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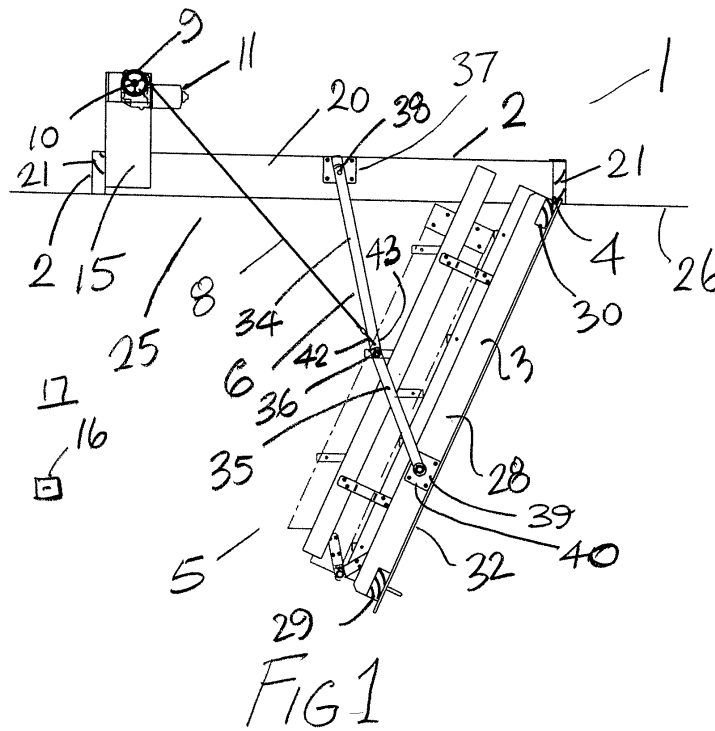
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(54) **A folding attic stair assembly**

(57) A folding attic stair assembly (1) comprises a rectangular outer mounting frame (2). An inner stairway carrying frame (3) is mounted by a hinge (4) at one end of the outer mounting frame (2) for movement between a raised stored position on the outer mounting frame (2) and a lowered position extending downwardly from the mounting frame (2). An expendable attic stair (5) is mounted on the inner frame (3). A pair of folding support

arms (6) extend between the outer mounting frame (2) and the inner stairway carrying frame (3). A cable (8) connects between each folding support arm (6) and an associated reel (9) mounted on a drive shaft (10) which is connected to a drive motor (11). This drive motor (11) is operable to wind and unwind the cables (8) on the reels (9) to raise and lower the attic stair (5) in a controlled manner.



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Description

Introduction

[0001] This invention relates to folding attic stairs.

Discussion of prior art

[0002] A folding attic stair assembly is disclosed in European patent no.1883739. This essentially comprises a folding stair assembly which can be raised and lowered on a support frame.

[0003] It is an object of the present invention to provide an improved folding attic stair assembly of this type.

Summary of the invention

[0004] According to the invention there is provided a folding attic stair assembly, comprising:

a mounting frame,

a collapsible attic stair,

the attic stair mounted on the mounting frame for movement between a raised stored position and a lowered position extending downwardly from the mounting frame,

an actuator for controlled movement of the attic stair between the raised position and the lowered position,

said actuator comprising a cable having an inner end connected to a reel and an outer end connected to the attic stair,

reel drive means operable to wind and unwind the cable on the reel to raise and lower the attic stair,

the reel drive means comprising an electric motor operatively connected

to an associated controller,

a position detector for detecting the position of the attic stair relative to the mounting frame,

the controller being operable to regulate operation of the motor in response to the sensed position of the attic stair.

[0005] In one embodiment of the invention the position detector is a current sensor for detecting the current drawn by the motor when the motor is operating, the controller being operable to switch off the motor when a preset motor operating current is sensed by the current sensor.

[0006] In another embodiment each reel is mounted on a one-way bearing which is mounted on a driveshaft driveably connected to the motor.

[0007] In another embodiment the controller is operable to continue to drive the motor for a preset period after the cable has been unwound from the reel.

[0008] In another embodiment the position detector includes a sensor for sensing the number of turns of the motor output shaft when the motor is running, the sensor being connected to a calculator in the controller for calculating the position of the attic stair relative to the mounting frame in response to the sensed turns of the motor output shaft.

[0009] In another embodiment the sensor is operable for measuring the ripple current in the motor, the calculator being operable to calculate the motor turns as a function of the frequency of the ripple current.

[0010] In another embodiment the sensor comprises an optical sensor, a hall sensor or a magnetic pickup in the motor.

[0011] In one embodiment of the invention the attic stair is hinged at one end of the ceiling opening and the reel is mounted at the opposite end of the opening.

[0012] In a preferred embodiment a pair of spaced-apart actuating cables and associated reels are provided, the cables being connected to opposite sides of the attic stair.

[0013] In another embodiment the or each reel is mounted on a drive shaft connected to a drive motor for rotation of the reels.

[0014] In another embodiment there is provided a hood assembly for the folding attic stair, the hood assembly comprising:

a support frame defining an access opening for the folding attic stair,

a cover hingedly mounted on the support frame and moveable between an open position and a closed position, and

sealing means engagable between the cover and the support frame when the cover is in a closed position to seal the access opening.

[0015] In another embodiment the cover incorporates a layer of insulating material.

[0016] In another embodiment a gas strut is mounted between the cover and the support frame, said gas strut being operable to urge the cover towards the open position.

[0017] In another embodiment a releasable latch is provided on the cover for engagement with the base frame to retain the cover in the closed position.

[0018] In another embodiment the collapsible attic stair is hingedly mounted at an opposite end of the support frame to the cover.

[0019] In another aspect the invention provides the ac-

tuating means in kit form for retrofitting to an existing collapsible attic stair.

[0020] In another aspect the invention provides the actuating means in kit form for retrofitting to an existing collapsible attic stair.

Brief description of the drawings

[0021] The invention will be more clearly understood by the following description of some embodiments thereof, given by way of example only, with reference to the accompanying drawings in which;

Fig. 1 is a partially sectioned elevational view of a folding attic stair assembly according to the invention, shown in a lowered position of use;

Fig. 2 is a partially sectioned end elevational view of the folding attic stair assembly of Fig. 1;

Fig. 3 is a partially sectioned elevational view of another folding attic stair assembly according to the invention;

Fig's 4 - 6 schematically illustrate a cable spooling system incorporated in the folding attic stair assembly of Fig. 3;

Fig. 7 is a view similar to Fig. 1 showing another folding attic stair assembly according to a third embodiment of the invention;

Fig. 8 is a partially sectioned end elevational view of the folding attic stair assembly shown in Fig. 7;

Fig. 9 is a sectional elevational view of a hood assembly for the folding attic stair assembly according to the invention, showing a cover of the hood assembly in an open position;

Fig. 10 is a sectional elevational view of the hood assembly, showing a cover of the hood assembly in a closed position;

Fig. 11 is an end elevational view of the hood assembly in the closed position; and

Fig. 12 is a sectional view taken along the line XII-XII of Fig. 11.

Detailed description of preferred embodiments

[0022] Referring to the drawings, and initially to Figs. 1 and 2 thereof there is illustrated a folding attic stair assembly according to the invention indicated generally by the reference numeral 1. The assembly 1 comprises a rectangular outer mounting frame 2. An inner stairway carrying frame 3 is mounted by a hinge 4 at one end of

the outer mounting frame 2 for movement between a raised stored position on the outer mounting frame 2 and a lowered position extending downwardly from the mounting frame 2 as shown in Fig. 1 and Fig. 2. A folding extendable attic stair 5 is mounted on the inner frame 3. A pair of folding support arms 6 extend between the outer mounting frame 2 and the inner stairway carrying frame 3. A cable 8 connects between each folding support arm 6 and an associated reel 9 mounted on a drive shaft 10 which is connected to a D.C. drive motor 11. This drive motor 11 is operable to wind and unwind the cables 8 on the reels 9 to raise and lower the attic stair 5 in a controlled manner.

[0023] The drive shaft 10 is rotatably supported on bearings 14 which are mounted on support posts 15 upstanding at each side of the outer mounting frame 2 to which they are attached. A switch 16 for operation of the motor 11 is mounted on a wall 17 below the stair assembly 1.

[0024] The outer mounting frame 2 is of rectangular configuration having a pair of spaced-apart side members 20 interconnected at their ends by end members 21. This outer frame 2 sits in an opening in a ceiling 26 to define an access opening 25 to an attic space above the ceiling 26.

[0025] The inner stairway carrying frame 3 has a pair of spaced-apart side beams 28 interconnected at their lower ends by a lower end beam 29 and interconnected at their upper ends by an upper end beam 30. The folding attic stair 5 is mounted on the inner frame 3 for movement between a collapsed, stored position as shown in the drawings and an extended in-use floor engaging position. An outer door panel 32 on an underside of the inner frame 3 closes off the access opening 25 when the folding attic stair 5 is in the raised closed position.

[0026] Each folding support arm 6 is of two-part construction, having an upper part 34 and a lower part 35 interconnected by a pivot joint 36. An upper end of the upper part 34 is pivotally connected to a side member 20 of the outer mounting frame 2 by an upper pivot mount 38 which engages a mounting bracket 37 secured to an inner face of the side member 20. Similarly, the lower part 35 is pivotally connected to the inner stairway carrying frame 3 by a lower pivot mount 39 which engages a lower mounting bracket 40 secured to an outer face of the side beam 28. A free outer end 42 of each cable 8 is attached adjacent a lower end 43 of the upper part 34 of the associated folding support arm 6.

[0027] In use, the attic stair 5 is nested within the outer mounting frame 2 when the assembly 1 is in a closed position. To gain access to the attic space above the ceiling 26 the motor 11 is operated to rotate the reels 9, paying out the cables 8 which lower the inner frame 3 with the extendable attic stair 5 in a controlled manner for deployment of the attic stair 5. After use, the motor 11 is reversed to reel in the cables 8 and gradually raise the inner frame 3 and folded attic stair 5 on the outer frame 2 into the raised stored position.

[0028] It will be appreciated that a complete folding attic stair assembly 1 may be provided and installed in a ceiling 26 as required. Alternatively a kit comprising the actuating assembly of cables 8, reels 9, drive shaft 10, motor 11, bearings 14, and support posts 15, can be provided for retrofitting to an existing folding attic stair assembly which has already been installed.

[0029] Referring now to Figs. 3 another folding attic stair assembly 45 is shown. Parts similar to those described previously are assigned the same reference numerals. In this case a stop block 46 is mounted within the outer frame 2 for engagement by the inner frame 3 when the inner frame 3 is in the raised closed position. The motor 11 is operatively connected to a controller 47. When operating, the current drawn by the motor 11 is proportional to the mechanical load on the motor 11. The controller 47 includes a current sensor 48. When the stair 5 is fully raised the inner frame 3 hits against the stop block 46. In the fully raised position the motor 11 is overloaded (because of the engagement of the stair 5 against the stop block 46) and thus it will draw much more current than it did when it was moving the stair 5. This overload is sensed by the current sensor 48 in the controller 47 prompting the controller 47 to switch off the power supply to the motor 11.

[0030] It will be noted that this sensed motor overload also provides a safety feature by way of pinch protection, switching off the motor 11 for example if a persons hand is accidentally trapped between the stair 5 and/or inner frame 3 and the mounting frame 2.

[0031] Referring to Figs. 3 to 6, each cable reel 9 is mounted on the motor driveshaft 10 by a one-way bearing 72. During lowering of the stair 5, the motor 11 rotates the driveshaft 10 feeding out the cables 8 from the reels 9. When the stair 5 is fully lowered and the cables 8 are fully paid out, the controller 49 allows the motor 11 to run on for a short period to establish that the reels 9 are fully unwound. During this period, the driveshaft 10 freely turns in the one-way bearings 72 so that the reels 9 do not start winding up the cables 8 again at this stage. To subsequently lift the stair 5 into the raised stored position, the motor 11 is reversed and the cables 8 are wound up again on the reels 9.

[0032] A number of other alternatives for measuring the position of the attic stair by measuring the motor turns with a view to detecting the position of the stair 5 for regulating operation of the motor 11 are also envisaged by the present invention. One alternative is to use ripple current measurement. While the motor 11 is operating it draws a current. This current contains a ripple. The frequency and number of cycles on this ripple corresponds to the motor speed and angular movement. The controller 47 is provided with means for sensing this ripple and using it to calculate by means of a calculator in the controller 47 how many turns the motor 11 has gone through and its speed of rotation. Other alternatives for measuring the turns of the motor 11 include providing a sensor 70 at the motor 11 such as an optical sensor, hall sensor or

magnetic pickup. Such sensor 70 could be mounted at the motor shaft, or at an output drive shaft of a gearbox associated with the motor or at the driveshaft 10 and is connected to the controller 47.

[0033] Referring now to Figs. 7 and 8 there is shown another folding attic stair assembly according to a third embodiment of the invention, indicated generally by the reference numeral 50. Parts similar to those described previously are assigned the same reference numerals. In this case the folding attic stair assembly 50 incorporates a safety hood assembly 52. The safety hood assembly 52 has a support frame 53 which sits on top of the outer mounting frame 2. A cover 54 is mounted by a hinge 55 at one end of the support frame 53 for movement between a raised open position as shown in the drawings and a lowered closed position against the support frame 53. A strut 56 extends between the cover 54 and the support frame 53 to hold the cover 54 in the raised open position and to facilitate closing of the cover 54 in a controlled manner, so that it does not slam shut for example. The cover 54 can be lowered onto the support frame 53 and secured thereto by a releasable latch 57. A sealing strip 58 seals between mating faces of the cover 54 and the support frame 53. A layer of insulation 59 within the cover 54 minimises heat loss through the cover 54 when the cover 54 is in the closed position. The sealing strip 58 prevents drafts between the cover 54 and support frame 53 when the cover 54 is in the closed position.

[0034] Referring in particular to Figs. 9 to 12, the hood assembly 52 is shown in more detail. The cover 54 is moveable between an open position as shown in Fig. 9 and a closed position as shown in Fig. 10.

[0035] The sealing strip 58 is mounted around a top edge of the support frame 53 for engagement by a complementary bottom edge 60 of the cover 54 when the cover 54 is in the closed position as shown in Fig. 10.

[0036] It will be noted that a cut-away portion 64 is provided in an end of the support frame 53 opposite the hinge 55 to allow ease of access to persons using the folding attic stair 5 when entering or leaving the attic space above the hood 52. The folding attic stair 5 is hingedly mounted on the outer mounting frame 2 at an opposite end of the outer mounting frame 2 to the cover 52 as shown in Fig. 7.

[0037] The cover 54 is also of rectangular configuration having side walls 66 interconnected by end walls 67. A rectangular top panel 68 engages in complementary mounting grooves 69 at upper ends of the side walls 66 and end walls 67.

[0038] Mounted directly beneath the top panel 68 is the layer of insulation 59 which minimises heat loss through the hood 52 when the hood 52 is in the closed position.

[0039] In use, a person lowers and extends the folding attic stair 5 as previously described. Upon ascending the stair 5 the person can then release the latch 57 and push up the cover 54 into the open position as shown in Fig. 9. The cover 54 is then retained in the open position by

the strut 56. The person then has free access into the attic space above the hood 52. Upon descending again from the attic space the person lowers the cover 54 into the closed position and after stepping down the attic stair 5 this can be folded up into the stored position within the mounting frame 2 beneath the hood 52 as shown in the drawings.

[0040] It will be appreciated that the sealing strip 58 between the support frame 53 and cover 54 prevents drafts and also the insulation layer 59 prevents heat loss through the cover 54 when the hood 52 is in the closed position. The hood 52 can also be closed when persons are in the attic space for safety reasons to prevent anyone accidentally falling through the access opening 25.

[0041] It will be noted that the hood assembly 52 of the invention can be fitted over existing folding attic stairs. Alternatively a folding attic stair assembly comprising the hood assembly 52 and a folding attic stair may be installed together in a ceiling ope.

[0042] The invention is not limited to the embodiments hereinbefore described which may be varied in both construction and detail within the scope of the appended claims.

Claims

1. A folding attic stair assembly, comprising:

a mounting frame,
a collapsible attic stair,
the attic stair mounted on the mounting frame for movement between a raised stored position and a lowered position extending downwardly from the mounting frame,
an actuator for controlled movement of the attic stair between the raised position and the lowered position,
said actuator comprising a cable having an inner end connected to a reel and an outer end connected to the attic stair,
reel drive means operable to wind and unwind the cable on the reel to raise and lower the attic stair,
the reel drive means comprising an electric motor operatively connected to an associated controller,
a position detector for detecting the position of the attic stair relative to the mounting frame,
the controller being operable to regulate operation of the motor in response to the sensed position of the attic stair.

2. The folding attic stair assembly as claimed in claim 1 wherein the position detector is a current sensor for detecting the current drawn by the motor when the motor is operating, the controller being operable to switch off the motor when a preset motor operating

current is sensed by the current sensor.

3. The folding attic stair assembly as claimed in claim 1 or claim 2, wherein each reel is mounted on a one-way bearing which is mounted on a driveshaft driveably connected to the motor.

4. The folding attic stair assembly as claimed in claim 3 wherein the controller is operable to continue to drive the motor for a preset period after the cable has been unwound from the reel.

5. The folding attic stair as claimed in claim 1, wherein the position detector includes a sensor for sensing the number of turns of the motor output shaft when the motor is running, the sensor being connected to a calculator in the controller for calculating the position of the attic stair relative to the mounting frame in response to the sensed turns of the motor output shaft.

6. The folding attic stair as claimed in claim 5, wherein the sensor is operable for measuring the ripple current in the motor, the calculator being operable to calculate the motor turns as a function of the frequency of the ripple current.

7. The folding attic stair as claimed in claim 5, where the sensor comprises an optical sensor, a hall sensor or a magnetic pickup in the motor.

8. The folding attic stair assembly as claimed in any preceding claim wherein the attic stair is hinged at one end of the ceiling opening and the reel is mounted at the opposite end of the opening.

9. The folding attic stair assembly as claimed in any preceding claim wherein a pair of spaced-apart actuating cables and associated reels are provided, the cables being connected to opposite sides of the attic stair.

10. The folding attic stair assembly as claimed in claim 9 wherein each reel is mounted on a drive shaft connected to the drive motor for rotation of the reels.

11. The folding attic stair assembly as claimed in any preceding claim wherein there is provided a hood assembly for the folding attic stair, the hood assembly comprising:

a support frame defining an access opening for the folding attic stair,
a cover hingedly mounted on the support frame and moveable between an open position and a closed position, and
sealing means engagable between the cover and the support frame when the cover is in a

closed position to seal the access opening.

- 12.** The folding attic stair assembly as claimed in claim 11 wherein the cover incorporates a layer of insulating material. 5
- 13.** The folding attic stair assembly as claimed in claim 11 or claim 12 wherein a gas strut is mounted between the cover and the support frame, said gas strut being operable to urge the cover towards the open position. 10
- 14.** The folding attic stair assembly as claimed in any one of claims 11 to 13 wherein a releasable latch is provided on the cover for engagement with the base frame to retain the cover in the closed position. 15
- 15.** The folding attic stair assembly as claimed in any one of claims 11 to 14 wherein the collapsible attic stair is hingedly mounted at an opposite end of the support frame to the cover. 20

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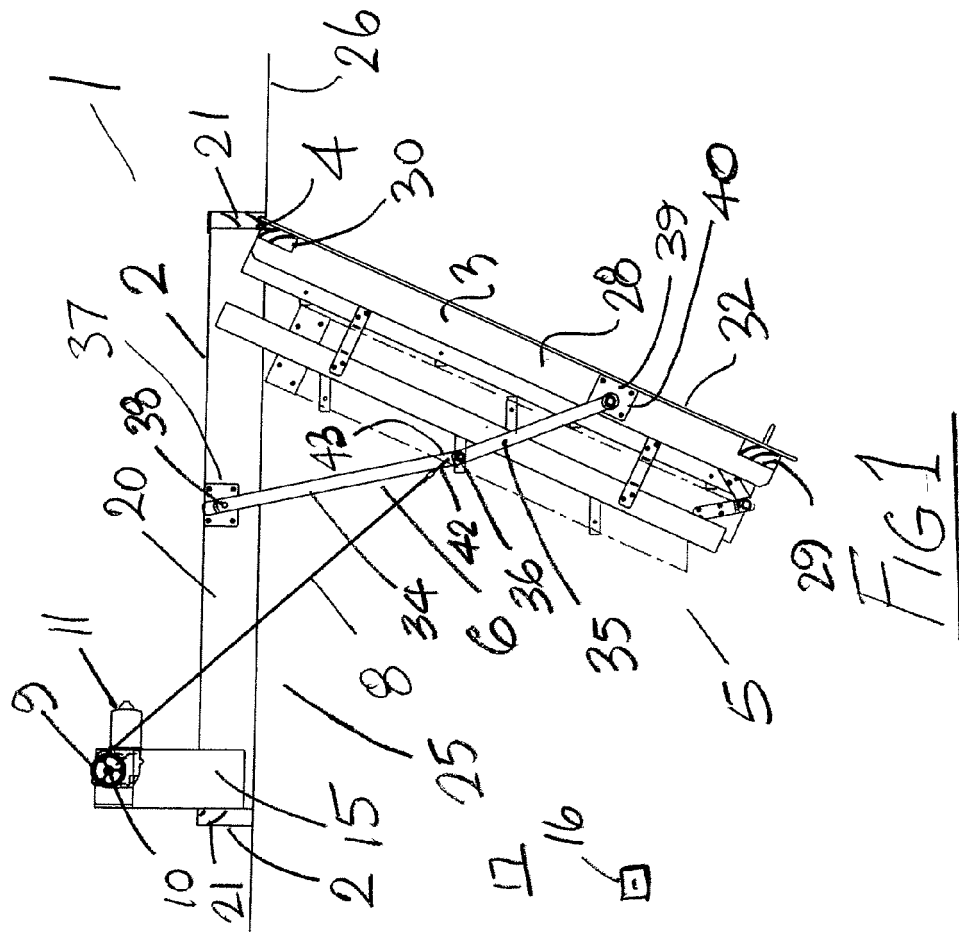
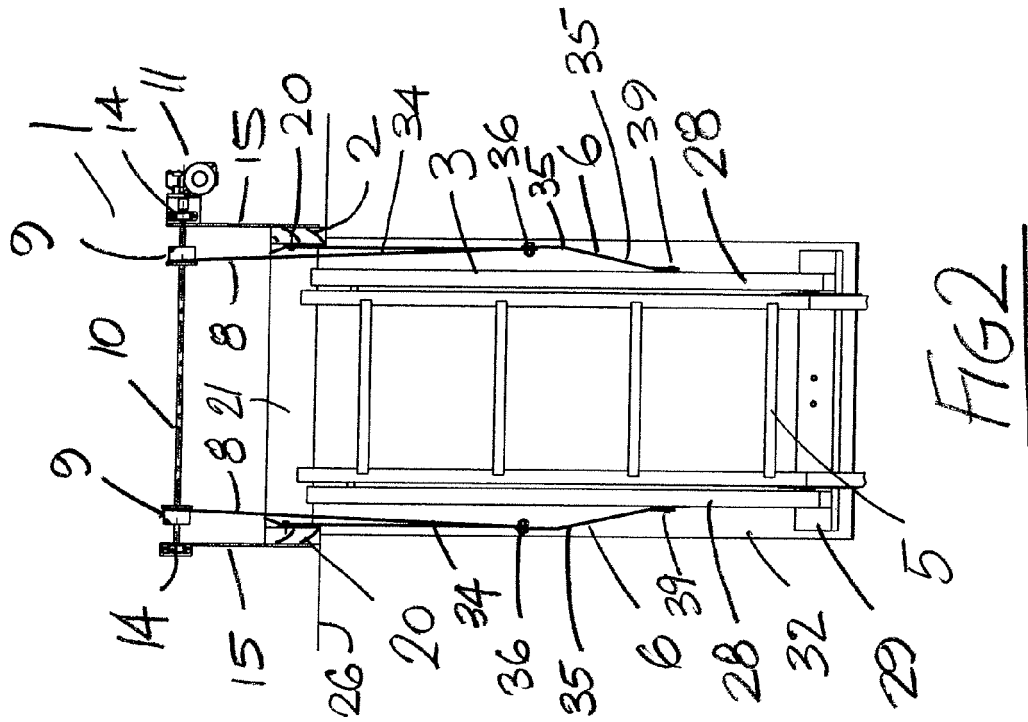
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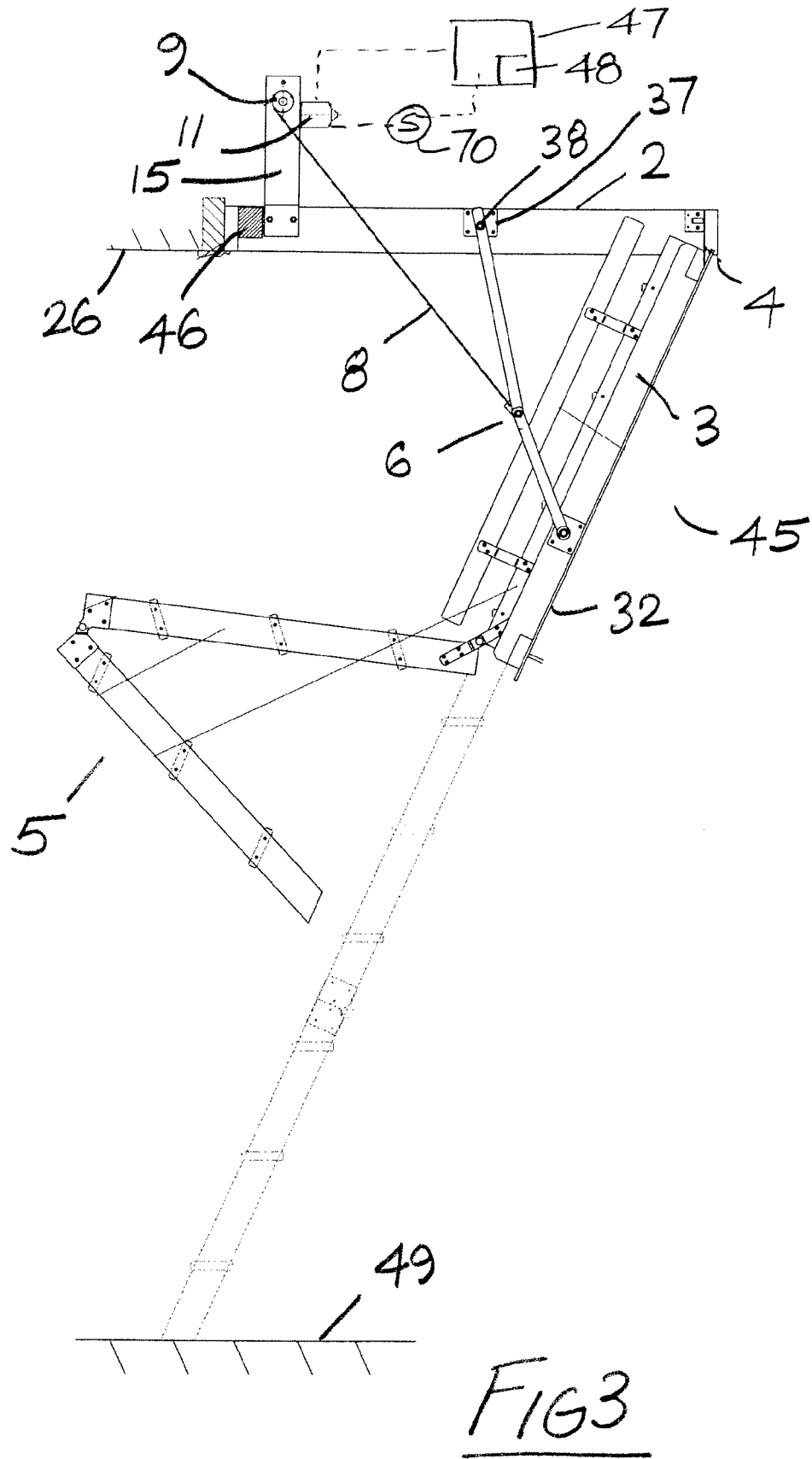
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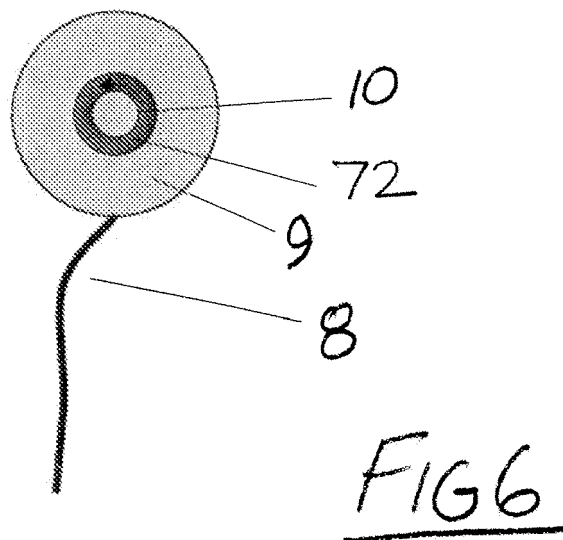
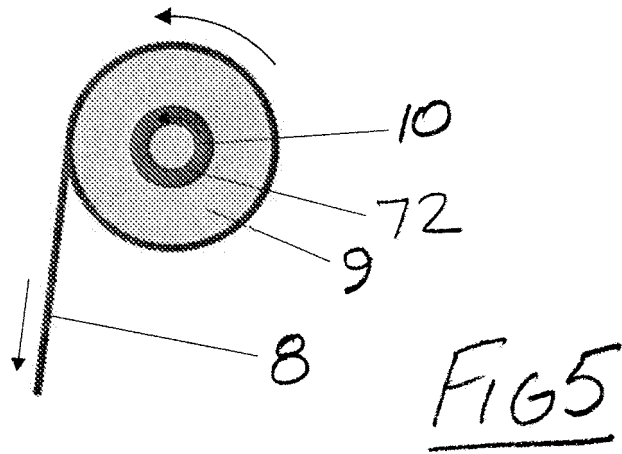
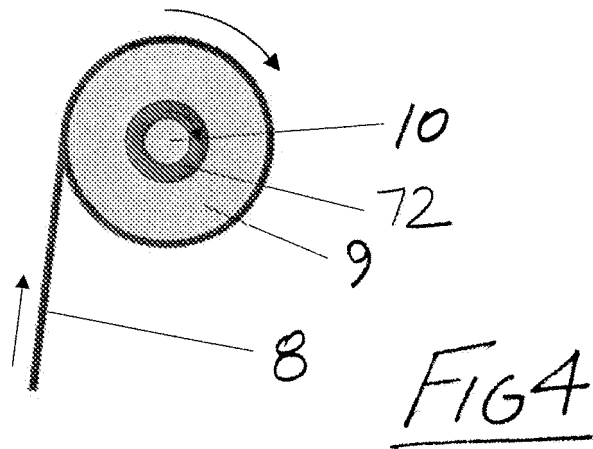
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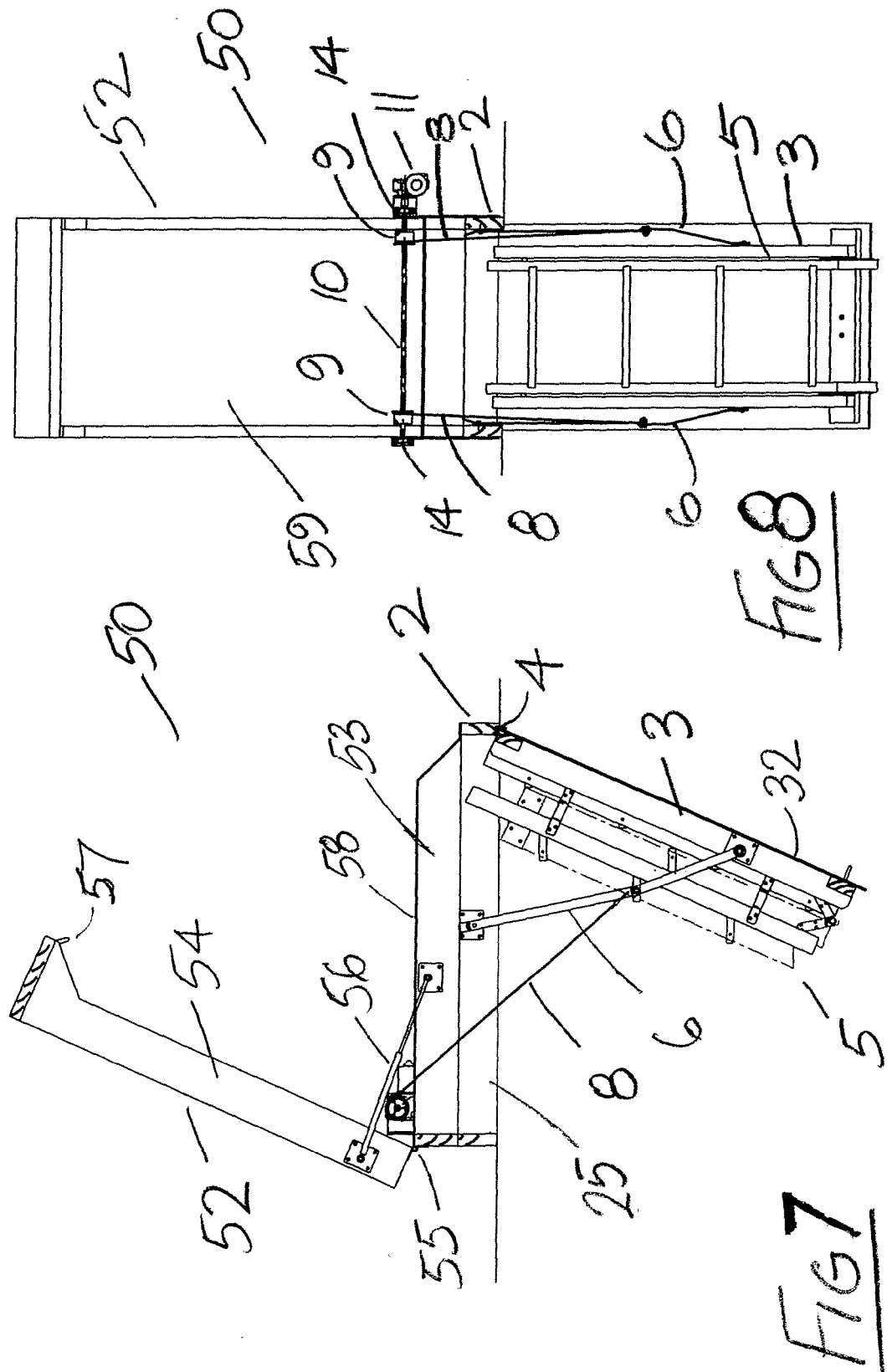
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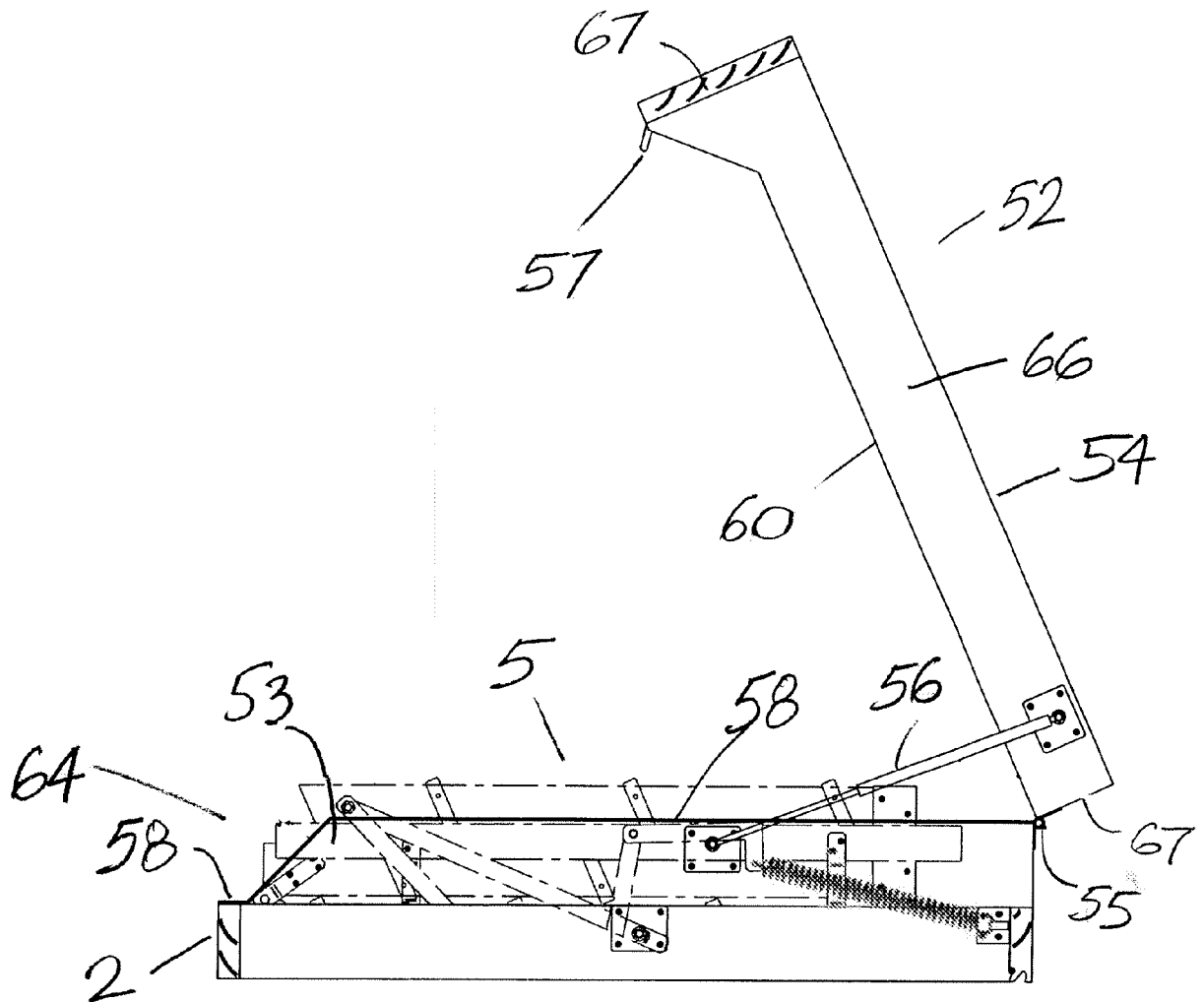
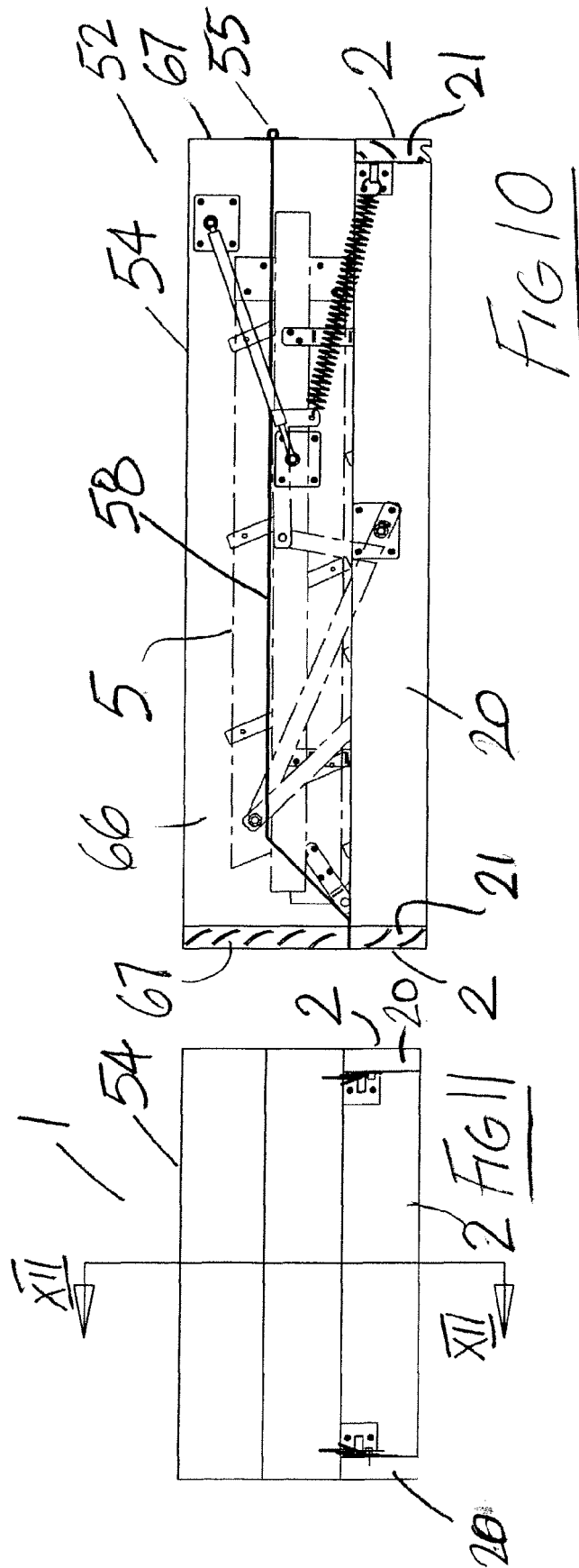


FIG 9



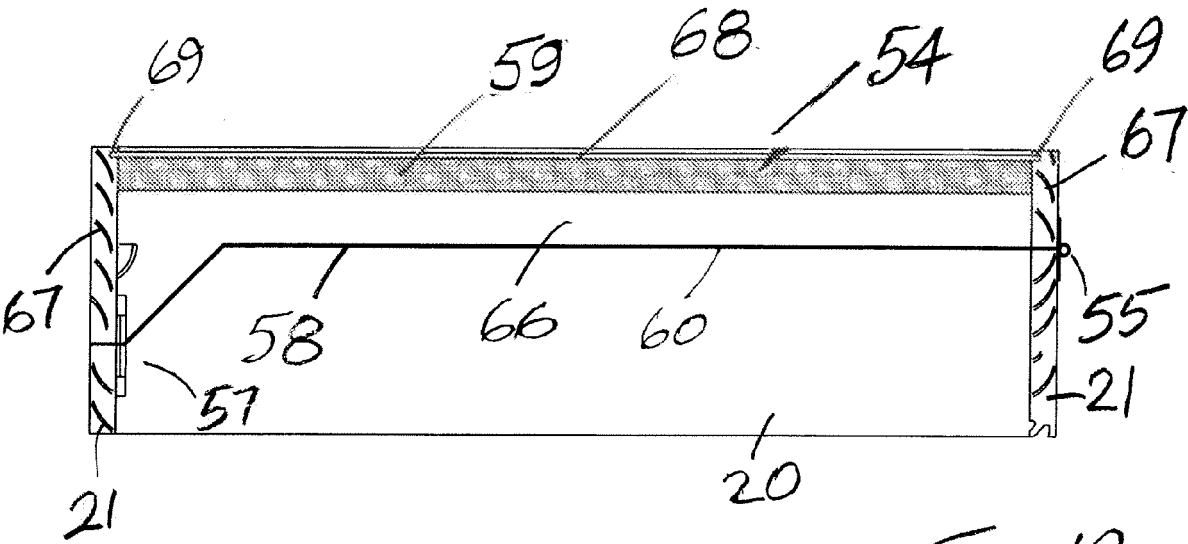


FIG 12

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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