July 28, 1953 A. ANDREWS 2,646,964

ESCAPE UNIT

Filed Sept. 10, 1951 2 Sheets-Sheet 1

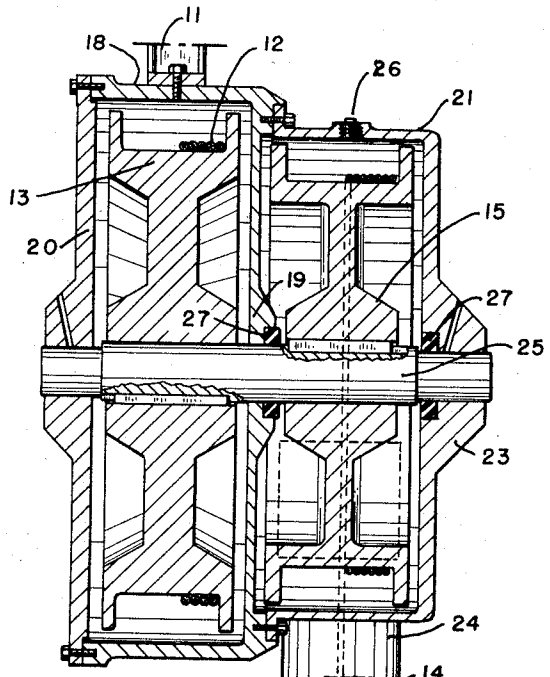


Fig. 2

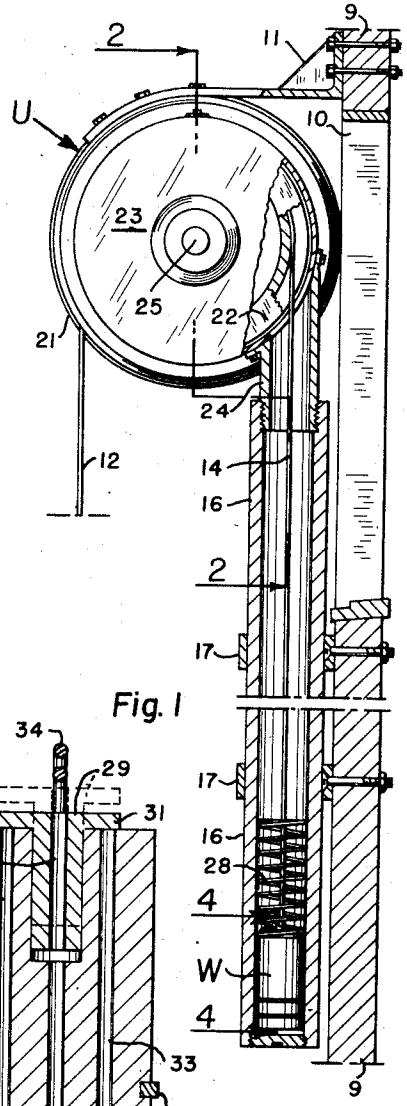


Fig. 1

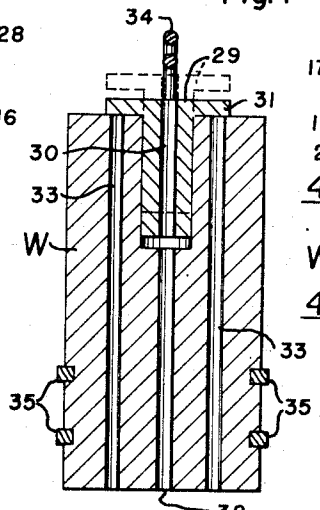


Fig. 4

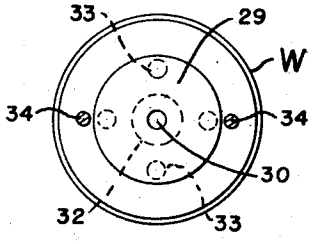


Fig. 3

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Fig. 6

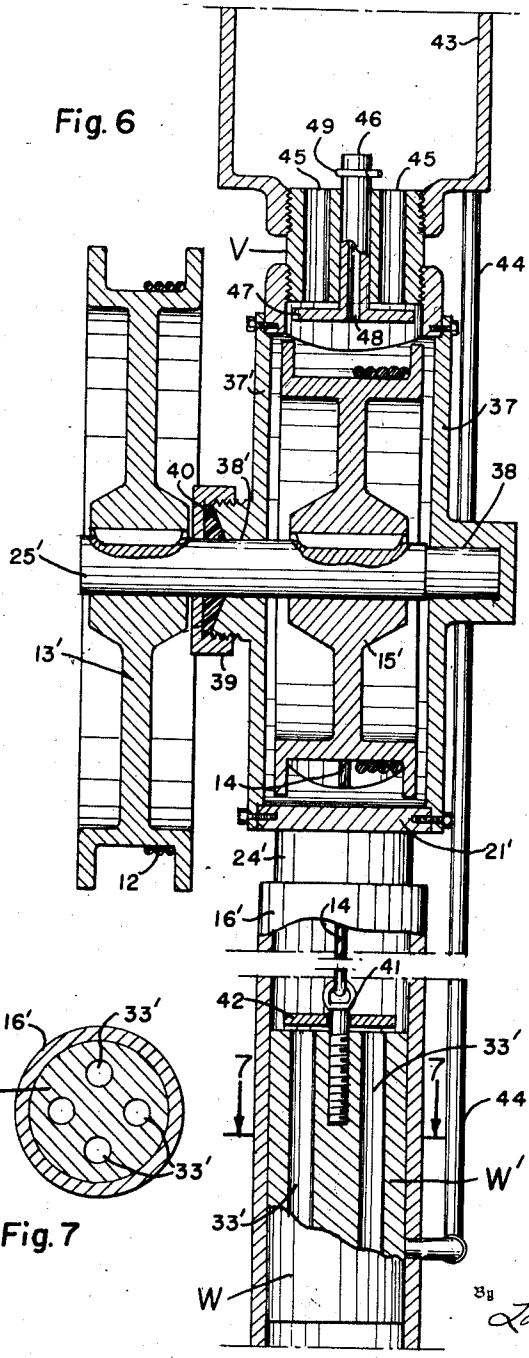


Fig. 7

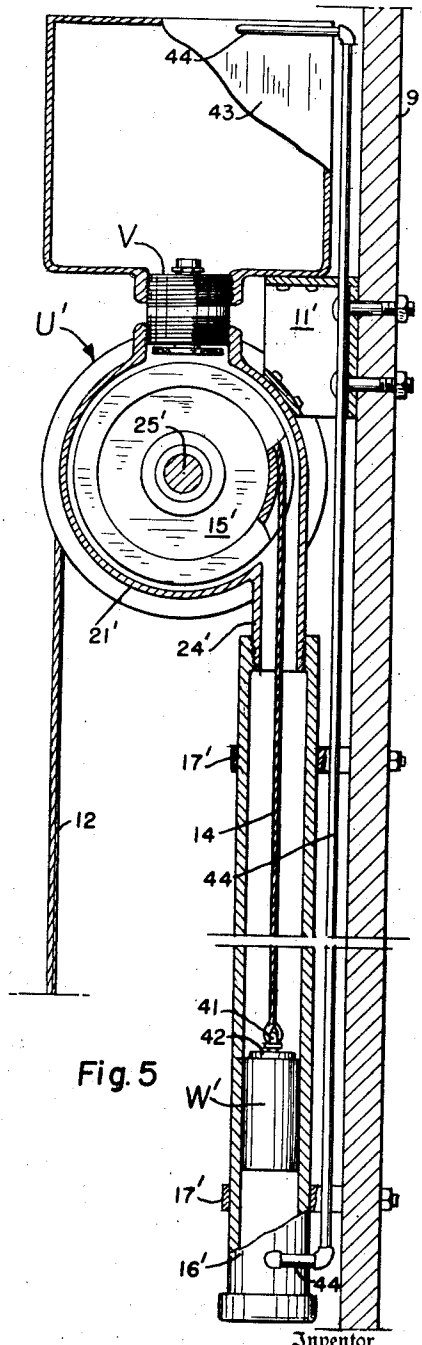


Fig. 5

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ESCAPE UNIT

Albert Andrews, Grand Junction, Colo.

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7 Claims. (Cl. 254—160)

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This invention relates to escape units, and more particularly to an escape unit adapted to be installed in an elevated position.

The escape unit of this invention is adapted to be installed at a desired height on a building, normally at or adjacent an opening such as a window in an upper story, and to permit the occupants of the building to escape or leave readily, as in the case of fire. The presence of adequate fire escapes, or fireproof stairways and the like, is usually required by building codes in the case of more modern buildings. However, in the case of buildings erected prior to the adoption of such a code, or at locations where such a code does not apply, adequate provision for escape of building occupants, particularly those on upper floors, is sometimes not provided. Particularly in the case of hotels, wherein the occupants may be awakened in the dead of night by the alarm resulting from the discovery of a fire, and who may be precluded by smoke or even flames from seeking a suitable avenue of escape within the hotel, it is extremely desirable to have a ready means of escape from the various rooms. In some hotels, it is customary to provide a coil of rope in each room, attached to a stanchion at a window, and the occupant of the room is expected to throw the rope out of the window and then climb down the rope. Many persons are not particularly capable of such simian nocturnal activities, and there is danger of falling from the rope, resulting perhaps in death on the ground below. Also, when children must escape, as from a point sixty feet or so above the ground level, it is often impossible for an adult, unless especially trained, to carry a child to safety. Thus, the actual value of such ropes for escape is less than might be thought. Attempts to provide escape units by which the user is lowered on a wire or cable have not been successful, for various reasons, such as unreliability in operation, undue speed on descent, inadequate return of the cable for subsequent users, and others.

The present application is an improvement of the escape unit disclosed and claimed in my co-pending application Serial No. 18,528, filed April 2, 1948, which discloses means including a cable or the like for the descent of a user from an elevated position, and braking means for limiting the speed of descent of the cable to a predetermined maximum, such braking means including means for producing a predetermined resistance to initial descending movement of the cable. More specifically, such braking means includes a centrifugally operated brake which produces the resistance to descending movement of the cable. Such escape unit may also include a clutch for disconnecting the brake when the cable is rewound on its reel, and a pipe for the rewinding cable, at the lower end of which a weight is attached.

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Among the objects of the present invention, which are also objects of the invention of my aforesaid application Ser. No. 18,528, are to provide a novel escape unit which may be installed adjacent a building opening, such as a window, and which also may be installed either inside or outside the building wall; to provide such a unit which is provided with a cable which lowers the user to the ground, and which will permit the quick and ready escape of a person through the window or opening, irrespective of the knowledge of the user of the best methods of descending ropes; to provide such an escape unit which will lower the user at a retarded speed which is maintained at or below a predetermined maximum, irrespective of the weight of the user or users; to provide such an escape unit which cannot be started downward except upon a minimum weight being imposed thereon; to provide such an escape unit wherein the amount of which minimum weight can be readily changed; to provide such an escape unit in which the cable is automatically returned to starting position, when the user has reached the ground and releases the cable; to provide such a unit which is compact in construction, and therefore occupies relatively little space; and to provide such a unit which is reliable and effective in operation.

Further objects of this invention are to provide a novel escape unit which is an improvement of the escape unit of my aforesaid application Serial No. 18,528; to provide such a unit which does not require the expense of a clutch and a mechanical brake, and which therefore can be made more cheaply; to provide such a unit which has fewer operating parts than the escape unit of my aforesaid application Serial No. 18,528, and therefore may be made more simply and inexpensively; to provide such a unit which may be operated hydraulically; to provide such a unit in which certain parts, such as a weight for returning an escape cable, may be modified as to act also as an hydraulic valve; and to provide such a units which may be made in several forms.

Additional objects of this invention, together with the novel features thereof, will become apparent from the description which follows, taken in connection with the accompanying drawings, in which:

Fig. 1 is a side elevation, partly in longitudinal section, of an escape unit constructed in accordance with this invention, installed on a building wall adjacent an opening such as a window;

Fig. 2 is an offset transverse longitudinal section of the upper end of the escape unit taken along line 2—2 of Fig. 1 but on a slightly enlarged scale;

Fig. 3 is a top plan view of a weight and cooperating valve, forming part of the apparatus of Fig. 1;

Fig. 4 is a transverse longitudinal section taken at the lower end of the escape unit along line 4—4 of Fig. 1, but on a further enlarged scale and showing only the piston and valve of Fig. 3;

Fig. 5 is a side elevation similar to Fig. 1 but illustrating an alternative embodiment of this invention;

Fig. 6 is a condensed longitudinal section similar to Fig. 2 and Fig. 4, but illustrating the alternative construction of Fig. 5; and

Fig. 7 is a horizontal cross section, taken along line 7—7 of Fig. 6.

An escape unit U, constructed in accordance with this invention, is shown in Fig. 1, attached to the wall 9 of a building adjacent a window frame 10, as by one or more brackets 11. It will be understood, of course, that certain parts of the escape unit of the present invention are similar to corresponding parts of the escape unit of my aforesaid application Ser. No. 18,528, and these will be described first, since the general operation of the two devices is similar. Thus, the escape unit U is provided with a descent cable 12, which, as in Fig. 2, is mounted on a reel 13, the cable 12 being adapted to unwind from the reel 13 as the user descends, the rate of descent being controlled by braking means described in detail later, and primarily distinguishes the present invention from the specific embodiments of my aforesaid application Serial No. 18,258. As the descent cable 12 unwinds, as in Fig. 2, a return cable 14 is wound upon a return pulley 15, directly connected to reel 13, and a weight W is attached to the free end of return cable 14, so that when the lower end of descent cable 12 is released, the weight W will cause return cable 14 to unwind from pulley 15, thereby rotating the pulley 15 and rewinding the descent cable 12 on the reel 13. Weight W and return cable 14 may move upwardly and downwardly in a pipe 16, attached to the wall of the building, as by brackets 17. Also, cable 14 is normally of a shorter length than the full length of descent cable 12, since pulley 15 may be smaller in diameter than reel 13, so that a shorter length of return cable 14 is required for each revolution of the return pulley 15 and reel 13.

The escape unit U is preferably mounted in a position such that the free end of descent cable 12 is readily accessible through the window or similar opening, and a stirrup or seat may be provided, on which the user may stand or sit, as the case may be, the latter being permanently attached to the lower end of descent cable 12, or disposed in an accessible position inside the room and provided with a hook or similar means for attaching the seat to the lower end of the descent cable 12.

The escape unit U may also be mounted on the inside of the building wall, with descent cable 12 and return cable 14 passing through suitable guide tubes or the like, mounted in the wall. In such case, the stirrup or seat preferably is

permanently attached to the free end of descent cable 12. Also, pipe 16 may be installed within the building, along with the escape unit U.

The operating parts of the escape unit may be mounted in protected position within an enclosure or housing, which may include a cylindrical housing 18 for reel 13, having suitable opening through which cable 12 passes and a flange 19 at one end. The opposite end of housing 18 may be closed by a cover plate 20, while return pulley 15 may be enclosed by a housing 21 having a side-closing flange 23 and in turn attached to housing 18 and provided with an opening 22, as in Fig. 1 for return cable 14, at which a nipple 24 attached to pipe 16 is, in turn, attached. As will be noted flange 19 of housing 18 may also close the opposite side of housing 21, while suitable bearings for a shaft 25, to which reel 13 and return pulley 15 are attached, as by keys, may be provided in housing flanges 19 and 23 and cover plate 20.

In accordance with the present invention, the housing 21, and also the pipe 16 are filled or substantially filled with a hydraulic fluid or liquid, such as oil, and the weight W is provided with or cooperates with a valve device which restricts the rate of flow of liquid to a considerably greater extent as the weight W moves upwardly in the pipe 16, i. e. during descent of a user on cable 12, than during the return of the cable 12. Such flow of liquid may be so proportioned that the rate of descent is limited to a predetermined maximum, which may vary slightly in accordance with the weight on the descent cable 12, but which is within the limitations of a safe speed of descent. Thus, for a smaller person, the descent will be less rapid than in the case of a larger person, but the larger person, such as an adult, is capable of descending without undue possibility of injury on landing, at a more rapid rate than a child. Furthermore, the valve device is so constructed that when the descent cable is released at the bottom, the weight will be able to cause the descent cable to rewind on the reel 13 at a sufficiently rapid rate for practical purposes.

In the embodiment of Figs. 1–4, both the housing 21 and the pipe 16 are filled with liquid such as oil, the housing 21 being provided with a filling and level inspection plug 26 at the top, and suitable seals 27 being provided for the shaft 25. In addition, a spring 28 may be disposed at the top of weight W, so as to cushion the impact as the weight W approaches the top of pipe 16, the spring 28 conveniently being sufficiently large in diameter to engage the lower end of nipple 24, as in Fig. 2, so as to be placed in compression as the weight moves further upwardly. When the weight moves down, the spring 28 will be released, but will tend to fall with the weight W to the bottom of the pipe 16, as to the position of Fig. 1.

The valve device, of which the weight W may form a part, may include a cylindrical sleeve 29 having a central hole 30 and a laterally extending flange 31 at the top. As will be evident from Figs. 3 and 4, the hole 30 in sleeve 29 is at all times in communication with a central hole 32 in weight W, in the enlarged upper end of which sleeve 29 moves, and the cross-sectional area of hole 30 will determine the rate at which liquid will flow downwardly through the weight W, in checking the descent. However, when the descent cable is released for upward travel, and the weight W begins to move downwardly in the pipe 16, the sleeve 29 will tend to move to the dotted position

of Fig. 4, lateral flange 31 uncovering laterally spaced holes 33 in the weight W, so that liquid will flow not only through the central hole 30 but also the holes 33 during descent of the weight W. In order to avoid interference with movement of the sleeve 29 between its different positions, the return cable 14 may be attached to a U-shaped bracket 34, as in Fig. 2. Also, the weight W may be provided with seal rings 35, to force the liquid to flow through the holes 30 and/or 33, rather than around the weight W. Thus, the weight W may be considered to be a piston movable upwardly in the pipe 16 during descending movement of cable 12, although it tends to operate primarily as a weight during the return of cable 12. The seal rings 35 may be omitted if desired, particularly if the weight W has a sufficiently close fit within pipe 16, or the flow of liquid therearound does not tend to detract from the resistance to downward movement of the descent cable 12. As will be evident, the oil or other suitable hydraulic liquid should fill pipe 16, and is preferably maintained at a sufficient height within housing 21 to insure a full supply of liquid within the pipe 16 at all times.

In the embodiment of Figs. 5–7, an escape unit U' may include a descent cable 12 mounted on a reel 13', which may be enclosed in a housing or may merely rotate in the open air, as shown. Reel 13 may be keyed to a shaft 25', to which a pulley 15' for a return cable 14 is also keyed. Return pulley 15' is adapted to rotate within an oil-filled housing 21' provided with side-closing flanges 37 and 37' having bearings 38 and 38', respectively, for shaft 25'. Bearing 38 may be a "blind" bearing, while flange 37' may be provided with a gland 39 for compressing packing 40, to provide a seal to prevent leakage of hydraulic fluid. Both bearings 38 and 38' may be lubricated by the hydraulic fluid, such as oil, within the housing 21'.

As in the case of escape unit U of Figs. 1–4, escape unit U' may be attached by a bracket 11' to a wall 9 of a building, while pipe 16' may be attached by brackets 17' to the wall. The return cable 14 may be attached by a bolt 41 to a weight W', which may be provided with a series of laterally spaced holes 33', closed during upward movement of the weight W' by a plate 42, which may be guided by bolt 41, the plate 42 moving upwardly during downward movement of the weight W' to uncover the holes 33' and permit a substantial flow of hydraulic fluid through the weight W' during the return of the descent cable 12.

A fluid reservoir 43 is preferably disposed directly above the housing 21, and connected thereto by a valve V, while a pressure equalization tube 44 may connect the upper end of reservoir 43 with the lower end of pipe 16'. The principal purpose of tube 44 is to permit air or liquid to flow from the top of the reservoir 43 to the lower end of pipe 16', during upward movement of the weight W', since the weight W', as in Fig. 7, may have a sufficiently close fit within pipe 16' that substantially no leakage of liquid around the weight W' occurs during upward movement thereof. Also, weight W' may be provided with piston rings or the like, as in the same manner as the weight W of Fig. 4.

The valve V may comprise a cylindrical body or nipple threaded at each end for attachment to housing 21' and reservoir 43, and provided with a series of laterally spaced holes 45 and a central hole through which extends a stem 46 of a valve sleeve having a lateral flange 47 at its lower end. Flange 47 is adapted to close the holes 45 when weight W' moves upwardly and tends to force the hydraulic fluid from the housing 21' in the reservoir 43. A central hole 48 in stem 46 regulates the rate of flow of liquid into the reservoir during upward movement of weight W', thus restricting the rate of descent of the cable 12 to a predetermined maximum, again with perhaps slight variations due to differences in the weight of the person using the descent cable. Stem 46 may be provided with a clip 49, to prevent the sleeve from dropping out of the valve, or with a nut or other suitable means for the same purpose.

As will be evident, with weight W' at the lower end of pipe 16', as in Fig. 5, when a user places his weight on the descent cable 12, the weight W' will begin to move upwardly in pipe 16' as the descent cable moves down. However, the plate 42 on weight W' will close off holes 33', so that the rate of descent will be controlled by the flow of liquid forced by the weight W' up through the pipe 16' and the housing 21', into the reservoir 43. However, the rate of flow will be controlled by the central orifice hole 48 of valve V, as indicated previously, since upon the tendency for liquid to be pushed upwardly from housing 21' into the reservoir 43, the lateral flange 47 will be pushed against the lower ends of holes 45, thus closing the same. As the weight moves further upwardly in the pipe 16', air and/or liquid will tend to be pulled into the lower end of the pipe 16'. After the user has descended, and the descent cable 12 is released, the valve V will drop to a position opening holes 45, and as the weight W' begins to descend, the liquid from the reservoir 43 will flow into the housing 21' and continue to fill the pipe 16' above the weight W.

It will be evident, of course, that if the reservoir 43 is completely full of oil or hydraulic fluid, then the hydraulic fluid will move back and forth in tube 44, rather than air. However, in the event that there is any air in pipe 16' below weight W', it will fall quickly through it and as soon as the weight W' reaches the liquid level in pipe 16', the plate 42 will be lifted to open holes 33' and permit the liquid to flow through the weight. This permits the weight W' to move comparatively rapidly to the bottom of the pipe 16', i. e. to rewind descent cable 12 on reel 13'. Thus, the descent cable may be returned comparatively quickly to a position in which another user may utilize the escape unit.

From the foregoing, it will be evident that the escape unit of this invention fulfills to a marked degree the requirements and objects hereinbefore set forth. The hydraulically operated braking device requires a minimum number of operating parts, and limits the speed of descent to a predetermined safe maximum. The return pulley, operated by a cable and weight and directly connected to the descent reel, insures a return of the descent cable for additional users, if necessary, and is much more reliable than a torsion spring or the like. Also, the provision of a pipe in which the return weight operates not only prevents tampering with the device and insures that the return weight will operate without striking any obstruction, swinging wildly, or the like, but also contains the hydraulic fluid through which the weight moves. As indicated previously, this pipe for the weight may, if desired, be placed on the inside of a building, although its presence on the outside of a building is relatively unobjectionable. The

device itself may be substantially completely enclosed, and the operating parts thus protected from the effects of weather and the like.

The weight and cooperating valve means, either formed as a part of the weight or separately therefrom, produce the desired result of resisting downward movement of the descent cable to a considerably higher degree than upon upward movement, so that the rate of descent of the person using the descent cable may be limited to a safe maximum, while the weight may readily return the descent cable for reuse. The embodiment of Figs. 1–4 includes slightly fewer parts than the embodiment of Figs. 5–7, although the latter insures an adequate supply of oil, by virtue of the oil reservoir, and also may tend to permit the weight to return more quickly, due to the connecting tube **44**. However, each embodiment is reliable and effective in operation.

It will be evident that various changes may be made in the construction described. Thus, either or both of the descent and rewinding cables may be wires, while other types of hydraulic valves, seals and bearing and housing constructions, as well as other types of reels or pulleys may be utilized. Also, although two different embodiments of this invention, and certain variations in parts thereof, have been illustrated and described, various other embodiments and modifications may be made. In addition, further changes may be made without departing from the spirit and scope of this invention.

What is claimed is:

1. In an escape unit, a reel adapted to be installed in an elevated position; a descent cable adapted to be wound on said reel; a rewinding cable having a weight attached to its lower end, said weight having holes extending longitudinally therethrough; a pulley on which said rewinding cable may be wound, said pulley being attached to said reel; a pipe adapted to be installed in a generally vertical position, for receiving said rewinding cable and weight and to be filled with hydraulic fluid; and a valve device for closing said holes upon upward movement of said weight.

2. In an escape unit, a reel adapted to be installed in an elevated position; a descent cable adapted to be wound on said reel; a rewinding cable having a weight attached to its lower end; a pulley on which said rewinding cable may be wound, said pulley being operatively connected with said reel; a housing for said pulley and adapted to contain hydraulic fluid; a reservoir above said housing; and a valve device between said reservoir and housing for restricting the flow of liquid during upward movement of said weight, to limit the speed of descent of said cable to a predetermined maximum.

3. An escape unit comprising a first housing having a flange at one end thereof; a plate adapted to close the opposite end of said housing; a second housing adapted to be connected to said first housing; a shaft extending centrally through said housings; a reel mounted on said shaft within said first housing and having a peripheral flange adapted to provide a cable receiving space; a descent cable adapted to be wound on said reel, said first housing having an opening on the underside for passage therethrough of said descent cable; a rewinding cable having a weight on its free end; a rewinding pulley mounted on said shaft within said second housing and adapted to receive said rewinding cable, said second housing have an opening on the underside for passage of said rewinding cable therethrough; a nipple attached to said housing at said opening; a pipe extending downwardly from said nipple, at least said pipe being adapted to contain hydraulic fluid and said weight moving in said fluid, said weight having a central hole and a plurality of laterally spaced holes therethrough, said central hole having an enlarged upper end; and a valve sleeve having a stem received in the enlarged upper end of said central hole and a laterally extending flange adapted to close said laterally spaced holes upon upward movement of said weight, said valve stem having a central hole through which said fluid may flow during such upward movement.

4. An escape unit as defined in claim 3, including a compression spring on the upper end of said weight adapted to be compressed when said weight reaches the upper end of said pipe.

5. An escape unit comprising a reel having a peripheral flange adapted to provide a cable receiving space; a descent cable adapted to be wound on said reel; a rewinding cable having a weight on its free end; a rewinding pulley adapted to receive said rewinding cable, said reel and pulley being attached to a common shaft; a housing enclosing said reel; a pipe extending downwardly from said housing and connected therewith, said weight being movable in said pipe; a reservoir above said housing, said reservoir, housing and pipe being adapted to contain hydraulic fluid; a valve connecting said reservoir and housing and having a regulating hole therethrough, additional holes therethrough and means for closing said additional holes when said weight moves upwardly in said pipe and tends to force fluid from said housing into said reservoir; and an equalization tube connecting said reservoir with the lower end of said pipe.

6. An escape unit as defined in claim 5, wherein said valve comprises a body having a central hole and a plurality of laterally spaced holes therethrough; and a valve sleeve having a stem movable in said central hole and a flange for closing said lateral holes, said stem having a fluid regulating hole therethrough.

7. An escape unit as defined in claim 5, wherein said weight is provided with at least one hole extending longitudinally therethrough and a plate for closing each said hole upon upward movement of said weight.

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