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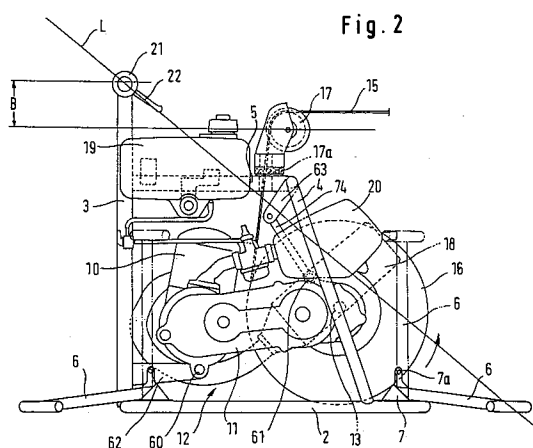
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D-81679 München (DE)(54) **Towing apparatus.**

(57) [OBJECT] The present invention provides a towing apparatus having a compact construction and having a high degree of freedom of arrangement of a guide pulley for guiding a tow cable, and control levers.

[CONSTRUCTION] A guide pulley (17) is disposed above a straight line (L) passing a winding operation control handle (21) and the free end of a foldaway stay (6) in an unfolded state, and the shaft (13) of a winding drum (16) is disposed below the straight line (L).

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[DETAILED DESCRIPTION OF THE INVENTION]

[0 0 0 1]

[Field of Utilization in Industry]

The present invention relates to a towing apparatus for towing a paraglider or drawing a beach seine.

[0 0 0 2]

[Related Art]

A known towing apparatus of this kind disclosed in Japanese Patent Laid-open (Kokai) No. 3-95098 comprises a power unit, a brake unit mounted on the output shaft of the power unit, a winding drum mounted on the output shaft of the power unit and combined with the brake unit to wind a tow cable thereon, and a guide pulley disposed above the winding drum so as to be swingable in horizontal directions to guide the tow cable when winding the tow cable on and unwinding the tow cable from the winding drum.

[0 0 0 3]

[Problem to be Solved by the Invention]

In this known towing apparatus, control levers including a brake lever and a throttle lever for controlling the winding operation of the winding drum are arranged in the vicinity of the tow cable and on both sides of the guide pulley. Therefore, the towing apparatus needs protective members for obviating the interference between the tow cable and the control levers, which inevitably makes the construction of the towing apparatus complex.

[0 0 0 4]

The present invention has been made in view of those problems in the prior art and it is therefore an object of the present invention to provide a towing apparatus provided with control levers, a guide pulley and a tow cable arranged so that the control levers will not interfere with the guide pulley and the tow cable, and having a construction having high degree of freedom.

[0 0 0 5]

[Means for Solving the Problem]

To solve the foregoing problems, the present invention provides a towing apparatus comprising a power unit provided with a brake unit and a winding

drum, a tow cable wound on the winding drum, and a guide pulley for guiding the tow cable when winding the tow cable on and unwinding the same from the winding drum. The angular position of the guide pulley with respect to a horizontal plane can be changed in a specified angular range, a brake operating lever and a winding operation control lever included in the power unit are disposed outside a range in which the angular position of the guide pulley is changed.

Preferably, the winding operation control lever is disposed on the same level as the guide pulley on the side opposite the towing side with respect to a guide pulley support unit supporting the guide pulley.

[0 0 0 6]

The guide pulley is disposed above a straight line passing the winding operation control lever and the free end of a foldaway stay in a fully unfolded state, and the winding drum is disposed with its axis positioned below the straight line.

[0 0 0 7]

The guide pulley is able to swing only in the specified angular range, and any control lever is not disposed within the range in which the guide pulley swings.

[0 0 0 8]

[Description of the Preferred Embodiments]

A towing apparatus in a preferred embodiment according to the present invention will be described hereinafter with reference to the accompanying drawings. Fig. 1 is a front view of a towing apparatus embodying the present invention, Fig. 2 is a side view of the towing apparatus of Fig. 1, Fig. 3 is a plan view of the towing apparatus of Fig. 1, Fig. 4 is a pictorial view of the towing apparatus of Fig. 1 in operation, and Fig. 5 is an enlarged side view of a foldaway stay.

[0 0 0 9]

Referring to Figs. 1 to 3, the towing apparatus has a frame structure 1 consists of a substantially rectangular bottom frame 2, a post 3, a support frame 4 having the shape of an inverted letter U, and a top frame 5. Foldaway stays 6 are joined pivotally, to brackets 7 fixed respectively to the four corners of the bottom frame 2.

[0 0 1 0]

Each foldaway stay 6 is fastened to the vertical arm of the bracket 7 by putting an eye-bolt 9 through a through hole 6a formed in the foldaway stay 6 and a through hole 7a formed in the vertical arm of the bracket 7 and securing the eye-bolt by a nut 8. When installing the towing apparatus in a state as shown in Fig. 5 for operation, the nuts 8 are removed from the eye-bolts 9, the eye-bolts 9 are pulled out from the vertical arms of the brackets 7 and the foldaway stays 6, the foldaway stays 6 are unfolded, the eye-bolts 9 are put through the through holes 6a of the foldaway stays 6 and through holes 7b formed in the horizontal arms of the brackets 7, and then the nuts 8 are screwed on the eye-bolts 9 to fasten the foldaway stays 6 to the brackets 7.

[0 0 1 1]

Thus, the foldaway stays 6 are unfolded when the towing apparatus is used, and the foldaway stays 6 are folded up to facilitate the transportation of the towing apparatus.

[0 0 1 2]

The towing apparatus has a power unit 12 formed by integrally combining an engine 10 and a transmission 11 provided with a centrifugal clutch. A brake unit 14 and a winding drum 16 for winding a tow cable 15 are mounted on the output shaft 13 of the transmission 11.

Shown also in the drawings are a guide pulley 17, an exhaust muffler 18, a fuel tank 19, an air cleaner 20, a control handle 21, i.e., a winding operation control lever, and a brake lever 22, i.e., a brake operating lever.

[0 0 1 3]

The power unit 12 is supported on the post 3 and the support frame 4 having the shape of an inverted letter U. The guide pulley 17 is supported on the top frame 5 by a swivel support supported for swivel motion in an angular range of about $180^\circ (= \theta_1 + \theta_2)$ in a horizontal plate on a bearing 17a. The free end of the tow cable 15 extending from the winding drum 16 via the guide pulley 17 is joined to a flier F hanging on a paraglider P.

[0 0 1 4]

The power unit 12 is supported by support pins 60 and 61 on the post 3. The support pin 60 is attached to a bracket 62 projecting from the post 3, and the support pin 61 is attached to one end of a

link 74 connected to the power unit 12 and having the other end joined to a bracket 63.

[0 0 1 5]

The control handle 21 and the brake lever 22 of the power unit 12 are disposed outside the angular range of swivel motion of the guide pulley 17 substantially on the same height as the guide pulley 17. The vertical center distance between the guide pulley 17 and the control handle 21 is B, and the horizontal distance between the center axis of the swivel support supporting the guide pulley 17 and the center axis of the control handle 21 is A.

[0 0 1 6]

The guide pulley 17 is disposed above a straight line L passing the control handle 21 and the free end of the foldaway stay 6 in the unfolded position, and the shaft 13 supporting the winding drum 16 is disposed below the straight line L.

[0 0 1 7]

The tow cable 15 is formed by connecting a kevlar cable and a nylon cable. The length L_k (m) of the kevlar cable and the length L_n (m) of the nylon cable are determined so that the spring constant K_t of a portion of the tow cable 15 is within a desired range of spring constant.

[0 0 1 8]

Suppose that the elongation percentage of the kevlar cable is dk (%) and that of the nylon cable is dn (%) under a load of 100 kgf. Then, $K_k = 100/L_k \times dk$, $K_n = 100/L_n \times dn$ and $1/K_t = 1/K_k + 1/K_n$, where K_k is the spring constant of the kevlar cable, K_n is the spring constant of the nylon cable and K_t is the spring constant of the tow cable 15.

[0 0 1 9]

Fig. 6 is a graph showing the relation between the length (m) of a portion of the tow cable 15 extending between the paraglider P and the winding drum 16, and the spring constant K_t (kgf/m), and values of spring constant K_t (kgf/m) meeting the weights (kg) of fliers.

In Fig. 6, a curve C indicates the variation of the spring constant K_t of the tow cable 15 with the length of the tow cable 15 when the tow cable 15 is formed by only a kevlar cable of 4 mm in diameter, and a curve D indicates the spring constant K_t of the tow cable 15 with the length of the tow cable 15 when the tow cable 15 is formed by only a nylon cable of 6 mm in diameter.

The elongation percentage dk of the kevlar cable of 4 mm in diameter is 1 %, and the elongation percentage dn of the nylon cable of 6 mm in diameter is 11.8 %. Accordingly, the tow cable 15 is able to absorb shocks and hence the power unit 12 need not be provided with any shock absorbing means.

[0 0 2 0]

It is known from Fig. 6 that an appropriate spring constant Kt of the tow cable 15 is 40 kgf/m to tow the paraglider P suspending a flier F of 50 kg in weight is 40 kgf/m, and 70 kgf/m to tow the paraglider F suspending a flier F of 80 kg in weight.

[0 0 2 1]

Referring to Fig. 7, the power unit 12 is formed by integrally combining the engine 10 and the transmission 11 provided with a centrifugal clutch.

A driving pulley 26 consisting of a first part 26a and a second part 26b is mounted on the crankshaft 25 of the engine 10. A V-belt 27 is wound round the driving pulley 26. Shown also in Fig. 7 are a cylinder 28, a piston 29, a cylinder head 30 and an exhaust pipe 31.

[0 0 2 2]

A driven pulley 36 consisting of a first part 36a integrally provided with an inner sleeve 37, and a second part 36b integrally provided with an outer sleeve 38 is mounted on the input shaft 35 of the transmission 11. The inner sleeve 37 and the outer sleeve 38 are interlocked by inserting a guide pin 39 fixed to the inner sleeve 37 in a cam slot 40 formed in the outer sleeve 38. The second part 36b is a movable driven part moved by a cam mechanism consisting of the guide pin 39 and the cam slot 40.

[0 0 2 3]

The second part 36b is pressed toward the first part 36a by a compression spring 42 extending between the second part 36b and a driving clutch plate 41 fixed to the inner sleeve 37. The V-belt 27 is extended between the driving pulley 26 and the driven pulley 36.

[0 0 2 4]

A centrifugal clutch 45 comprises the driving clutch plate 41, expanding friction shoes 43 mounted on the driving clutch plate 41, and a clutch drum 44 fixed to one end of the input shaft 35 so

as to cover the driving clutch plate 41. When the driving clutch plate 41 rotates at a rotating speed exceeding a predetermined rotating speed, the expanding friction shoes 43 come into contact with the clutch drum 44 to transmit the rotation of the driven pulley 36 through the driving clutch plate 41, the expanding friction shoes 43 and the clutch drum 44 41 to the input shaft 35 of the transmission 11. A pinion 46 is mounted on the other end of the input shaft 35 to drive the output shaft 13 of the transmission 11 through a gear 47, a pinion 48, and a gear 49 fixed to the output shaft 13.

[0 0 2 5]

The brake drum 50 of the brake unit 14 is welded to a sleeve 51, and the winding drum 16 for winding the tow cable 15 is welded to the brake drum 50. The sleeve 51 is put on the output shaft 13 and secured to the same with a nut 52. Brake shoes 53 are arranged near the inner circumference of the brake drum 50 so as to be brought into frictional contact with the brake drum 50 by cams, not shown, which are operated by a brake cable. The centrifugal clutch 45 is housed in a clutch case 54.

[0 0 2 6]

As is apparent from the foregoing description, according to the present invention, the guide pulley does not interfere with the operation of the control levers because the guide roller swings within a fixed angular range of swing motion and the control levers are disposed outside the range of swing motion of the guide pulley.

Since the control levers are arranged on the same level as the guide pulley, the operator is able to operate the control levers, paying attention to the direction of the guide pulley.

0027

Fig.8 shows the perspective view of the towing apparatus which is further equipped with communication lamps 110 which is mounted on the upper part of the support frame 4. The communication lamp 110 is consist of three types of color 110a 110b 110c which are selectively lighted on when signal switch 100 is operated by the operator. The signal switch 100 is mounted on the winding operation control handle 21 at the opposite side to the brake lever 22.

A stop switch 101 is mounted on the same side of the winding operation handle 21, so that the operator can easily stop the engine 10. The engine 10 is started by the starter motor which is not shown, is mounted on the the control handle 21

near to the stop switch 101.

The main switch 102 is equipped on the top frame 5 near to the control handle 21.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[Fig. 1]

Fig. 1 is a front view of a towing apparatus in a preferred embodiment according to the present invention.

[Fig. 2]

Fig. 2 is a side view of the towing apparatus of Fig. 1.

[Fig. 3]

Fig. 3 is a plan view of the towing apparatus of Fig. 1.

[Fig. 4]

Fig. 4 is a pictorial view of the towing apparatus of Fig. 1 in operation.

[Fig. 5]

Fig. 5 is an enlarged view of a foldaway stay.

[Fig. 6]

Fig. 6 is a graph showing the relation between the spring constant K_t (kgf/m) of a portion of a tow cable and the length (m) of the portion of the tow cable.

[Fig. 7]

Fig. 7 is a sectional view of a power unit.

Fig. 8 is a perspective view of the towing apparatus.

[DESCRIPTION OF REFERENCE CHARACTERS]

1 ... Frame structure, 2 ... Bottom frame, 3 ... Post, 4 ... Support frame, 5 ... Top frame, 6 ... foldaway stay, 10 ... Engine, 11 ... Transmission, 12 ... Power unit, 13 ... Output shaft, 14 ... Brake unit, 15 ... tow cable, 16 ... Winding drum, 17 ... Guide pulley, 21 ... Winding operation control handle (Winding operation control lever), 22 ... Brake lever (Brake operating lever) Fig. 6

1 ... Spring constant K_t (kgf/m), 2 ... Length of the tow cable, 3 ... 4 mm dia. Kevlar cable, 4 ... 6 mm dia. Nylon cable, 5 ... Weight of the flier (kg)

Description of Fig. 8

100 --- Signal Switch

101 --- Stop Switch

102 --- Main Switch

110 --- Communication Lamp

1. Communication lamp 110 is consist of three types of color 110 a, 110 b and 110 c which are selectively lighted on when signal switch 100 is operated.

2. Stop switch 101 is equipped near to the winding operation control handle 21, so that operator can easily stop the engine 10.

3. Main switch 102 is equipped on the top frame 5 near to the control handle 21.

Claims

1. A towing apparatus comprising: a power unit provided with a brake unit and a winding drum; a towing cable wound on the winding drum; and a guide pulley for guiding the towing cable when winding the towing cable on and unwinding the same from the winding drum;

characterized in that the angular position of the guide pulley with respect to a horizontal plane can be changed in a specified angular range, a brake operating lever and a winding operation control lever included in the power unit are disposed outside a range in which the angular position of the guide pulley is changed.

2. A towing apparatus according to claim 1, wherein the winding operation control lever is disposed on the same level as the guide pulley on the side opposite the towing side with respect to a guide pulley support unit supporting the guide pulley.

3. A towing apparatus characterized in that a guide pulley is disposed above a straight line passing a winding operation control lever and the free end of a foldaway stay in a fully unfolded state, and a winding drum is disposed with its axis positioned below the straight line.

Fig. 1

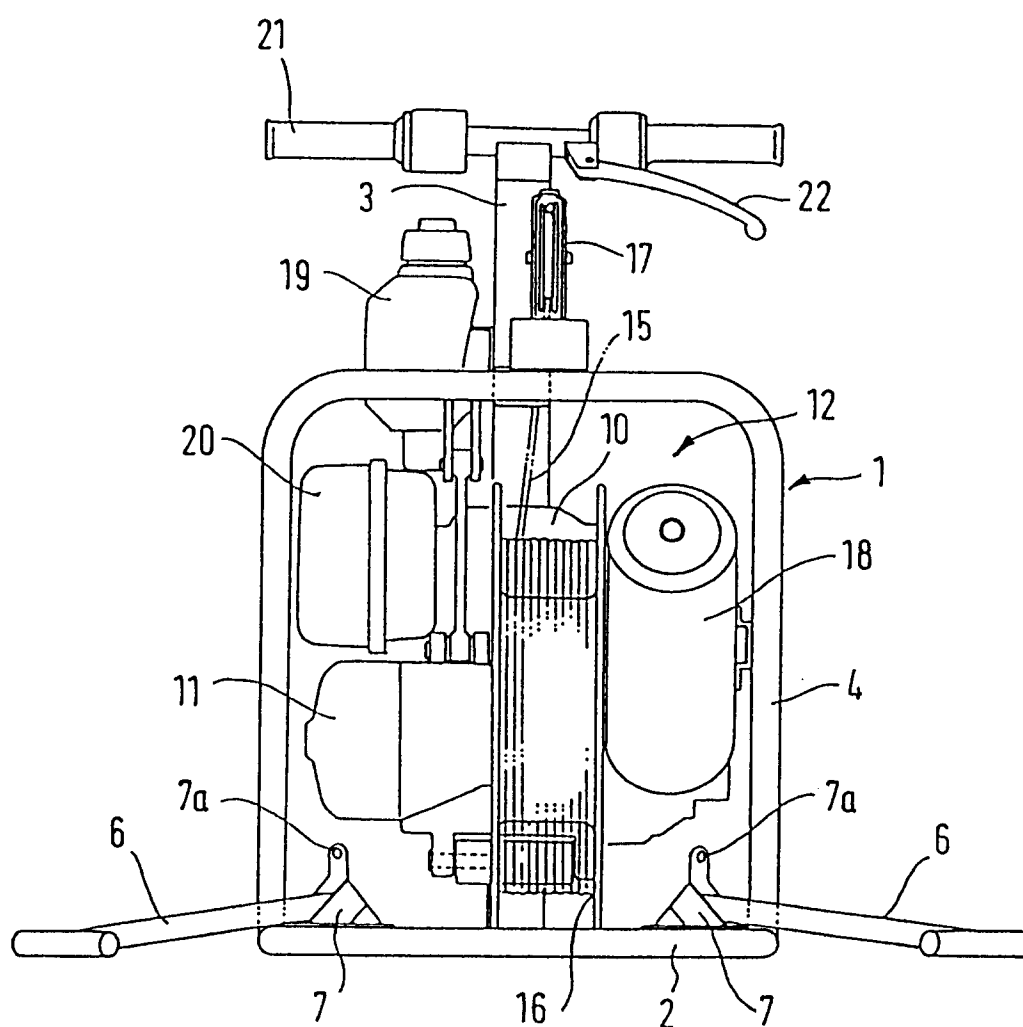


Fig. 2

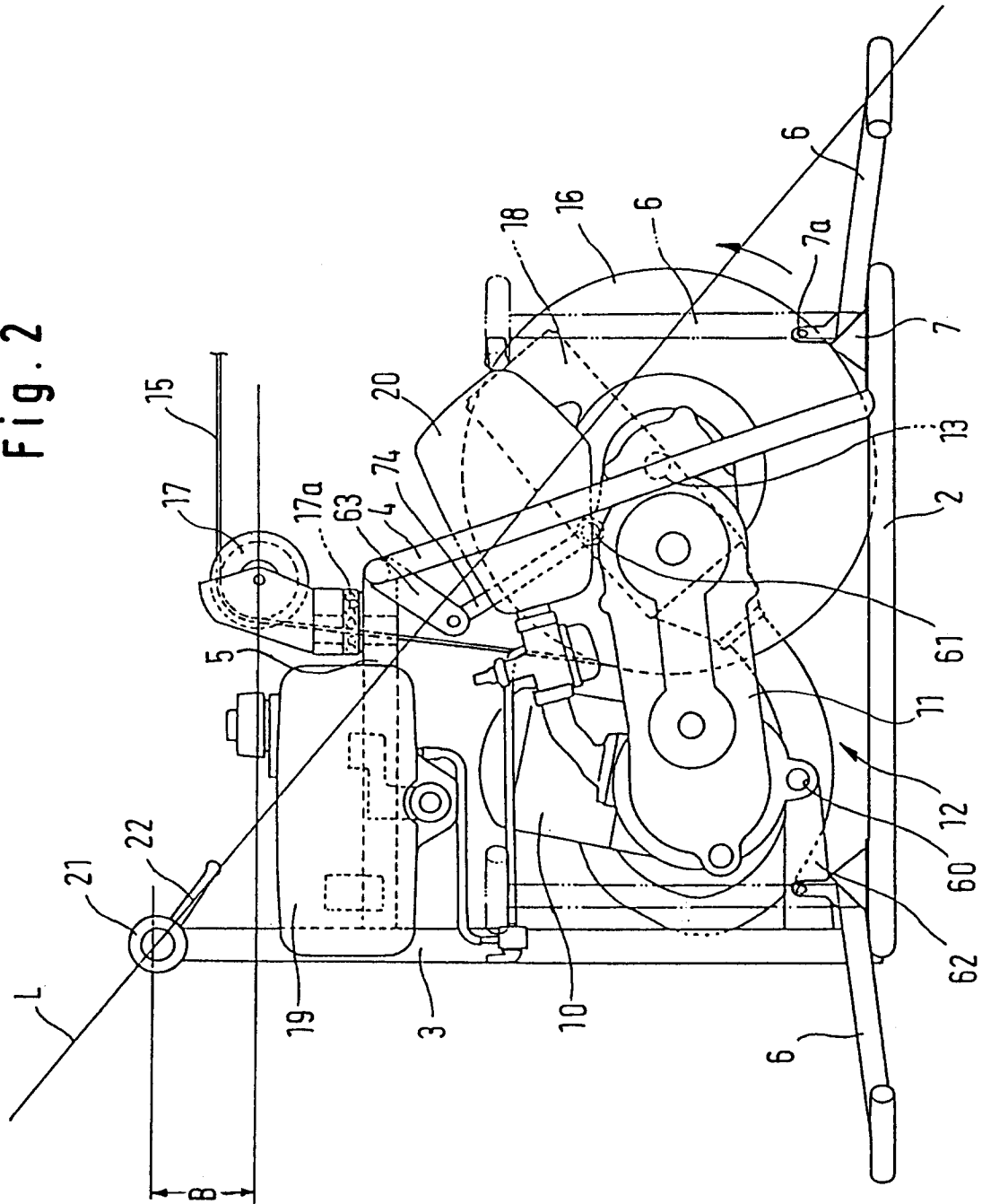
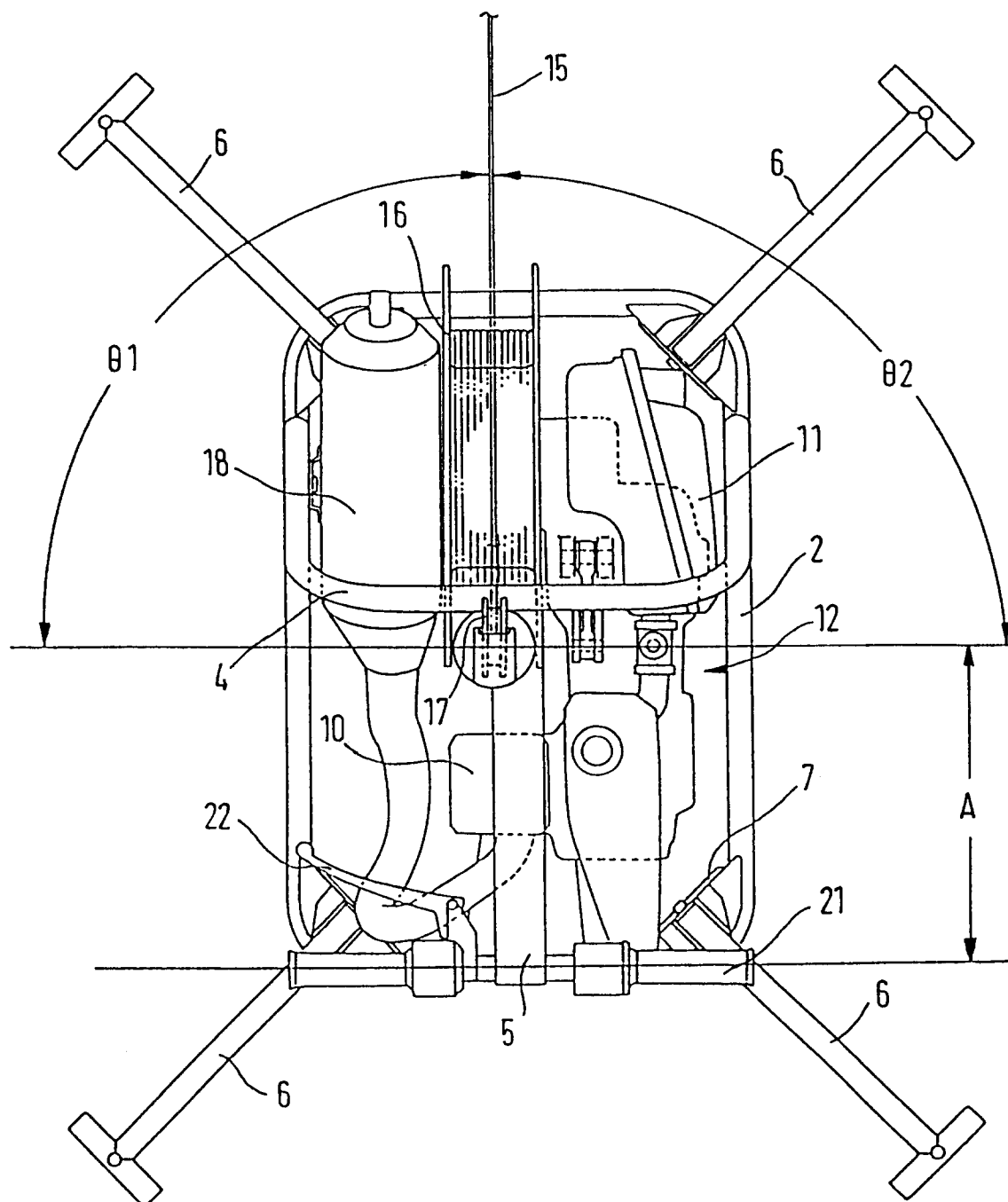


Fig.3



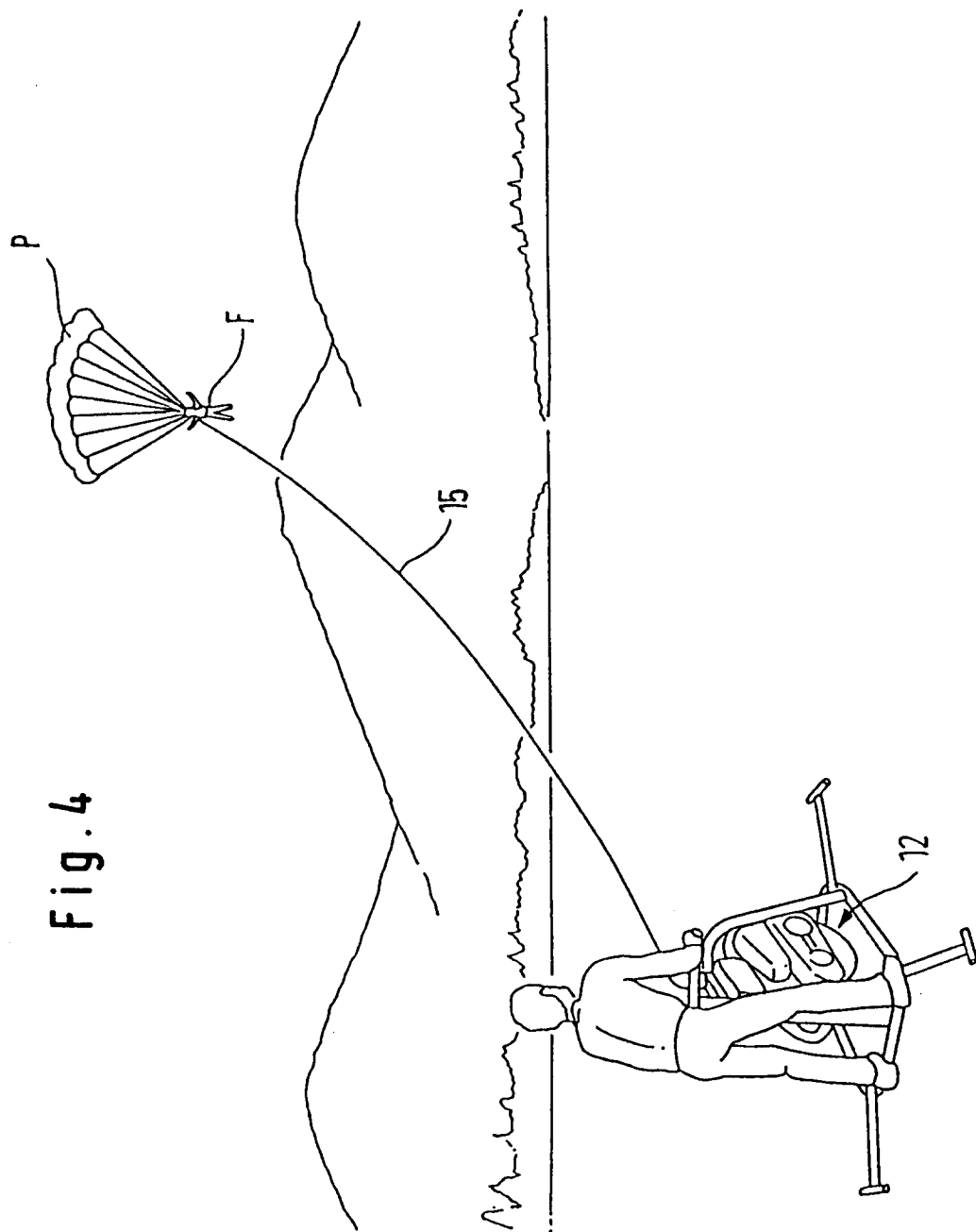


Fig. 4

Fig. 5

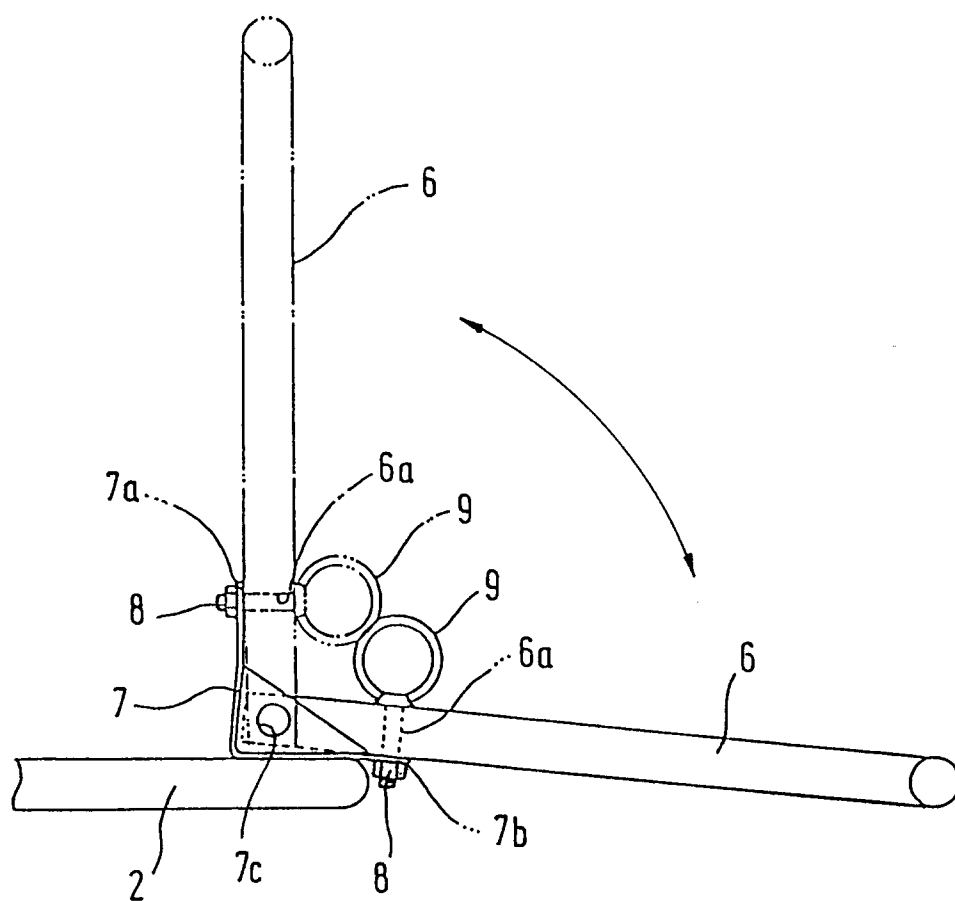


Fig. 6

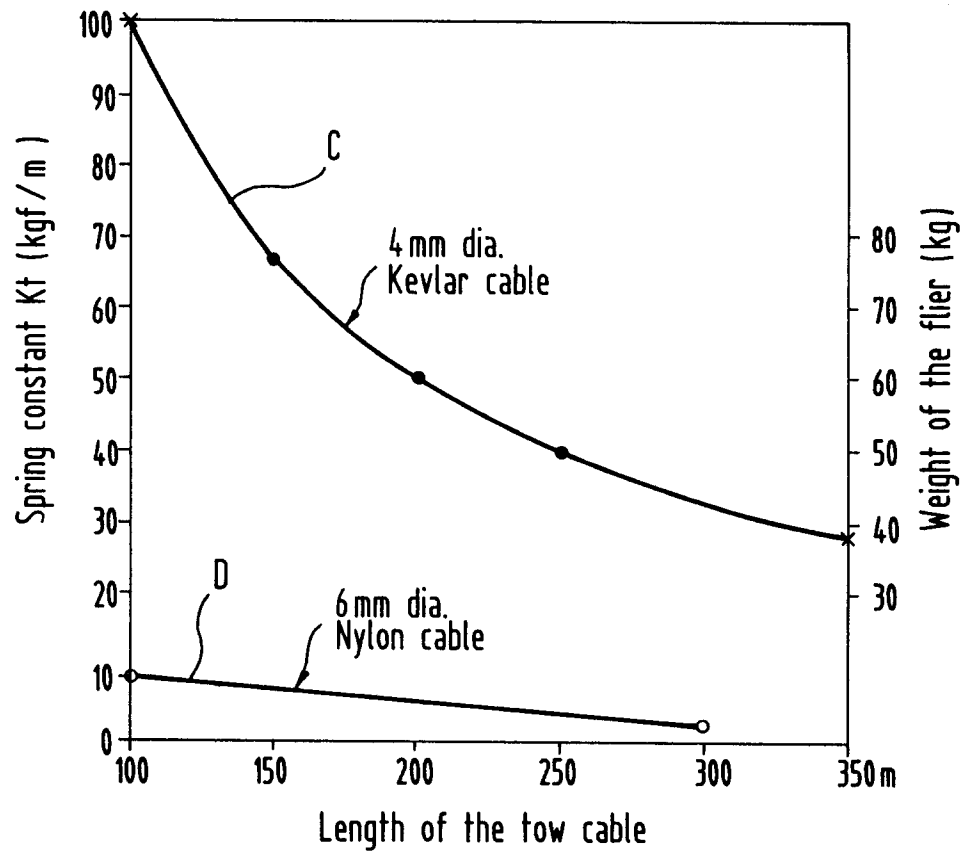
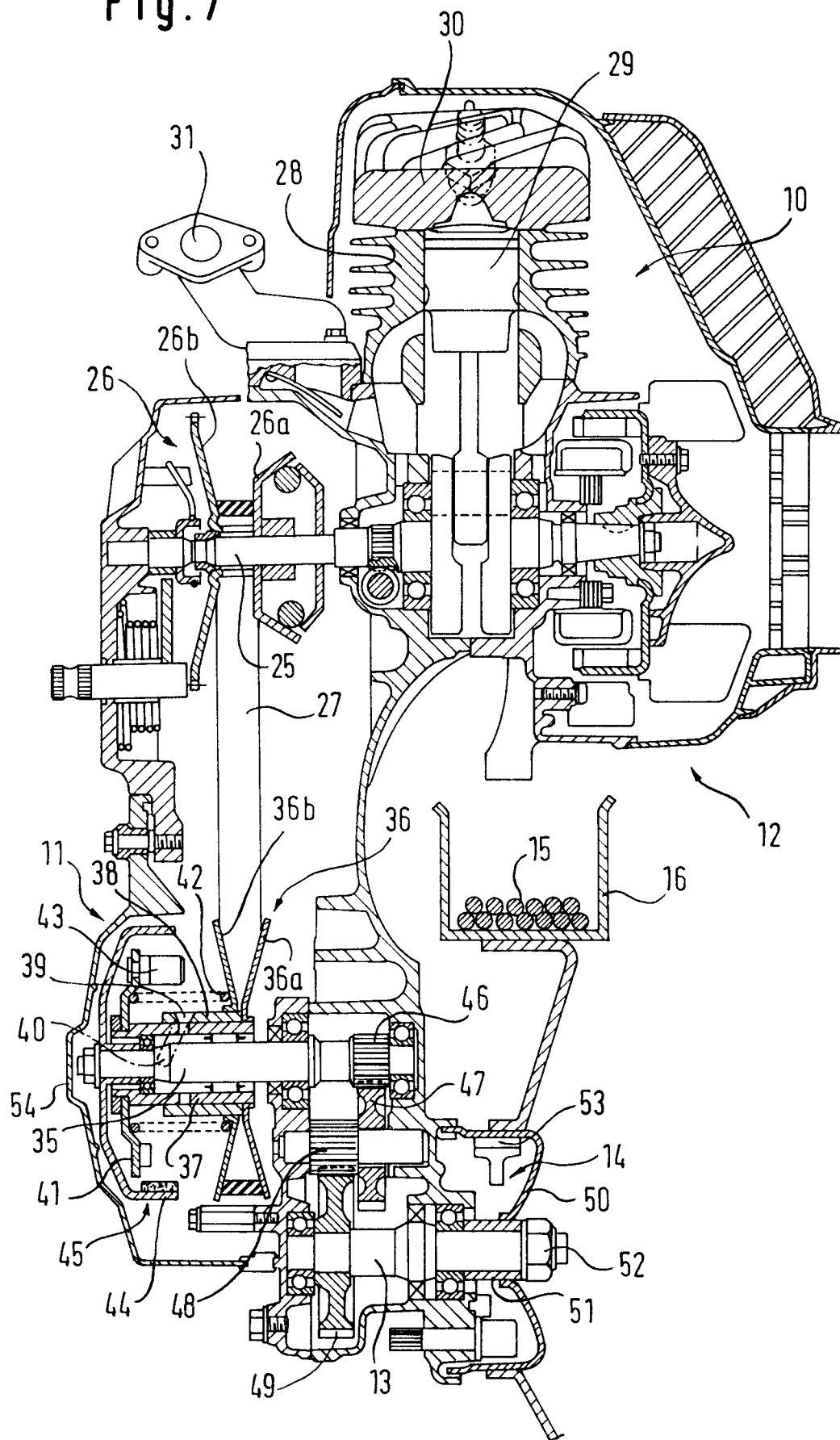


Fig. 7



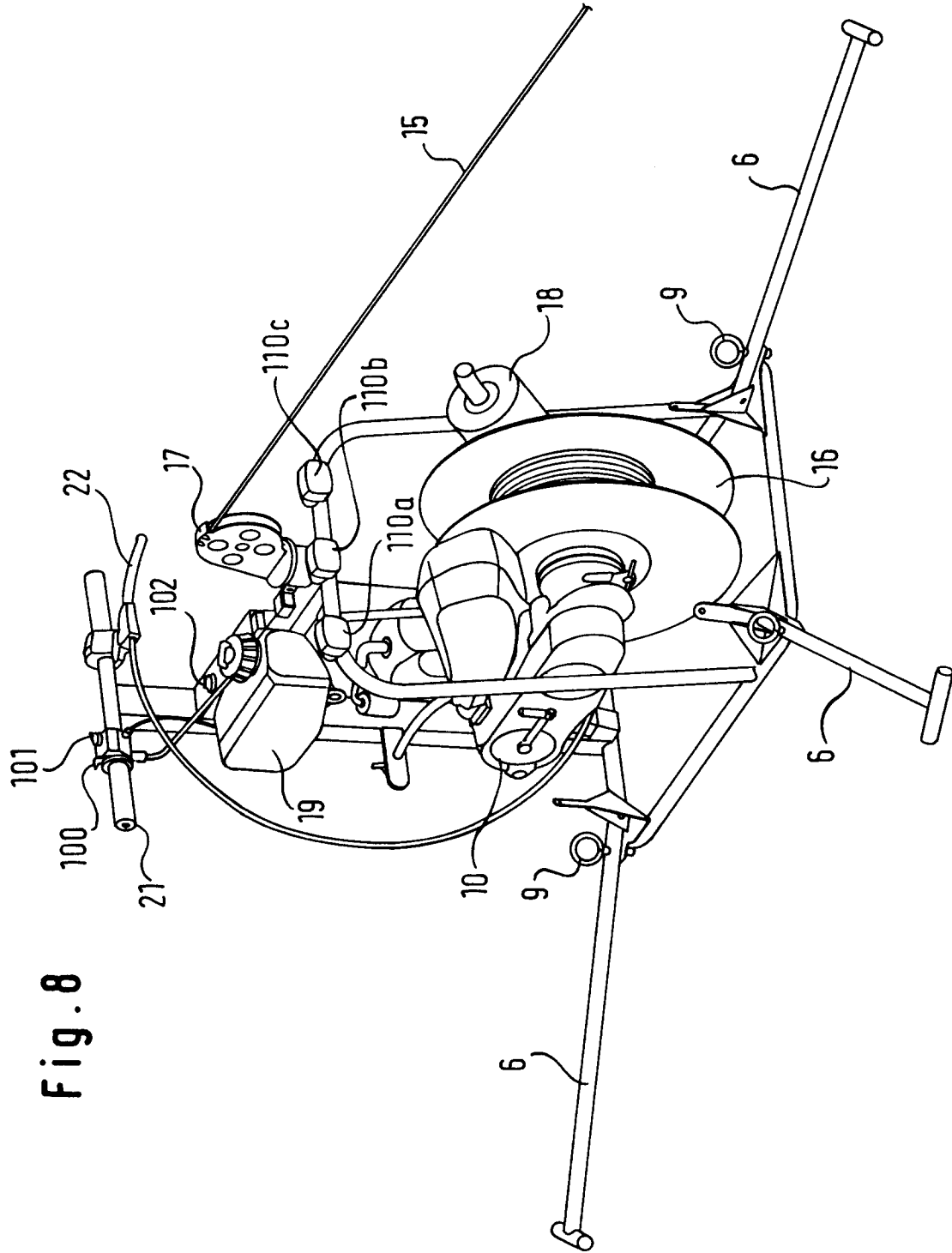


Fig. 8



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EUROPEAN SEARCH REPORT

Application Number
EP 93 11 6977

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 A	WO-A-93 13006 (CLEVELAND) * page 4, line 10 - line 16 * * figures 1,5,6 * ---	1,2 3	B66D1/60 B66D1/00
D,Y	PATENT ABSTRACTS OF JAPAN vol. 15, no. 276 (M-1135)12 July 1991 & JP-A-03 095 098 (HONDA MOTOR CO. LTD.) 19 April 1991 * abstract * * figure * ---	1,2	
Y	US-A-3 322 398 (SMITH) * column 2, line 14 - line 21 * * column 3, line 13 - line 16 * * figures 1-3 * ---	1,2	
A	GB-A-2 220 908 (AUTOSTEER CONTROLS LTD.) * figure * * page 3, line 2 - line 5 * * page 3, line 8 - line 11 * ---	1	
A	US-A-2 896 911 (CARPENTER) * column 2, line 41 - line 48 * * column 3, line 20 - line 28 * * figure 1 * ---	1	TECHNICAL FIELDS SEARCHED (Int.Cl.6) B66D
A	CA-A-1 207 748 (DAVID) * page 5, line 14 - line 15 * * page 5, line 21 - line 24 * * page 6, line 6 - line 9 * * page 6, line 15 - line 17 * * page 7, line 9 - line 10 * * figures * ---	1,3	
A	CH-A-603 393 (ALFATECH A.G.) * column 1, line 51 - line 60 * * column 2, line 7 - line 11 * * figures * ---	1	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 15 February 1994	Examiner Guthmuller, J
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			



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EUROPEAN SEARCH REPORT

Application Number
EP 93 11 6977

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)
A	DE-A-39 15 501 (ROTZLER G.M.B.H. & CO.) -----		
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 15 February 1994	Examiner Guthmuller, J
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			