Dec. 12, 1967 R. S. FOOTE 3,357,520

STRAND BRAKE FOR LOAD LOWERING ASSEMBLY

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FIG. 2

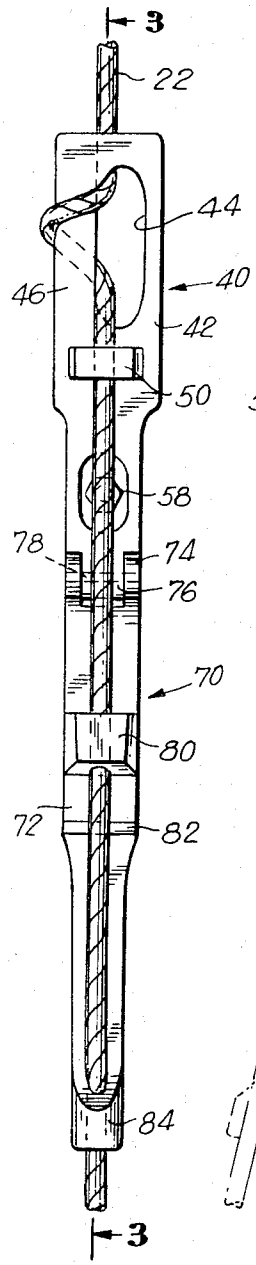


FIG. 3

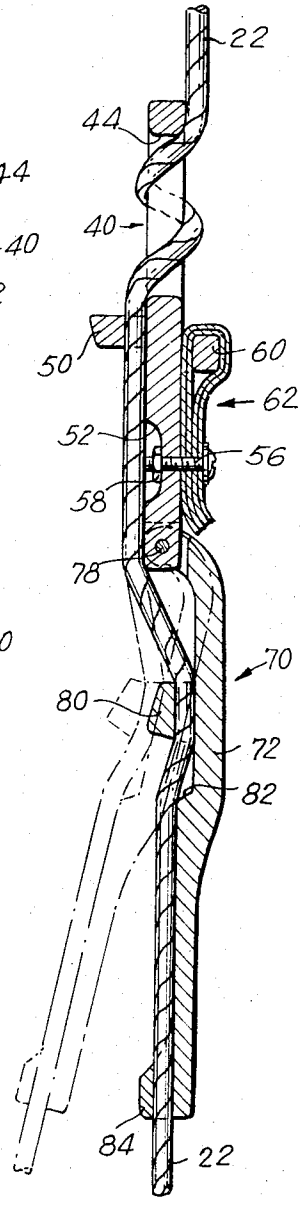
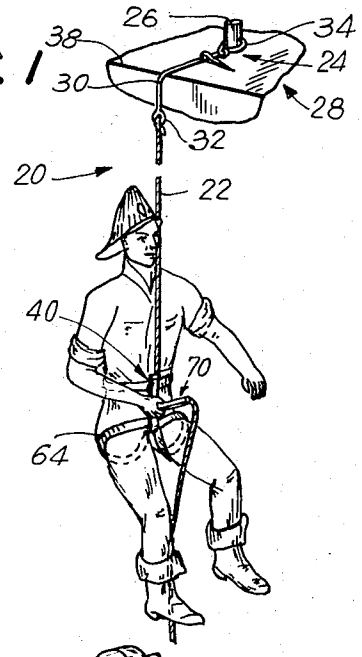


FIG. 1



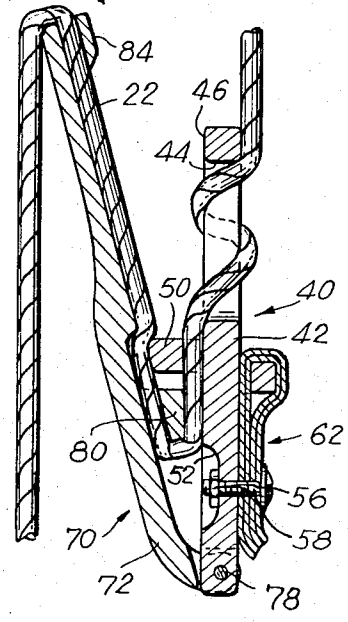


FIG. 4

INVENTOR.
RONALD S. FOOTE

BY

Steinberg & Blake
ATTORNEYS

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STRAND BRAKE FOR LOAD LOWERING ASSEMBLY

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FIG. 5

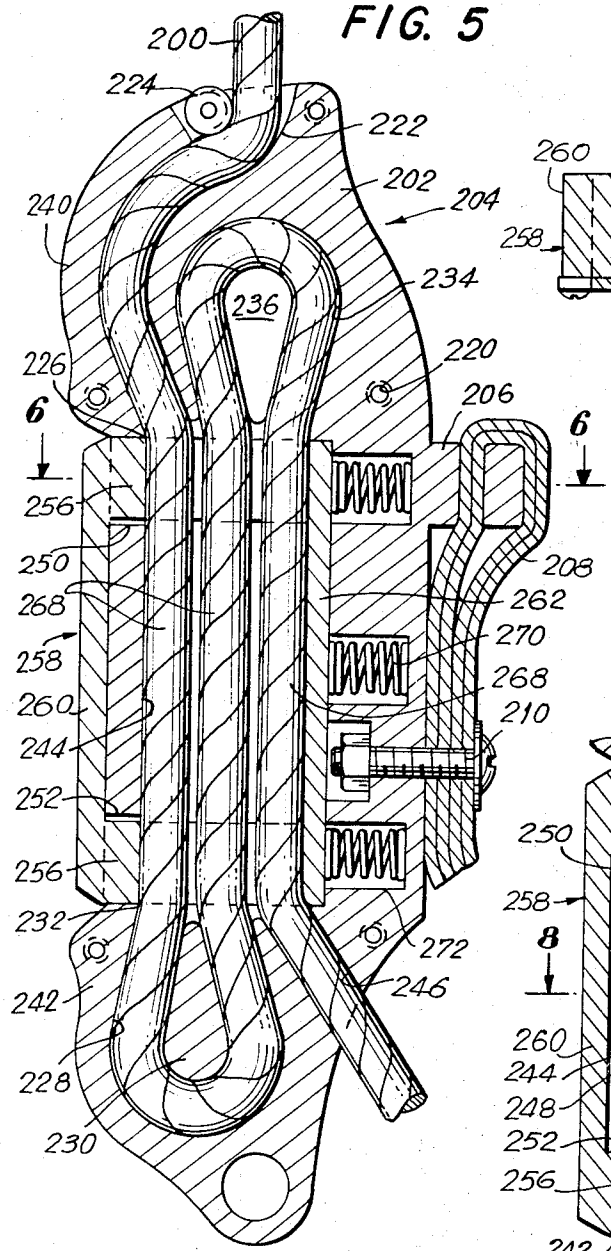


FIG. 6

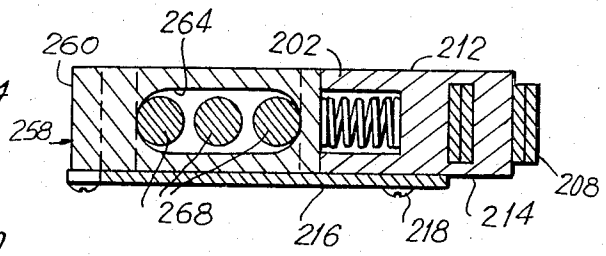


FIG. 7

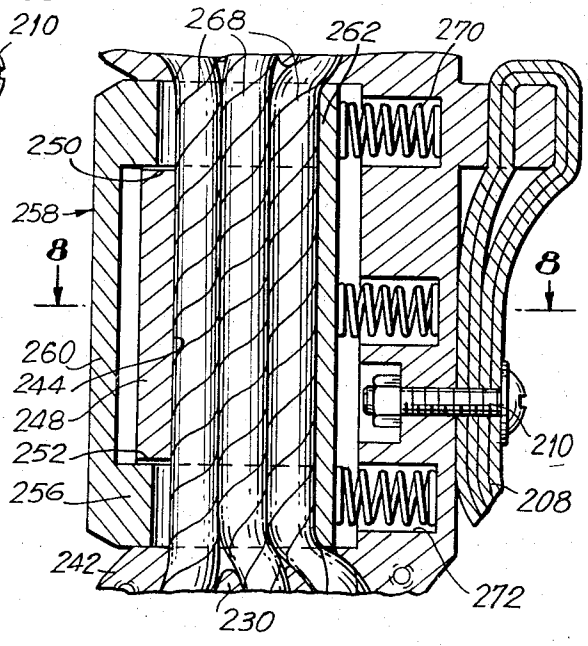
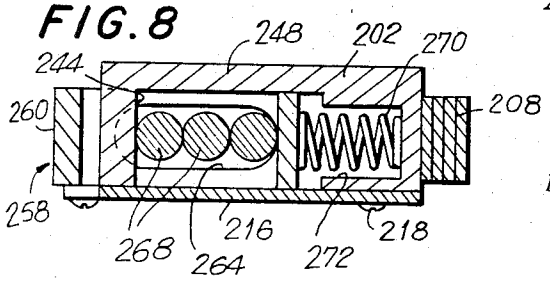


FIG. 8



INVENTOR.
RONALD S. FOOTE

BY

Steinberg & Blake

ATTORNEYS

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STRAND BRAKE FOR LOAD LOWERING ASSEMBLY

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FIG. 9

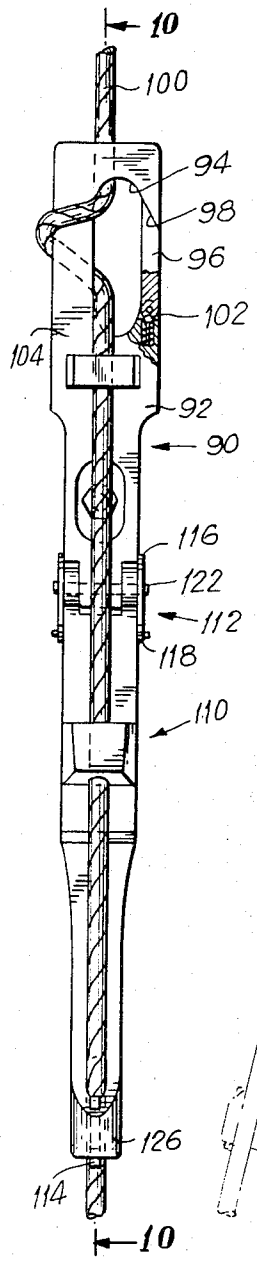


FIG. 10

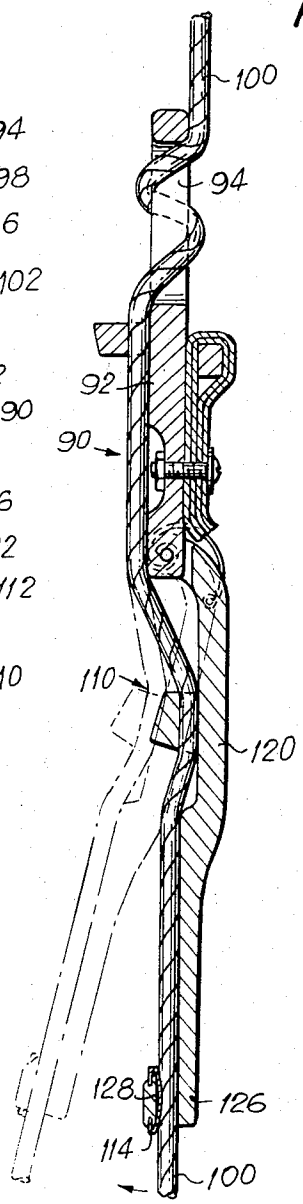
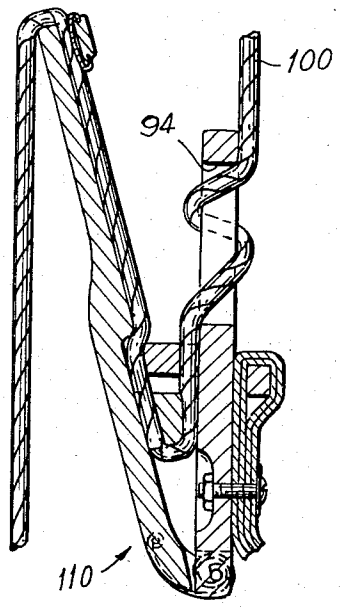


FIG. 11



INVENTOR.
RONALD S. FOOTE

BY

Steinberg & Blake
ATTORNEYS

United States Patent Office

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3,357,520

STRAND BRAKE FOR LOAD LOWERING ASSEMBLY

Ronald S. Foote, 2672 Hubbard St., Brooklyn, N.Y. 11235

Filed Mar. 10, 1966, Ser. No. 533,374
11 Claims. (Cl. 188—65.3)

ABSTRACT OF THE DISCLOSURE

A load-lowering assembly, particularly of a type which is suitable for fire-fighting purposes. The assembly includes a friction slider means for frictionally engaging and sliding down a rope and for carrying a load which urges the slider means downwardly along the rope. A manually operable brake means is operatively connected with the slider means for automatically assuming a braking position braking movement of the slider means and a load carried thereby downwardly along the rope, this brake means being manually displaceable with respect to the slider means from the braking position to a release position releasing the slider means for movement downwardly along the rope. The slider means and the brake means respectively include a pair of elongated bodies both of which are formed with openings through which the rope passes for frictionally engaging these bodies. The slider means has an upper end and the brake means is pivotally connected to the slider means below the upper end thereof. When the brake means is in its release position it extends downwardly from its pivotal connection to the slider means, and the brake means, when released by the operator, coacts with the rope for responding automatically to tension in the rope to be pulled upwardly by the tension in the rope to its braking position, this brake means when in its braking position extending upwardly from the above pivotal connection to the slider means and being situated alongside of the body of the slider means.

The present invention relates to load-lowering assemblies.

In particular, the present invention relates to that type of assembly in which an individual can lower himself downwardly along a rope.

Although assemblies of this general type are known, in mountain climbing, for example, it is essential with the conventional assemblies of this type that the operator manually engage the structure for stopping the lowering of the load at a selected elevation along the rope. Thus, it is essential that an individual who is being lowered downwardly along such a rope have at least one hand free in order to manipulate the structure for terminating the lowering at a selected elevation. A further difficulty encountered with the conventional structure of the above type is that it is not always possible to regulate the speed with which the load is lowered. Since the individual who is being lowered will release the structure to permit it to move downwardly along the rope, there is practically no control on the speed of movement downwardly along the rope, and the individual who is being lowered only manipulates the structure in order to stop the downward movement.

Structure of the above general type not only has the above drawbacks but in addition it includes the drawback of preventing an individual who is being lowered from having both hands free when his movement down the rope is terminated. Thus, if an individual moving downwardly along the rope should wish to perform certain operations part of the way down, only one hand would be available for these operations since the other hand would necessarily be required to control the structure which prevents movement downwardly along the rope.

It is, therefore, a primary object of the present invention to provide a load-lowering assembly which will avoid the above drawbacks.

In particular, it is an object of the invention to provide a load-lowering assembly which enables the individual who is being lowered to stop his downward movement at any selected elevation while at the same time having both hands free at wherever elevation the lowering is terminated.

An additional object of the present invention is to provide an assembly of this type which is particularly suitable for fire-fighting purposes.

It is especially an object of the present invention to provide a structure of this type which is eminently suitable for rescuing operations in connection with fires or other calamities.

Furthermore, it is an object of the invention to provide a structure which is exceedingly simple and inexpensive while at the same time very reliable in operation and extremely convenient to use.

Primarily, with the structure of the invention the rope down which the load is to be lowered is in frictional engagement with a friction slider means which slides downwardly along and frictionally engages this rope. A brake means is also in frictional engagement with the rope, and in accordance with the present invention the brake means will automatically assume a braking position preventing movement of the slider means downwardly along the rope. This brake means is manually operable so that it can be displaced by the operator from its braking position to a release position where the brake means releases the slider means for movement downwardly along the rope, and in this way whenever the brake means is released it will automatically terminate the movement of the slider means downwardly along the rope, so that the operator will have both hands free while situated at a selected elevation along the rope.

The invention is illustrated by way of example in the accompanying drawings which form part of the application and in which:

FIG. 1 is a fragmentary schematic illustration of the manner in which the structure of the invention can be used;

FIG. 2 is a front elevation of one possible embodiment of an assembly according to the invention;

FIG. 3 is a longitudinal sectional elevation of the structure of FIG. 2 taken along line 3—3 of FIG. 2 in the direction of the arrows;

FIG. 4 shows the structure of FIG. 3 in its braking position;

FIG. 5 is a longitudinal sectional elevation of another embodiment of a structure according to the present invention;

FIG. 6 is a sectional plan view taken along line 6—6 of FIG. 5 in the direction of the arrows;

FIG. 7 fragmentarily illustrates part of the structure of FIG. 5 in a braking position;

FIG. 8 is a sectional plan view taken along line 8—8 of FIG. 7 in the direction of the arrows;

FIG. 9 is a front elevation of another embodiment of a structure of the type shown in FIG. 2;

FIG. 10 is a longitudinal sectional elevation of the structure of FIG. 9 taken along line 10—10 of FIG. 9 in the direction of the arrows; and

FIG. 11 shows a structure of FIG. 10 in a braking position.

Referring now to FIG. 1, the load-lowering assembly 20 illustrated therein includes an elongated rope 22 which carries at its upper end a fixing means 24 by which it

can be fixed to a selected support. In the example shown in FIG. 1 the fixing means **24** fixes the upper end of the rope **22** to a pipe **26**, for example, situated at the top of a building **28**. The fixing means **24** is in the form of a wire cable **30** having at its lower end an eye **32** through which the top end of the rope **22** passes and to which the top end of the rope **22** is fixed, and this cable **30** carrise at its free end a ring **34** so that the cable can pass through this ring to form a loop extending around the pipe **26**. However, the cable **30** can also carry a spike capable of being driven into any suitable beam of wood or the like for fixing the top end of the rope **22**. It is preferred to use a wire cable **30** because the top end of a building **28** will generally have a sharp-edge **38** forming the outer upper periphery of a concrete ledge or the like over which the cable **30** can pass. Since the cable is in the form of a twisted wire it will not easily become frayed, while a conventional rope would become frayed by the edge **38**, thus rendering the support of the load more precarious than by the use of a wire cable **30**.

In the example shown in FIG. 1, the assembly **20** is used in connection with fire-fighting operations, and there is indicated in FIG. 1 a fireman lowering himself downwardly along the rope **22** so that, for example, when the fireman is situated at the elevation of a window of a building where an individual is located to be rescued, the fireman can carry out these rescue operations in a highly efficient maner with the structure of the invention.

Referring now to FIGS. 2–4, the structure of the invention includes an elongated friction slider means **40** in the form of an elongated metal body **42** formed in any suitable way as by a casting made of iron, for example, in a suitable mold. The elongated friction slider body **42** has at its upper end an opening **44** through which the rope **22** is threaded in the manner shown in FIGS. 2 and 3. Thus, the rope **22** is passed through the opening **44** and around the lateral portion **46** of body **42**. The lateral portion **46** is wider than the opposed lateral portion, so that it is better capable of cooperating with the rope **22**.

The elongated body **42** which constitutes the friction slider means **40** integrally carries a projection **50** formed also with an opening through which the rope **22** passes so as to frictionally engage the body **42**. Below the projection **50** the body **42** is formed with a recess **52** which receives the end of a screw **56** together with a nut **58** on this screw.

An attaching means **60** is provided for attaching a harness **62** to the friction slider means **40**, and this attaching means **60** is in the form of a metal loop integral with the body **42** and through which bands of the harness **62** pass. The harness **62** is conventional and includes, for example, a pair of leg loops **64** (FIG. 1) adapted to pass around the legs of the operator in the manner indicated in FIG. 1.

In the position of the parts shown in FIGS. 2 and 3, a brake means **70** is situated below and extends downwardly from the friction slider means **40**. The brake means **70** will, in accordance with the invention, automatically assume a braking position shown in FIG. 4 when the operator releases the structure of the invention. Thus, the structure of the invention is shown in its release position in FIGS. 2 and 3, and it is necessary for the operator to to maintain the structure of the invention in the position of FIGS. 2 and 3. The brake means **70** includes an elongated body **72** which also may be in the form of a metal casting. This body **72** is formed with a pair of spaced ears **74** which are formed with aligned bores and which receive the bottom end portion **76** of the friction slider body **42**, in the manner shown most clearly in FIG. 2. The portion **76** is formed with a bore passing therethrough in alignment with the openings of the ears **74**, and a pivot pin **78** extends through the bore of the portion **76** and the openings of the ears **74**, so that in this way the brake means **70** is pivotally connected with the friction slider means **42** at an elevation lower than the upper end thereof. In the release position of the brake means **70** extends downwardly from its pivotal connection **78** with the friction slider means **40**, while in its braking position, the brake means **70** extends alongside of the friction slider means **40**, as indicated in FIG. 4.

The elongated body **72** has an integral projection **80** formed with an opening through which the rope **22** passes, so that the rope **22** is also in frictional slidable engagement with the body **72** of the brake means **70**. Just beyond the projection **80** the body **72** is formed at its face which carries the projection **80** with a shoulder **82** for a purpose described below. The rope **22** extends downwardly beyond the shoulder **82**, in the position of the parts shown in FIGS. 2 and 3, and at its free end the body **72** is formed with an elongated bored portion **84** through which the rope **22** passes so as to be in frictional engagement with the body **72** at its free end portion also, guided through the bore at the end of this free end portion.

In using the above-described apparatus of FIGS. 1–4, the operator will initially fix the top end of the rope **22** to a selected support such as the pipe **26** in the manner described above by way of the fixing means **24**.

Then the operator will put on the harness **62**, after the rope **22** has been threaded through the friction slider means and brake means to have the position indicated in FIGS. 2–4. Of course, before the fixing means is attached to a selected support the rope has already been threaded through the apparatus of the invention so that the assembly of the invention is ready for use at any time.

With the brake means **70** maintained in the release position shown in FIGS. 2 and 3 the operator can slide freely downwardly along the rope **22** which by being passed a selected number of turns around the portion **46** of the slider **42** will provide a selected frictional resistance to downward movement, thus providing a predetermined speed of downward movement of the load when the brake means is in the fully released position thereof shown in FIGS. 2 and 3.

Assuming now that the operator wishes to terminate his downward movement when reaching a given elevation, such as the elevation of a window where an individual to be rescued is located, the operator will simply release the body **72**. The result is that due to the frictional resistance to movement of the rope through the opening of the projection **80** as well as through the bore of the free end portion **84** of the brake means and through the opening of the projection **50**, the slider continues to move downwardly for a slight distance along the rope **22**, but the rope **22** itself pulls on the projection **80** so as to automatically turn the body **72** into the position of FIG. 4. In this position it will be noted that the projection **80** is located beneath the projection **50** pressing the rope against the friction slider body **42**, while at the same time the projection **50** presses the rope **22** against the brake body **72** and in particular against the portion of the brake body **72** which is provided with the shoulder **82** which becomes situated just above the projection **50** in the braking position shown in FIG. 4. As a result there is a very high frictional engagement with the rope preventing further downward movement of the structure which will thus remain automatically in the position shown in FIG. 4, freeing both hands of the operator for rescue operations.

A further feature of the invention resides in the fact that when the operator displaces the brake means **70** from its braking position of FIG. 4 toward its release position of FIGS. 2 and 3, it is not essential that the operator turn the brake means all the way to its release position. As the brake means **70** approaches the braking position thereof shown in FIG. 4 there will be greater resistance to movement downwardly along the rope with consequent slowing down of the rate of downward movement, whereas as the braking means **70** approaches the release position of FIGS. 2 and 3 the speed of downward movement of the load will increase, so that by selectively positioning

the brake means between its braked position of FIG. 4 and its released position of FIGS. 2 and 3 it is possible for the operator to control the speed of movement downwardly along the rope.

FIGS. 9–11 show another embodiment of a structure according to the invention which corresponds generally to that of FIGS. 1–4. The embodiment of FIGS. 9–11, however, is particularly suitable for use with relatively heavy ropes, whereas the embodiment of FIGS. 2–4 can be used with lighter ropes. The friction slider means **90** of FIGS. 9–11 is substantially identical with the friction slider means **40**. It differs therefrom in that the friction slider body **92** is provided at its thinner right side, as viewed in FIG. 9, which defines the opening **94** with an interruption accommodating a hinged gate **96** through which the rope **100**, which is heavier than the rope **22**, can pass into the opening **94**. For this purpose the body **92** pivotally carries the gate **96** which has an inclined end **98** preventing it from moving to the right beyond the position shown in FIG. 9. At its lower pivoted end the gate **96** is formed with a detent recess receiving the spring-pressed free end of a detent element **102** which is situated in a suitable bore of the member **92**, as indicated in FIG. 9, so that the gate **96** will be releasably maintained in a position shown in FIG. 9. However the operator can at any time turn this gate inwardly toward the opening **94** so as to introduce or remove a rope **100** therefrom, and in this way the rope can have any desired number of turns passing around the wider portion **104** of the body **92**.

Except for these differences the friction slider means **90** of FIG. 9 is identical with that of FIGS. 2–4.

The braking means **110** of FIGS. 9–11 is also substantially identical with the brake means **70**. The only differences reside in the fact that a spring means **112** is provided for urging the brake means **110** to its braking position, and an additional friction element **114** is provided to frictionally engage the rope, as indicated at the lower part of FIGS. 9 and 10.

The spring means **112** includes a pair of wire springs **116** each fixed at one end **118** to opposed side faces of the body **120** which constitutes the brake means **110**. The wire springs **116** are also fixed to the ends of the pivot pin **122** which extends through the bore of the bottom of the body **92** which is received between the upper ears of the body **120**, these features being the same as those described above in connection with FIGS. 2–4 at the interconnection between the friction slider means and the brake means. The springs **116** are under stress in the position of the parts shown in FIG. 10 and seek to turn the body **120** toward its braking position shown in FIG. 11, so that with this construction the springs means **112** urges the brake means **110** toward its braking position, and full reliance need not be made on the pulling upwardly of the brake means by the rope **100** itself. Therefore this construction is particularly suitable for use with a relatively heavy rope.

In order to increase the frictional contact with such a relatively heavy rope, the lower free, bored end **126** of the body **120** carries in its bore an elongated, bowed leaf spring **128** having its free ends curved backwardly upon itself and situated in suitable notches of the body **120**, as indicated most clearly in FIGS. 9 and 10, so that in this way the central bowed portion of the leaf spring **128** will press against the rope **100** to increase the frictional contact therewith, and this also will contribute to prevention of continued sliding movement of the brake means downwardly along the rope when the brake means is released by the operator. Therefore, the increased friction achieved by the leaf spring **128** will also contribute to automatic movement of the brake means **110** into the braking position thereof shown in FIG. 11 when the braking means is released by the operator.

Otherwise the structure of FIGS. 9–11 is identical with that of FIGS. 2–4 and therefore is not further described.

A further embodiment of the invention is illustrated in FIGS. 5–8. This embodiment is shown in cooperation with a rope **200** which can be fixed to any selected support in the same way as the rope **22** described above.

The rope **200** is threaded through the friction slider body **202** in the manner shown most clearly in FIG. 5, this body **202** forming the friction slider means **204** of this embodiment. The body **202** is integral with an attaching means **206** in the form of a metal loop through which the harness **208** can pass in the manner shown most clearly in FIGS. 5 and 6, and the bands of the harness are bolted to the body **202** by way of the bolt and nut assembly **210**.

The body **202** is formed with the rope-receiving passages extending inwardly toward the face **212** of the body **202** (FIG. 6) from the face **214** thereof. These rope-receiving recesses, however, terminate short of the face **212**, and at its face **214** the body **202** removably carries a cover **216** which can be releasably fastened by way of screws **218** received in threaded bores **220** formed in the body **202**. Thus, the plate **216** will retain the rope in the rope-receiving recesses of the body **202**.

The rope-receiving recesses of the body **202** include a curved entrance recess **222** where the body turnably carries a guide roller **224** to facilitate the entrance of the rope **200** into the entrance recess **222**. This curved recess **222** is situated at its end **226** opposite one end of a substantially U-shaped recess **228** which extends around a substantially drop-shaped guide member **230** around which the rope **200** passes. Between the end **226** of the recess **222** and the end **232** of the recess **228** there is a free space across which the rope **200** extends.

Beside the curved recess **222** the body **202** is formed with another substantially U-shaped recess **234** which is substantially identical with the curved recess **228** and also extends around a core or drop-shaped guide member **236**. Thus, from the recess **228** the rope will pass across a free space formed between portions **240** and **242** of the body **202** into the curved recess **234** and around the guide body **236** with respect to which the rope can slide. After again passing downwardly across the free space **244** situated between the upper portion **240** and the lower portion **242** of the body **202**, as viewed in FIG. 5, the rope **200** extends out through an elongated bore **246** which is formed in the body **202**.

Between its body portions **240** and **242**, the body **202** is provided with a portion **248** of substantially L-shaped profile, as shown in FIG. 8, and it is this portion **248** which defines with the portions **240** and **242** the free space **244** through which the three passes of the rope **200** extend in the manner described above and shown in FIG. 5.

The portion **248** of L-shaped profile terminates in an upper edge **250** and a lower edge **252** (FIG. 5), and these edges define with the body portions **240** and **242**, respectively, spaces which receive upper and lower limbs **254** and **256** of an endless body **258** of substantially rectangular configuration having the vertically extending limbs **260** and **262** extending between the horizontal limbs **256** which are received in the spaces defined on the one hand between the body portion **240** and the upper edge **250** of the body portion **248** and on the other hand between the body portion **242** and the lower edge **252** of the body portion **248**.

As is indicated in FIGS. 6 and 8, the limbs **256** of the rectangular endless body **258** are respectively formed with elongated slots **264** through which the passes **268** of the rope **200** freely extend in the manner shown most clearly in FIG. 6.

The limb **262** of the body **258** is pressed against by three compression springs **270** which are respectively accommodated in recesses **272** formed in the body **202** between its upper portion **240** and its lower portion **242**, so that in this way the springs **270** urge the body **258** to the left from the position of FIG. 5 to the position of FIG. 7. This body **258** forms the brake means of the embodiment of FIGS. 5–8, and when the operator releases the body **258** the springs **270** will expand to the position

shown in FIG. 7 where the limb **262** presses the passes **268** against part of the portion **248** of the body **202**, as indicated in FIG. 7, so as to achieve the required braking of the movement downwardly along the rope **200**. The operator can, however, pass his fingers completely around the device just below the harness attachment means **206** so that with the palm of his hand the operator can press on the limb **260** to displace the brake means **258** to the right, as viewed in FIG. 7, in opposition to the springs **270** from the position of FIG. 7 into the position of FIG. 5 which is the release position, and now the load will again move downwardly around the rope. In this case also by selectively locating the brake means between the fully braked position of FIG. 7 and the fully released position of FIG. 5 it is possible to control the speed of movement downwardly along the rope.

In the example illustrated in FIGS. 5–8 there are three passes **268** of the rope **200** extending through the brake means to be pressed against each other by the brake means for the purpose of achieving the braking action in the manner shown in FIG. 7. However, it is clear that in accordance with the invention there may be any desired number of passes of the rope which are pressed against each other by the brake means of the embodiment of FIGS. 5–8. Furthermore, it is possible to provide, instead of fixed rope guides **236** and **230**, guides which include rollers which reduce the friction and which may be used with heavier ropes than the rope **200**. Such a roller could also be located at the upper end of the discharge bore **246** in order to guide a rope through the latter.

It will thus be seen that with all embodiments of the present invention when the operator releases the structure it will automatically brake itself so that it will stop its movement downwardly along a rope, and thus with the structure of the invention it is possible for the operator to terminate his downward movement at any desired elevation while leaving both hands free to carry out any desired operations at the elevation at which the operator releases the structure.

What is claimed is:

1. For use in a load-lowering assembly, friction slider means for frictionally engaging and sliding down a rope and for carrying a load which urges said slider means downwardly along the rope, and manually operable brake means operatively connected to said slider means for automatically assuming a braking position braking movement of said slider means and a load carried thereby downwardly along the rope, said brake means being manually displaceable with respect to said slider means from said braking position to a release position releasing said slider means for movement downwardly along the rope, said slider means and brake means respectively including a pair of elongated bodies both of which are formed with openings through which the rope passes for frictionally engaging said bodies, said slider means having an upper end and said brake means being pivotally connected to said slider means below the upper end of said slider means, and said brake means when in said release position thereof extending downwardly from the pivotal connection of said slider means and brake means to each other, said brake means when released by the operator coacting with the rope for responding automatically to tension in the rope to be pulled upwardly by the tension in the rope to said braking position, said brake means when in said braking position thereof extending upwardly from said pivotal connection and being situated alongside of said friction slider means.

2. The combination of claim **1** and wherein said bodies respectively have projections directed toward each other when said brake means is in said braking position thereof, and said projections engaging and pressing against the rope to increase the frictional pressure between the latter and said bodies when said brake means is in said braking position.

3. The combination of claim **2** and wherein said projections are formed with openings through which the rope passes.

4. The combination of claim **3** and wherein said projection of said body of said brake means is situated beneath said projection of said body of said friction slider means when said brake means is in said braking position thereof.

5. The combination of claim **4** and wherein said body of said brake means is formed with a shoulder which becomes situated over said projection of said body of said slider means when said brake means is in said braking position thereof, said shoulder engaging the rope and deflecting the latter over said projection of said body of said slider means when said brake means is in said braking position.

6. The combination of claim **1** and wherein a spring means urges said body of said brake means to turn upwardly to the braking position.

7. The combination of claim **1** and wherein said body of said brake means is formed with an opening through which the rope passes and said body of said brake means carrying in said latter opening thereof a friction element against which the rope frictionally slides.

8. The combination of claim **1** and wherein the rope is coiled about said body of said friction slider means at one side of said opening thereof, said body of said friction slider means being formed at the other side of said latter opening with an interruption through which the rope may be inserted into the latter opening.

9. For use in a load-lowering assembly, friction slider means for frictionally engaging and sliding down a rope and for carrying a load which urges said slider means downwardly along the rope, and manually operable brake means operatively connected to said slider means for automatically assuming a braking position braking movement of said slider means and a load carried thereby downwardly along the rope, said brake means being manually displaceable with respect to said slider means from said braking position to a release position releasing said slider means for movement downwardly along the rope, said friction slider means including a body formed with an opening through which the rope is adapted to pass with said rope coiled around said body at one side of said opening thereof, said body carrying at the opposite side of said opening a pivotally mounted gate giving access to said opening and a spring-pressed detent releasably maintaining said gate in a position closing said opening.

10. The combination of claim **9** and wherein said body is wider at said one side thereof than at said opposite side thereof.

11. The combination of claim **9** and wherein said gate is turnable into said opening for giving access thereto and has an end overlapping and engaging said body to prevent turning of said gate outwardly beyond said opening.

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MILTON BUCHLER, *Primary Examiner.*

GEORGE E. A. HALVOSA, *Examiner.*

B. S. MOWRY, *Assistant Examiner.*