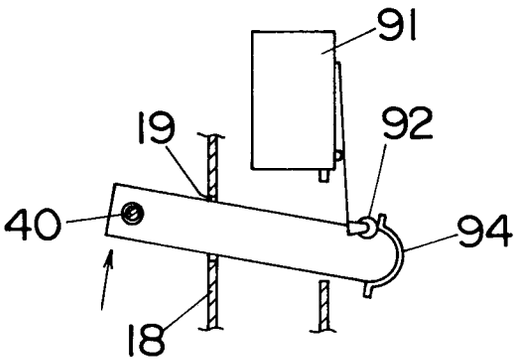


Fig.18A

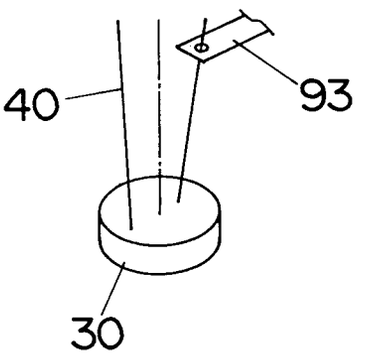


Fig.19B

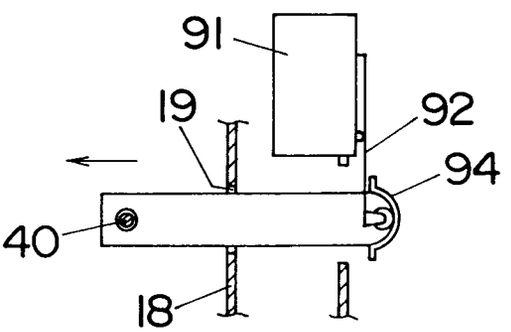


Fig.19A

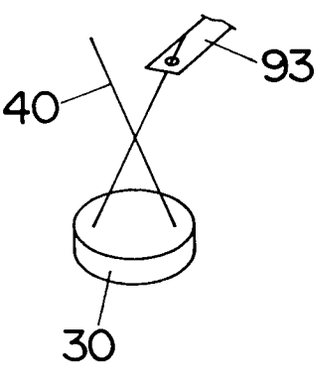


Fig.20A

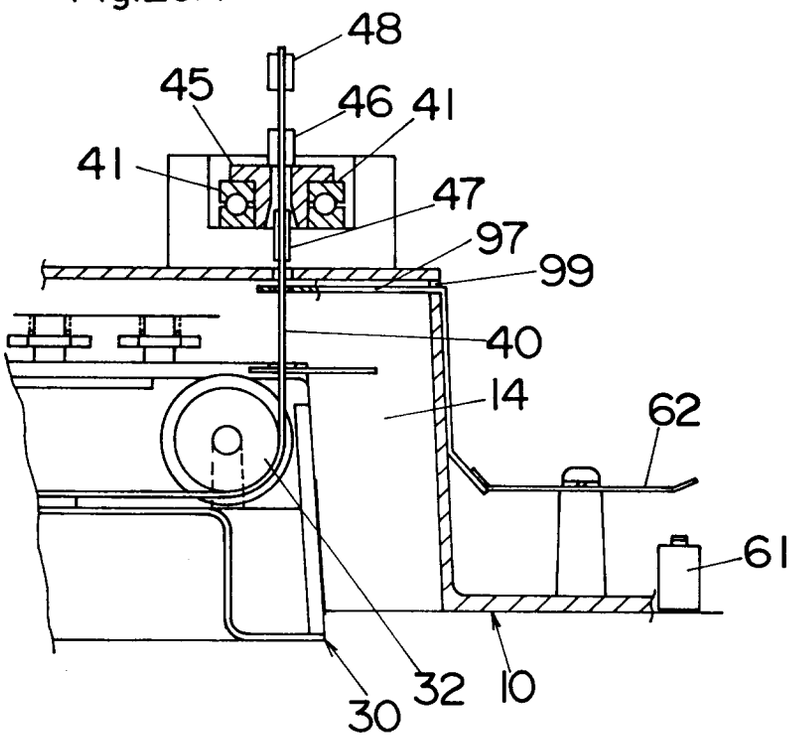


Fig.20B

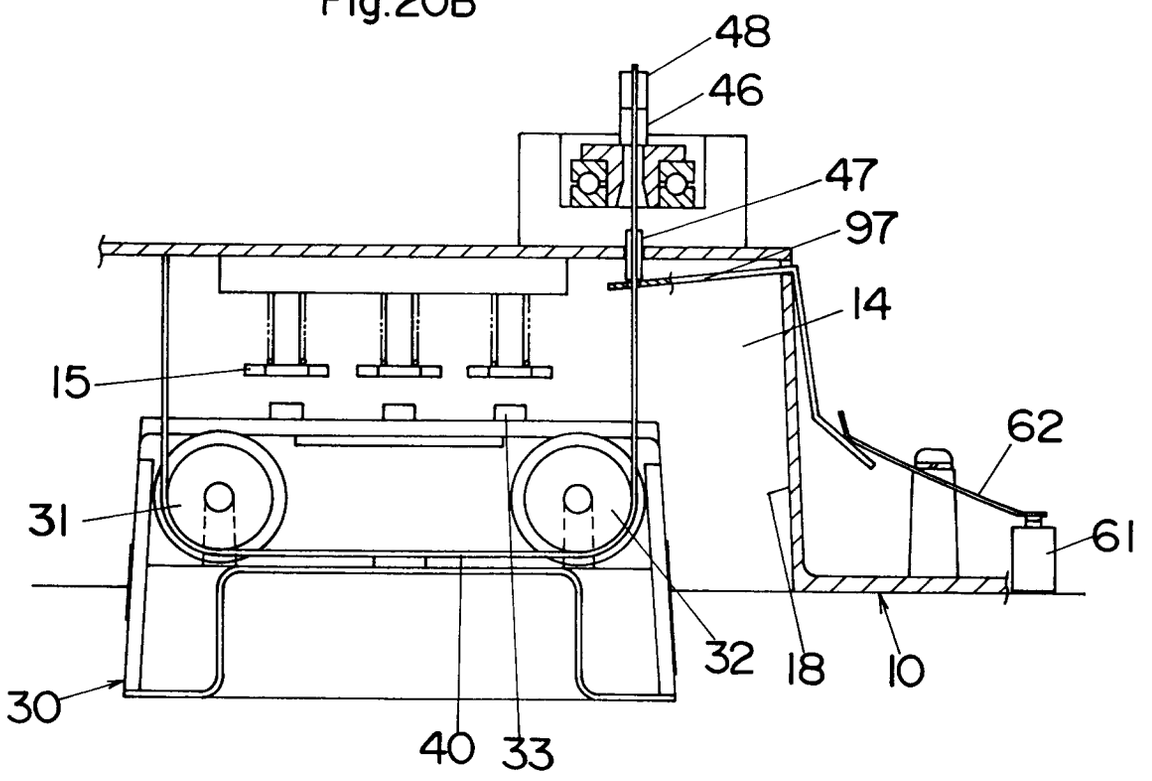
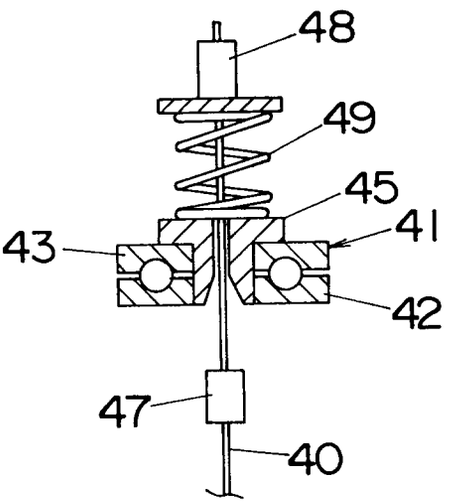


Fig.21



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 10 8926

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)
Y	DE-A-32 32 625 (STUDIOTECHNIK W HENSEL KG) * page 6, line 18 - line 27 * * page 7, line 23 - line 30 * * page 8, line 7 - line 18; figures 1-8 *	1	F21V21/38
Y	US-A-4 234 165 (MURRAY OMER E ET AL) * column 1, line 67 - column 2, line 11 * * column 2, line 38 - column 3, line 22; figures 1-6 *	1	
A	DE-C-254 514 (FABRIK FÜR BELEUCHTUNGS-ANLAGEN) * page 1, line 41 - line 55; figures 1,2 *	1-3	
A	EP-A-0 270 492 (ORLANDI ALDO ;LESCHOT GEORGES ANDRE (CH)) * abstract; page 12, line 10 - line 14; figures 1,3 *	3	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

F21V
F21S

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	20 October 1995	Martin, C

CATEGORY OF CITED DOCUMENTS

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