June 7, 1955 E. R. BOYNTON ET AL 2,709,966

SKI TOW

Filed Jan. 20, 1950 5 Sheets-Sheet 1

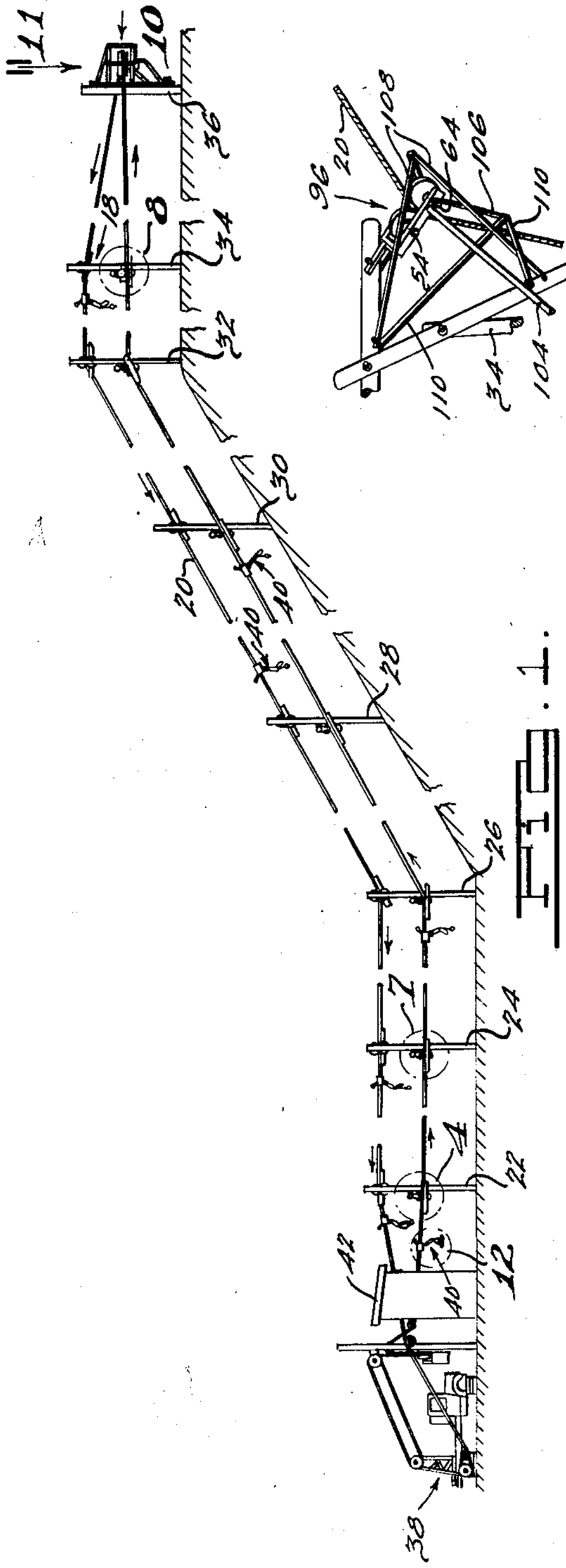

FIG. 1.

FIG. 10.

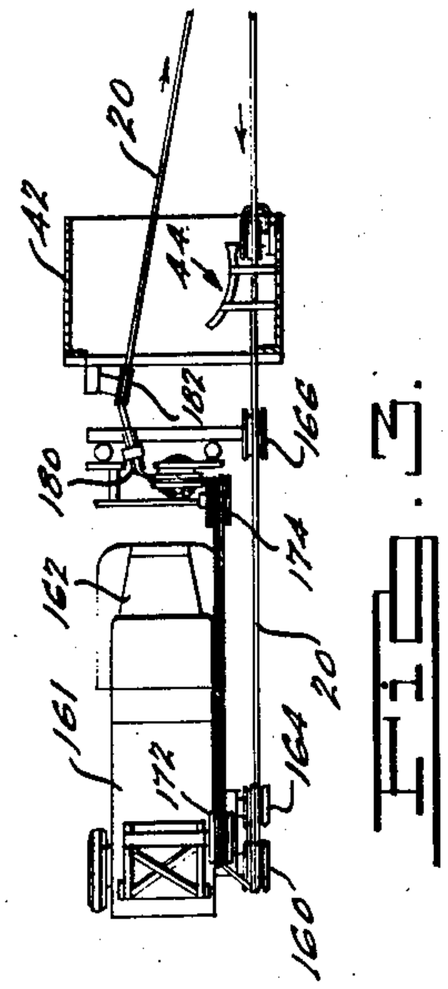

FIG. 11.

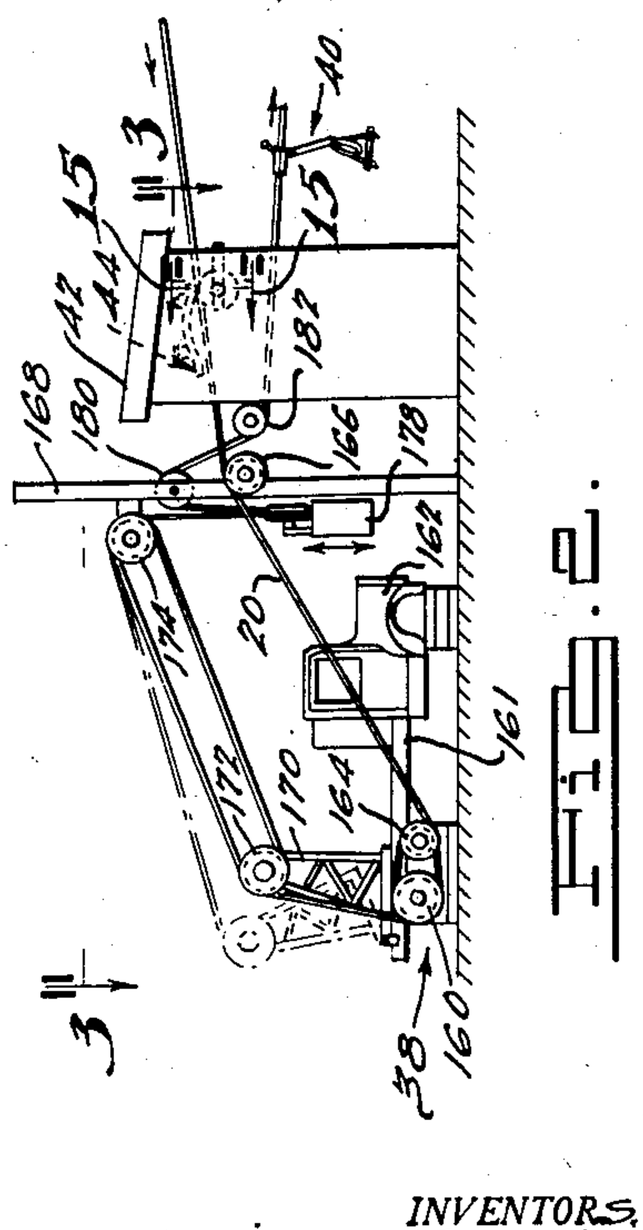

FIG. 2.

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June 7, 1955 E. R. BOYNTON ET AL 2,709,966

SKI TOW

Filed Jan. 20, 1950 5 Sheets-Sheet 2

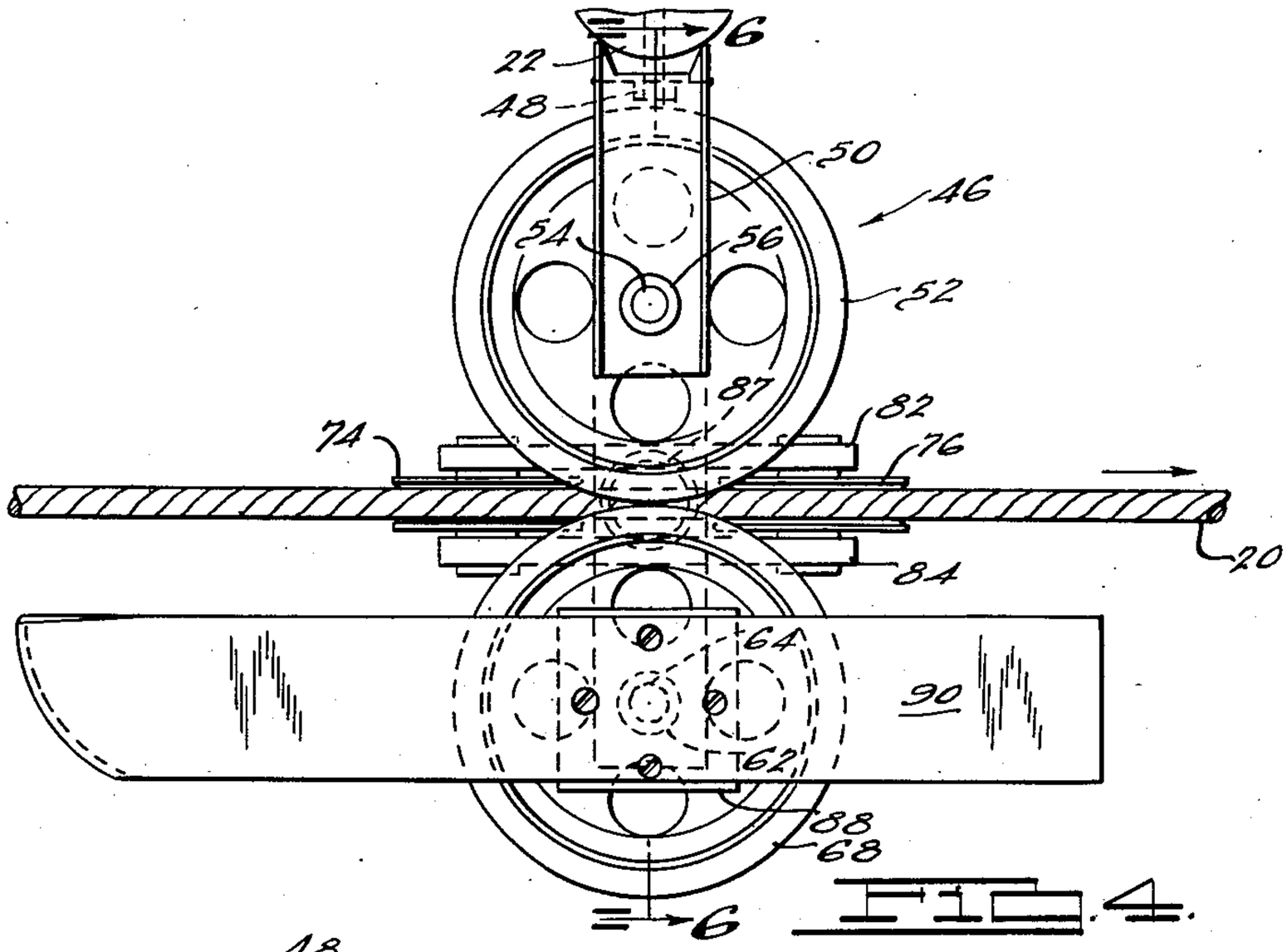
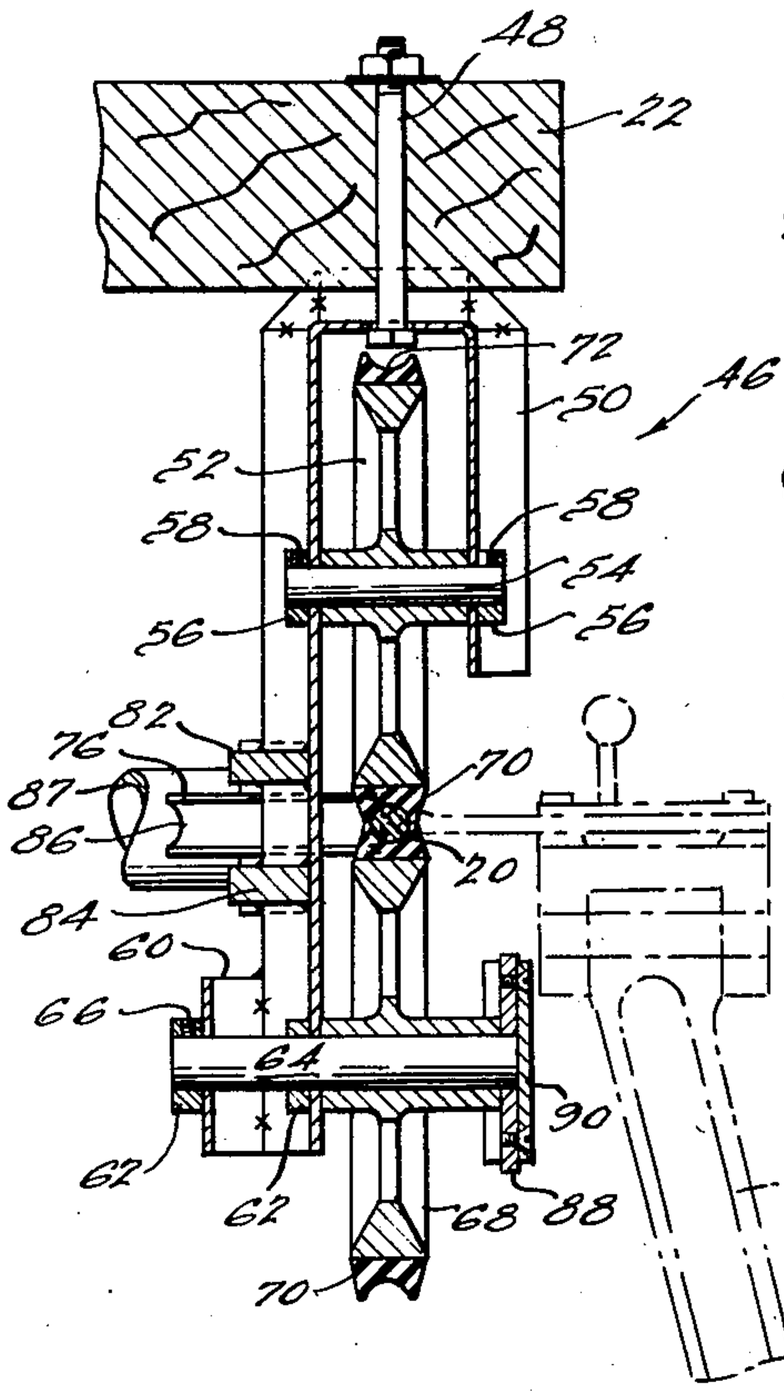


FIG. 4.



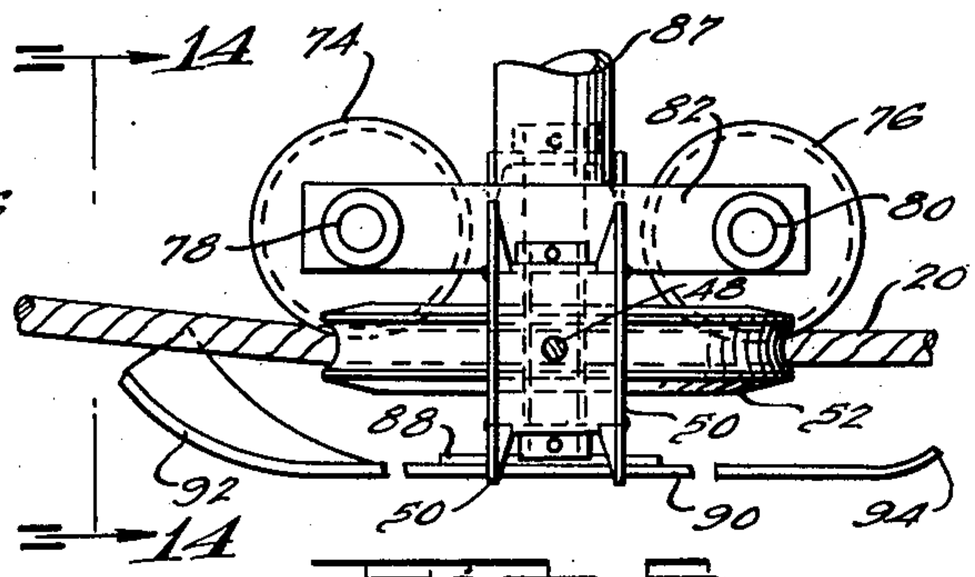


FIG. 5.

FIG. 6.

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SKI TOW

Filed Jan. 20, 1950 5 Sheets-Sheet 3

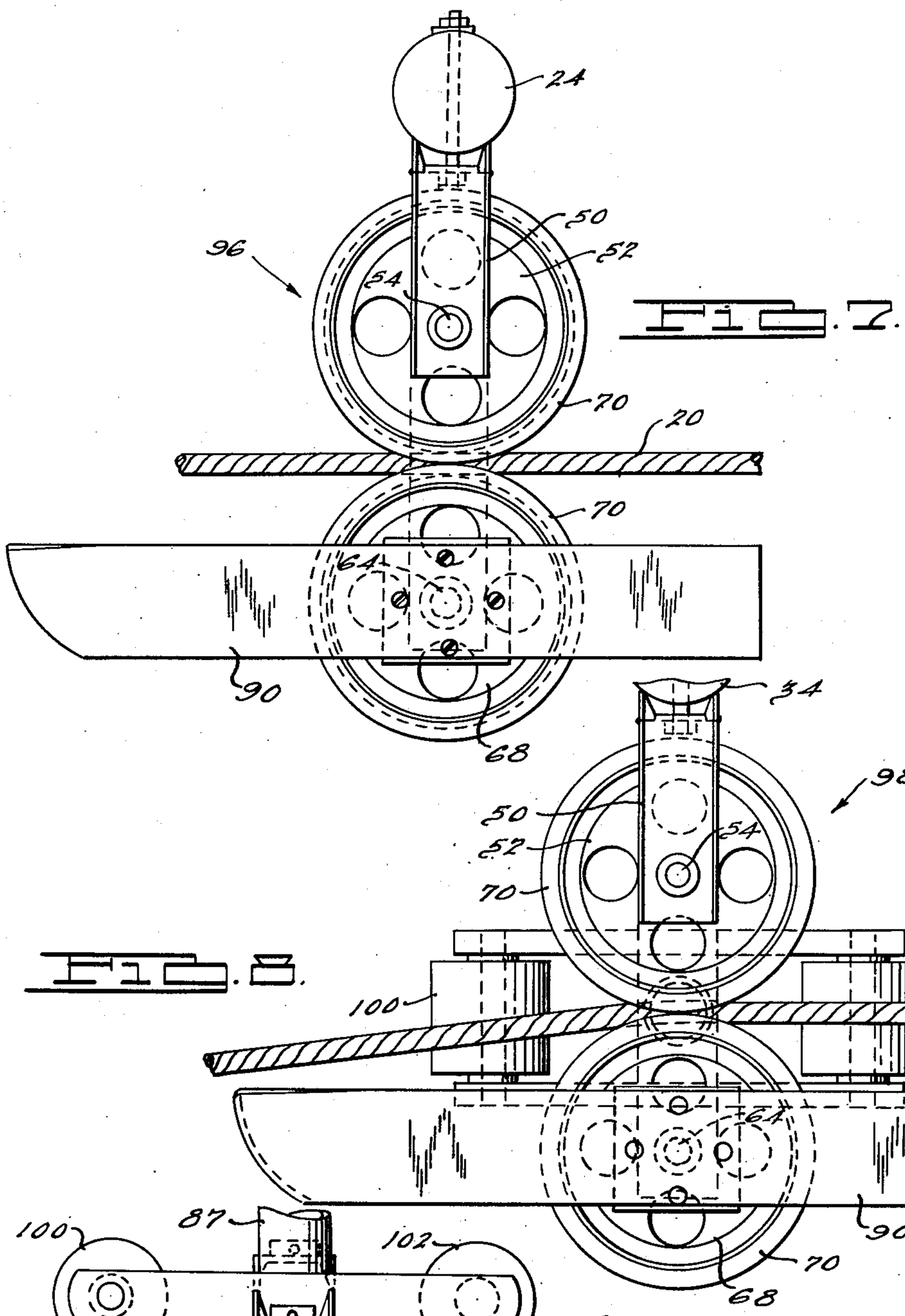

Fig. 7.

Fig. 8.

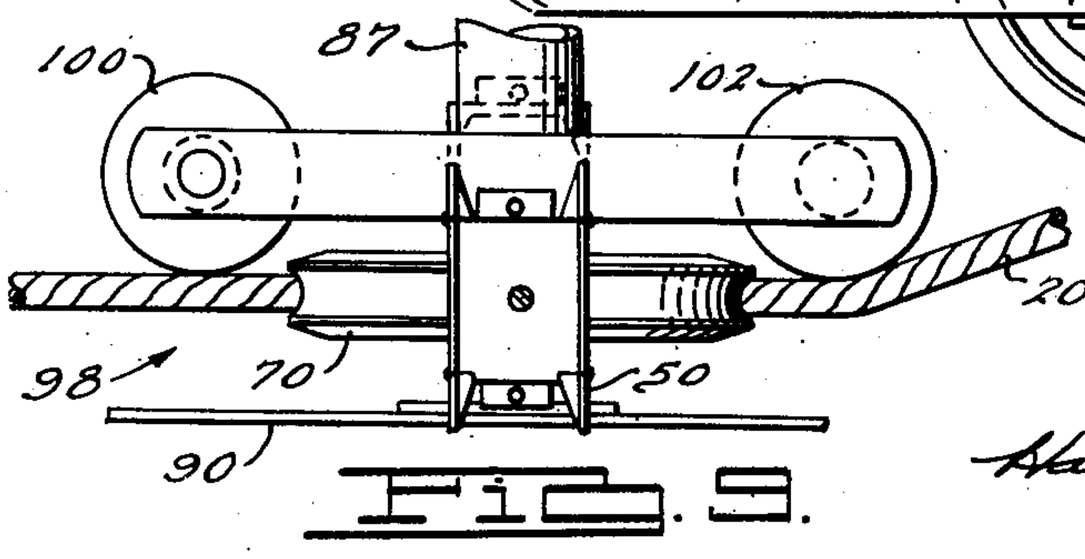

Fig. 9.

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SKI TOW

Filed Jan. 20, 1950 5 Sheets-Sheet 4

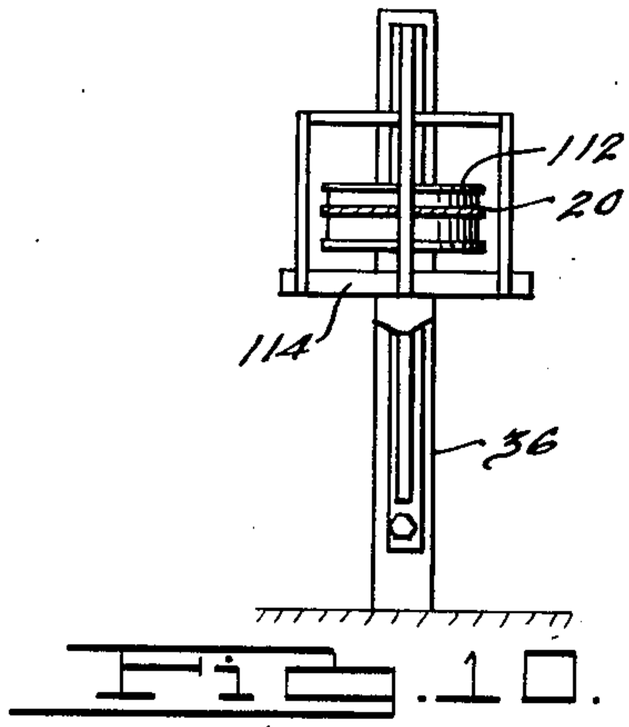

Fig. 10.

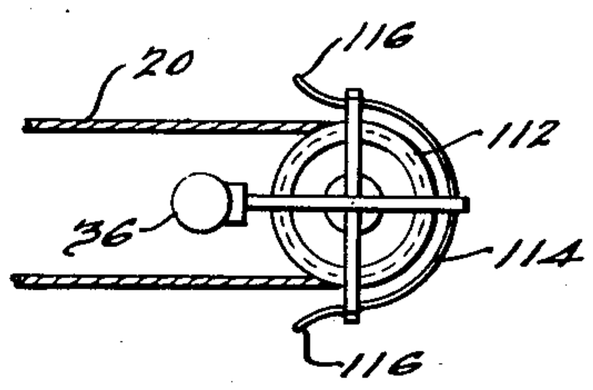

Fig. 11.

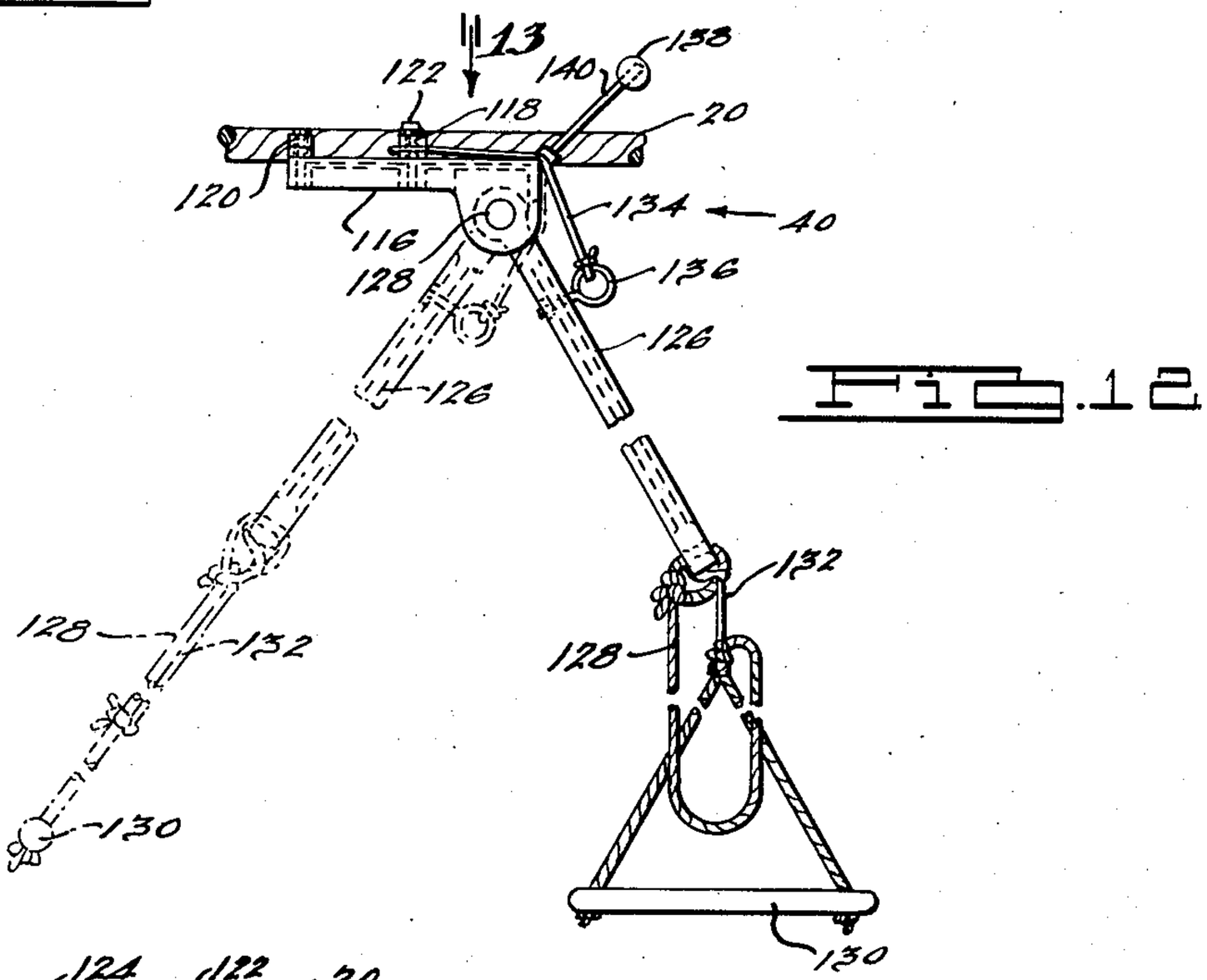

Fig. 12.

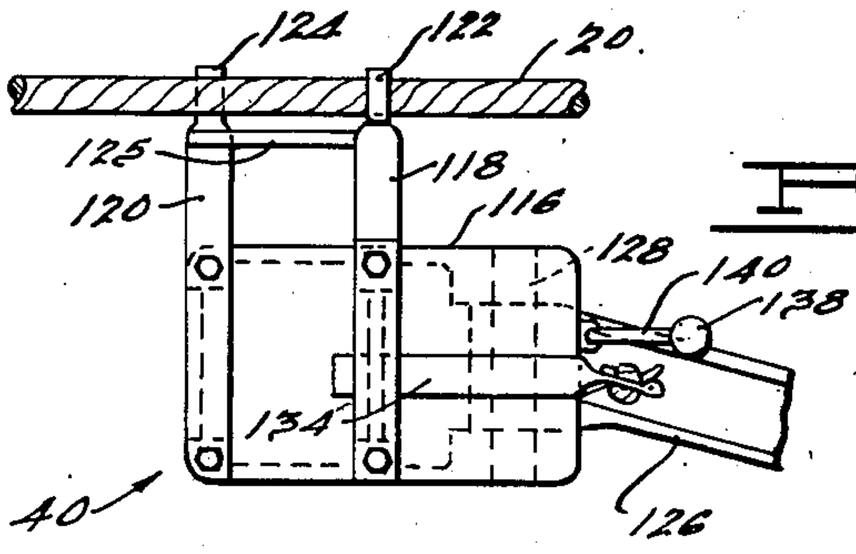

Fig. 13.

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June 7, 1955 E. R. BOYNTON ET AL 2,709,966

SKI TOW

Filed Jan. 20, 1950 5 Sheets-Sheet 5

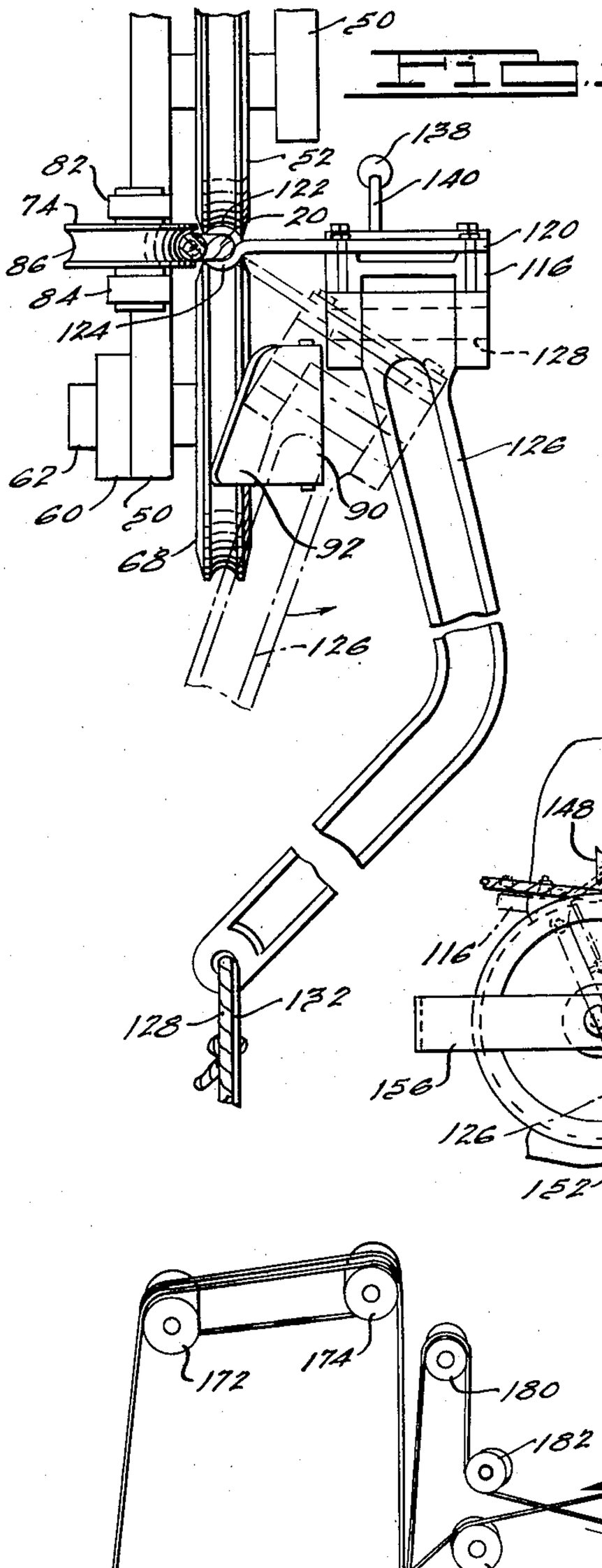

FIG. 14.

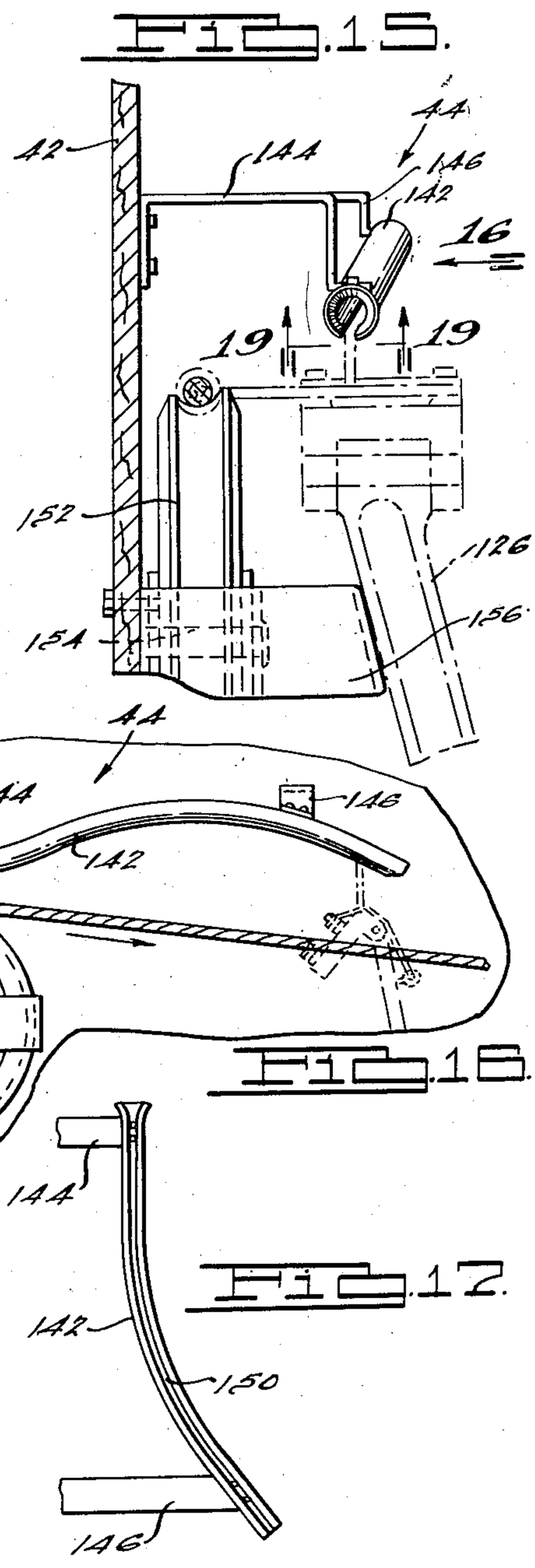

FIG. 15.

FIG. 16.

FIG. 17.

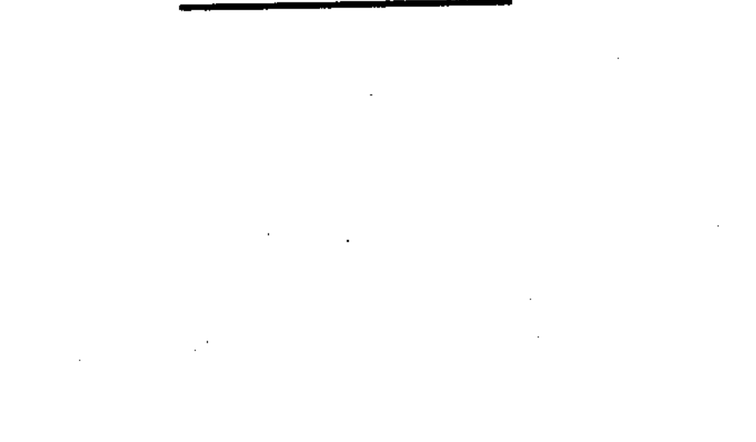

FIG. 18.

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United States Patent Office

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Patented June 7, 1955

2,709,966

SKI TOW

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Application January 20, 1950, Serial No. 139,546

33 Claims. (Cl. 104—173)

The present invention relates to an improved ski tow.

It is an object of the invention to provide an improved ski tow in which the main rope may be supported at a plurality of points along the course that skiers are to be moved by the tow, and in which the leads by which the skiers are pulled are detachably connected to the main rope and movable past the points at which the main rope is supported, while they are connected to the latter.

It is a further object of the invention to provide an improved ski tow of the above mentioned type including improved means for automatically detaching the leads from the main rope.

Another object of the invention is to provide an improved lead for a ski tow of the above mentioned type which includes a lead connector readily attachable to and detachable from the main rope.

It is also an object of the invention to provide such a lead connector which effectively grips the rope to prevent slipping of the connector along the rope when a load is applied to the lead, and which, when there is no load on the lead grips the rope sufficiently to cause the lead to be carried with the rope but which at the same time permits the rope to rotate about its longitudinal axis in the manner common in such driven ropes.

Another object of the invention is to provide a lead of the above mentioned type including a lead connector attachable to and detachable from the main rope and an arm pivotally connected to the lead connector so that any pull applied to the free end of the arm by a skier, either at right angles to the main rope, back along the rope, or at any angle in between, will result in a gripping of the rope by the lead connector.

It is also an object of the invention to provide an improved hangar for use in a ski tow of the above mentioned type adapted to support the rope and permit lead connectors to be carried through the hangar by the rope.

Another object of the invention is to provide an improved hangar for a ski tow of the above mentioned type, the use of which permits the course of the main rope to be changed at the hangar, in a vertical plane.

It is also an object of the invention to provide an improved ski tow hangar which permits the course of the main rope to be changed in an inclined plane, thereby permitting the main rope to turn through a horizontal angle as well as through a vertical angle.

Another object of the invention is to provide improved means for taking up the slack that normally develops in the main rope of a ski tow during use thereof, when the main rope is of a manila hemp type construction.

A further object of the invention is to provide improved means for maintaining the desired tension in the main rope of a ski tow.

It is also an important object of the present invention to provide an improved ski tow which is relatively inexpensive to install and which is particularly adapted

for use on irregular terrain requiring the course of the tow to be changed through both vertical and horizontal angles.

Other and more detailed objects of the invention will become apparent from a consideration of the following specification, the appended claims, and the accompanying drawings wherein:

Figure 1 is a broken and somewhat diagrammatic elevational view of a ski tow embodying the present invention;

Fig. 2 is a broken enlarged elevational view of a portion of the structure illustrated in Figure 1;

Fig. 3 is a plan view partially in section taken from the line **3—3** of Fig. 2;

Fig. 4 is a greatly enlarged broken elevational view of that portion of the structure of Figure 1 indicated by the circle **4**;

Fig. 5 is a plan view of the structure illustrated in Figure 4;

Fig. 6 is a sectional view of the structure illustrated in Figure 4, taken substantially along the line **6—6** thereof;

Fig. 7 is a greatly enlarged elevational view of that portion of the structure of Figure 1 indicated by the circle **7**;

Fig. 8 is a greatly enlarged elevational view of that portion of the structure of Figure 1 indicated by the circle **8**;

Fig. 9 is a plan view of the structure illustrated in Figure 8;

Fig. 10 is an enlarged elevational view of a portion of the structure illustrated in Figure 1, looking in the direction indicated by the arrow **10** therein;

Fig. 11 is an enlarged plan view of a portion of the structure illustrated in Figure 1, looking in the direction indicated by the arrow **11** therein;

Fig. 12 is a broken and greatly enlarged elevational view of that portion of the structure illustrated in Figure 1, indicated by the circle **12**;

Fig. 13 is a broken plan view of the structure illustrated in Figure 12, looking in the direction indicated by the arrow **13—13** therein;

Fig. 14 is a broken sectional view of the structure illustrated in Figure 5, taken substantially along the line **14—14** thereof and showing in full lines, a lead connector of the construction illustrated in Figures 12 and 13 passing through the hangar illustrated in Figures 4, 5 and 6, with the lead connector in the loaded position, and showing in broken lines, the position of the lead connector of an empty lead as it engages the hangar guide arm;

Fig. 15 is a greatly enlarged broken sectional view of the structure illustrated in Figure 2, taken substantially along the line **15—15** thereof;

Fig. 16 is a broken elevational view of the structure illustrated in Figure 15, looking in the direction indicated by the arrow **16** therein;

Fig. 17 is a broken bottom view of the structure illustrated in Figure 15, looking in the direction indicated by the arrow **17** therein;

Fig. 18 is a somewhat diagrammatic perspective view illustrating the course of the rope through the drive mechanism illustrated in Figures 1 and 2; and

Fig. 19 is a perspective view of the structure illustrated in Figure 1, looking in the direction indicated by the arrow **19** therein.

It will be readily appreciated from a complete understanding of the present invention that the improvements thereof may be readily embodied in ski tows of widely differing types and sizes and adapted for use on slopes of greatly differing contours. In an illustrative, but not in a limiting sense, the present invention is herein illus-

trated and described as embodied in a tow extending over a lower flat section, a steeply inclined intermediate section and a generally flat upper section (see Fig. 1) and in which the tow turns through a horizontal angle (see Fig. 9).

Referring to the drawings, the ski tow illustrated and described herein generally comprises a continuous closed main rope **20** supported at a plurality of stations **22, 24, 26, 28, 30, 32, 34** and **36** on hangars, as hereinafter described. The rope **20** is driven by a drive and take-up mechanism generally indicated at **38** and carries leads **40** detachably secured thereto by connectors adapted to be carried through the hangars by the rope **20**. The rope **20** passes through a tower **42** in which the leads **40** are attached to the outgoing course of the rope **20** and are automatically removed from the return course of the rope **20** by a take-off mechanism generally indicated at **44**.

In the embodiment illustrated, the main rope **20** is of conventional construction of a manila hemp material and of a size sufficient to safely withstand the loads to be imposed thereon. The use of a rope **20** of this construction is very important in the provision of a ski tow which is relatively inexpensive to install and it is an important feature of the present invention that it makes possible the use of such a rope on a relatively long tow.

The outgoing course of the rope **20**, as it leaves the drive and take-up mechanism **38**, which will be described hereinafter, passes through the tower **42** and to a hangar **46** secured to station **22** by a bolt **48** (see Figs. 4 and 6). The hangar **46** comprises a frame **50** which is in the form of an inverted J, as best illustrated in Fig. 6 and is of channel shaped cross section. An upper wheel **52** is rotatably mounted on an upper shaft **54** supported at its opposite ends in shaft collars **56** welded to the frame **50** and fixed against axial movement by set screws **58** carried in the collars **56**. At its lower end the frame **50** has an oppositely facing channel section **60** welded with its flanges abutting the flanges of the frame **50**. The web portions of the frame **50** and the channel section **60** carry spaced aligned shaft collars **62** welded thereto which provide a cantilever support for a lower shaft **64** held against axial movement by a set screw **66** in the outer shaft collar **62**. A second wheel **68** is rotatably mounted on the shaft **66** and disposed in the plane of the wheel **52**.

The radially outer peripheral portions of the wheels **52** and **68** are formed of an annularly shaped suitably resilient material such as rubber **70** and have annular mating grooves **72** formed in the radially outer surfaces thereof adapted to co-operate to receive said rope **20** therein and provide a limited lateral support therefor. The wheels **52** and **68** and the frame **50** are so proportioned that the wheels **52** and **68** are substantially tangent, as best illustrated in Figures 4 and 6.

As is readily seen in Figure 5, the rope **20** turns through a horizontal angle as it passes through the hangar **46**. To prevent the tension in the rope **20** from causing it to be pulled laterally from the grooves **72**, because of this horizontal angle through which the rope turns, lateral support for the rope **20** is provided by a second pair of wheels **74** and **76**, which are rotatably mounted on parallel shafts **78** and **80** fixedly supported in bars **82** and **84** carried by the frame **50**. The shafts **78** and **80** are spaced on opposite sides of the plane of the parallel shafts **54** and **64** and the wheels **74** and **76** are so proportioned that when the rope **20** is tangent to these wheels and received in the grooves **86** in the outer surfaces thereof, it is properly aligned in the grooves **70** of the wheels **52** and **68**. Lateral support for the hangar frame **50** is provided by a brace **87** abutting the bars **82** and **84** intermediate the wheels **74** and **76** and fixed at its other end to the station **22** in any suitable manner (not shown).

A small plate **88** is secured to the unsupported end of the shaft **64** and carries a guide arm **90** which extends generally parallel to the rope **20**. The left hand end of the guide arm as viewed in Figure 4, is at the side of the hangar **46** at which the rope **20** moves toward the hangar, and is curved under the rope as indicated at **92** and twisted as illustrated in Figures 4 and 5 so that the lower edge of the arm **46** is closer to the frame **50** than the upper edge. The opposite end of the guide arm **90**, at the side of the hangar at which the rope leaves the hangar, is curved toward the rope **20** to a lesser extent, as indicated at **94**. The functioning of the guide arm **90** will be described at a later point in the specification.

The outgoing course of the rope **20** is supported at station **24** by the hangar **96** illustrated in Figure 7. This hangar **96** is in all respects identical with the above described hangar **46** illustrated in Figures 4, 5 and 6 with the exception that it does not include the wheels **74** and **76** or the bars **82** and **84** and shafts **78** and **80** upon which they are carried. Also, since there is no lateral load on the hangar **96**, no brace corresponding to the brace **87** is required. Hangars of this construction are used at all points on both the outgoing and return courses of the rope where there is no lateral load on the hangar. In the ski tow illustrated in Figure 1, hangars **96** of the construction illustrated in Figure 7 are used to support the outgoing course of the rope at stations **24, 26, 28, 30** and **32** and to support the return course of the rope at stations **22** to **34** inclusive. It will be appreciated, of course, that the hangars **96** are adapted to provide a force acting either upwardly or downwardly on the rope **20** as required to maintain it in the proper position.

At station **34** the rope **20** turns through a horizontal angle which is best seen in Figure 9 and also turns through a vertical angle as illustrated in Figure 8. Also, leads **40** on the outgoing course of the rope **20** at station **34** are normally fully loaded. This load on the leads **40** may cause some vertical movement of the rope **20**. To take care of these conditions, a hangar **98** is provided at station **34** which differs from the above described hangar **46** illustrated in Figures 4, 5 and 6, in that the wheels **74** and **76** are replaced by cylindrical rollers **100** and **102** having substantial axial extents and adapted to provide lateral support for the rope **20** throughout the limits of its vertical movement.

The hangar at station **34** for the return course of the rope **20** is illustrated in Figure 19. As stated above, one of the hangars **96** is used. To avoid lateral loading of the hangar **96**, it is supported on the station **34**, as illustrated in Figure 19, by a brace **104** so that the wheels of the hangar are disposed in the plane defined by the rope **20** as it enters and leaves the hangar. A guide bar **106** is connected intermediate its ends to the hangar plate **88** on the end of the lower shaft **64** and has its opposite ends supported on the station **34** by braces **108** and **110**.

At the end station **36**, the rope **20** passes around a large wheel **112** supported on the station **36** for rotation about a vertical axis. A generally semicircular guard **114** having outwardly turned ends **116**, is supported on the station **36** in coaxial relation with the wheel **112** and spaced below and radially outwardly thereof. The guard **114** functions as hereinafter described to prevent excessive swinging of the leads **40** as they travel around the wheel **112**.

Referring to Figures 12, 13 and 14, the leads **40** include a lead connector body **116** spaced laterally of the rope **20** and having spaced parallel fingers **118** and **120** which project laterally from the body **116** and have oppositely facing arcuately shaped end portions **122** and **124** adapted to engage the rope **20** at its upper and lower sides respectively, at points spaced axially therealong. A guard **125** is connected at one end to the finger **118** adjacent the rope engaging portion **122** and extends across the top of, and is secured to, the finger **120** adjacent the rope engaging portion **124** thereof. This guard prevents the rope **20** from moving out of the portions **122** and **124** and along the fingers toward the connector body **116**.

The leads **40** also include a lead connector arm **126** pivotally connected to the body **116** by a pin **128** for

pivotal movement about an axis parallel to the fingers **118** and **120** and spaced therefrom in the direction of the movement of the rope and spaced from the plane defined by the fingers so that any load applied to the free end of the arm by a skier grasping the lead **40**, will tend to turn the body **116** to effect a gripping of the rope **20** by the fingers **118** and **120**. The spacing of the fingers **118** and **120** is such that when the body **116** is turned in the opposite direction, or in a counterclockwise direction from the position illustrated in Figure 12, the fingers **118** and **120** are moved clear of the rope **20**. When the body **116** is in this position relative to the rope **20**, the lead may be freely moved transversely of the rope **20** to remove it from the rope.

The arm **126** is so curved that its free end is substantially in a plane perpendicular to the fingers **118** and **120** and including the axis of the rope. It will be appreciated that by virtue of this construction, a load such as that normally applied to the free end of the arm **126** by a skier grasping the lead **40**, will result in pivoting the connector body **116** about the rope **20** to the position illustrated in full lines in Figure 14, in which the fingers **118** and **120** are disposed horizontally.

A lead rope **129** is connected to the free end of the arm **126** and carries a handle **130** adapted to be readily grasped by a skier to be moved up the tow. Suitable resilient means, such for example as the rubber **132**, may be provided for greatly shortening the over-all length of the lead **40** when it is unloaded.

The leads **40** are also provided with resilient means for urging the arm **126** toward the full line position illustrated in Figure 12, with the result that when there is no load on the lead, it assumes this full line position which slightly increases the grip of the rope by the fingers **118** and **120**. In the construction illustrated, this resilient means is the rubber **134**, one end of which is anchored under the finger **118** and the other end of which is secured to an eye **136** fixed in the arm **126**. When the lead **40** is loaded, the arm **126** assumes the position illustrated in broken lines in Figure 12 and the lead rope **129** is extended as there indicated.

The connector body **116** also carries means co-operable with the earlier mentioned automatic take-off mechanism **44** mounted in the tower **42**. This means comprises a ball **138** fixed on the upper end of a rod **140** secured to the leading edge of the connector body **116**, or right hand edge thereof as viewed in Figure 12. The rod **140** extends forwardly, or to the right as there viewed, and upwardly, at an angle of approximately 45°.

The take-off mechanism **44** comprises a tube **142** rigidly supported within the tower **42** in spaced relation to a side wall thereof, on a pair of brackets **144** and **146**. The tube **142** is of an internal diameter adapted to slidably receive the ball **138** and extends generally along and in spaced relation above the rope **20**. The left hand end, as viewed in Figure 16, opens toward the balls **138** mounted on the lead connector bodies **116** and is disposed in their path of movement as they are carried t hrough the tower **42** on the return course of the rope **20**. The left hand end of the tube **142** is outwardly flared as indicated at **148** to facilitate movement of the balls **138** into the tube **142** and the latter has a slot **150** (see Fig. 17) extending along its underside through which the rod **140** extends when the ball **138** is disposed with the tube **142**. The rope **20** is supported directly below the flared end **148** of the tube **142** on a pulley wheel **152** similar in construction to the wheels **52** and **68** and rotatably mounted on a horizontal shaft **154** supported on the tower **42** by a bracket **155**. A horizontally extending guide strap **156** is secured to the outer end of the shaft **154** and is curved under the rope **20** at the side of the wheel toward which the leads are carried as they move along on the rope **20**. The guide strap **156** engages the arm **126** of each lead **40** and pivots the connector body **116** about the rope **20** to a position in which the fingers

118 and **120** extend substantially horizontally and the ball **138** is disposed to enter the flared end **148** of the take-off tube **142**. Beyond the wheel **152** the rope **20** slopes downwardly, as shown in Figure 16, and the tube **142** turns upwardly away from the rope **20**. As the ball **138** moves along the tube **142**, it will thus be seen that it lifts the leading edge of the connector and turns the connector body **116** in a counterclockwise direction which, as described above, disengages the fingers **118** and **120** from the rope **20**. Beyond the point at which the fingers are disengaged and the connector is supported in the tube **142** on the ball **138**, the tube **142** turns laterally away from the rope and downwardly so that continued movement of the ball along the tube results in the connector moving away from the rope and sliding down out the right end of the take-off tube **142**, as viewed in Figure 16. The momentum of the lead **40**, as it moves along with the rope, is such that it carries the ball **138** through the tube **142** even though the fingers **118** and **120** become disengaged soon after the ball **138** enters the tube **142**. As a safety precaution, a safety switch (not shown) may be disposed so as to be opened to stop the drive mechanism **38**, by any lead which may get past the take-off mechanism.

Referring now to Figures 1, 2, 3 and 18, the drive and take-up mechanism **38** is disposed behind the tower **42** or to the lift thereof as seen in these figures. The rope **20** is driven by a multiple groove wheel **160** mounted on a main frame **161** and driven by an engine **162** also mounted on the frame **161**. An idler wheel **164** is disposed adjacent the drive wheel **160** and the rope **20** passes over the wheels **160** and **164** as shown to provide an effective driving engagement of the drive wheel **160** with the rope. The axis of the wheel **164** is slightly inclined relative to the axis of the wheel **160** so that as the rope comes from one of the grooves of the wheel **160** and passes around the wheel **164**, it is aligned with the adjacent one of the grooves on the wheel **160**.

The return line of the rope **20** runs from the wheel **152** in the tower **42** to an idler wheel **166** rotatably supported on a station **168** adjacent the tower from which it runs directly to the idler wheel **164**. An auxiliary frame **170** is pivotally mounted on the main frame **161** and is moved relative thereto by a conventional hydraulic cylinder and pump assembly (not shown), the pump of which is driven by the engine **162**. From the driving wheel **160**, after making two and one-half turns about the wheels **160** and **164**, the outgoing rope runs to a take-up wheel **172** rotatably mounted on the auxiliary frame **170** from which it is trained over a second take-up wheel **174** rotatably mounted on the station **168**. From the wheel **174** the rope passes again around the wheel **172** and back over the wheel **174** from which it runs down around a wheel **176** rotatably mounted on a floating weight **178** from which it runs up over an idler wheel **180** rotatably supported on the station **168** and thence around another idler wheel **182** rotatably supported on the tower **42**. From the wheel **182** the rope runs through the tower **42**, where the leads **40** are manually connected to the rope, and out to the hangar **46** at the station **22**.

In the above described construction, the magnitude of the floating weight **178** may be adjusted to provide and maintain the desired tension in the rope **20**. The gradual elongation of the rope **20**, which takes place during the use of the rope **20**, results in the weight **178** floating at a lower and lower elevation. When the cumulation of this elongation becomes too great, it is offset by pivoting the auxiliary frame **170** to a position such as that illustrated in broken lines in Figure 2 and this elongation is taken up between the slack take-up wheels **172** and **174**. It will be appreciated that the slack take-up and tension control may also be effected without the use of the floating weight **178** by automatically maintaining a desired hydraulic pressure in the cylinder controlling the pivotal position of the auxiliary frame **170**, by suitable conven-

tional means which may include a relief valve or pressure responsive switch (not shown).

The operation of the above described ski tow is generally as follows. The engine **162** is started and the rope **20** is driven in the direction indicated by the arrows in the drawings, through the driving mechanism **38**. The leads **40** are connected to the rope **20** in the tower **42** by turning the lead connector body **116** counterclockwise from the position illustrated in Figure 12, through an angle of approximately 90°, in which the finger **118** is spaced vertically above the finger **120**. The connector is then moved toward the rope **20** until the guard bar **125** engages the rope. In this position the finger portion **122** is disposed above the rope and the finger portion **124** is disposed below the rope. A pull on the arm **126** will now cause the connector body **116** to turn to the position shown in Figure 12 in which the rope **20** is gripped by the fingers **118** and **120**, and the lead **40** is then carried from the tower on the outgoing course of the rope. As the lead **40** approaches the hangar **46** at station **22**, if it is unloaded, i. e., the handle **130** thereof has not been grasped by a skier, it will be supported in approximately the position illustrated in broken lines in Figure 14. The arm **126** then engages the guide arm **90** on the hangar **46** and causes the connector body **116** to pivot about the rope **20** to approximately the position illustrated in full lines in Figure 14. The fingers **118** and **120** are then disposed horizontally and may pass between the adjacent surfaces of the wheels **52** and **68** by virtue of the resilient tires **70** on these wheels. The leads **40** are so proportioned that when empty leads **40** are carried along the outgoing course of the rope **20**, in the position illustrated in Figure 12, the handle **130** is at an elevation at which it may be readily grasped by a skier. The pull of the tow on the skier gradually increases as the angle between the lead rope **129** and the main rope **20** decreases, until it is sufficient to move the skier along at the speed of the rope **20**. As indicated above, the construction of the lead connector is such that the loaded leads automatically assume the proper position, illustrated in full lines in Figure 14, for passage through the hangars.

The skier will be pulled along the course of the tow so long as he or she continues to grasp the handle **130**. When the end of the tow is reached, the skier releases the handle **130** and the lead **40** travels around the wheel **112**, the arm **126** riding against the guard **114** to prevent excessive swinging of the lead **40**, and back along the return course of the rope **20**. In passing the station **34** on the return course of the rope **20**, the arm **126** of the lead connector engages the guide bar **106** and as it moves therealong it pivots the connector body **116** upwardly to a position in which the fingers **118** and **120** are substantially parallel to the shafts **54** and **64** of the hanger **96**, so that the lead connector, as it passes between wheels **52** and **68**, is in the same position relative to that hangar, which is supported in an inclined position by the brace **104**, as it is relative to the other hangars when passing through them.

As the lead **40** moves into the tower **42** on the return course of the rope **20**, the arm **126** of the connector engages the guide strap **156** and pivots the empty connector body **116** into proper position so that the ball **138** carried thereby moves into the flared end **148** of the take-off tube **142**. As described above, the momentum of the lead **40** carries the ball **138** through the tube **142** and automatically removes the lead **40** from the rope **20**.

It will now be appreciated that the improvements of the present invention make possible the installation of a long tow over irregular terrain, including both vertical and horizontal changes in the course of the tow, and at a relatively small expense. They also provide a tow in which the skier never comes in direct contact with the main tow rope and in which the lead by which he is pulled is detachably connected to the main rope. As an example of what can be done in a tow embodying the present invention, the inventors have constructed and are operating a tow giving a ride of about one quarter of a mile in length and lifting the skiers about 300 feet.

While only one specific embodiment of the invention has been illustrated and described in detail herein, it will be readily appreciated by those skilled in the art that numerous modifications and changes may be made without departing from the spirit of the present invention.

What is claimed is:

1. A ski tow comprising a continuous main rope, a plurality of hangar elements for supporting said rope at spaced intervals along its course and each including a pair of pulley wheels mounted for rotation about spaced parallel axes and substantially in rolling contact with each other, said wheels having outer annular rubber portions having mating rope receiving grooves and providing lateral support for said rope, means for driving said rope, a plurality of leads including connector elements spaced laterally of said rope and including spaced fingers disposed at right angles to said rope and operable to engage said rope at opposite sides therof at points spaced therealong, said fingers being movable with said rope between said pulley wheels while operatively engaging said rope, and said leads including portions adapted to be engaged by a skier to be moved up the tow.

2. A lead connector for a ski tow having a main rope supported at a plurality of points along the course that skiers are to be moved by the tow, said connector comprising a body, a pair of spaced fingers on said body adapted to engage said rope at opposite sides thereof, and an arm connected to said body for pivotal movement about an axis so spaced from said fingers that a load applied to the free end of said arm produces a couple urging said fingers in a direction to grip said rope.

3. A lead connector as defined in claim 2, wherein said fingers and said axis are all substantially parallel.

4. A lead connector as defined in claim 2, wherein said fingers are substantially parallel to each other and perpendicular to said rope.

5. A lead connector as defined in claim 2, wherein said fingers are substantially parallel to each other and perpendicular to said rope and said axis is parallel to said fingers.

6. A lead connector as defined in claim 2, wherein said fingers are substantially parallel to each other and perpendicular to said rope and said axis is parallel to said fingers, and wherein one of said fingers is disposed to engage the upper side of said rope and said axis is spaced from said one of said fingers in a direction opposite from the other of said fingers.

7. A lead connector as defined in claim 2, wherein said fingers are substantially parallel to each other and perpendicular to said rope and said axis is parallel to said fingers and wherein one of said fingers is disposed to engage the upper side of said rope and said axis is spaced from said one of said fingers in a direction opposite from the other of said fingers and is spaced downwardly from the plane of said fingers.

8. A lead connector as defined in claim 2, wherein said fingers are substantially parallel to each other and perpendicular to said rope and said axis is parallel to said fingers and wherein one of said fingers is disposed to engage the upper side of said rope and said axis is spaced from said one of said fingers in a direction opposite from the other of said fingers and including a resilient element urging said arm to pivot upwardly in a direction away from said fingers.

9. A lead connector as defined in claim 2, wherein said fingers are disposed in the same plane and said arm is curved with its free end disposed substantially in a plane perpendicular to said plane of the fingers and through the portion of the fingers adapted to engage the rope.

10. A lead connector as defined in claim 2, wherein said arm is curved toward the portion of said fingers

adapted to engage said rope so that for any given position of pivotal movement of said arm about said axis, the free end of said arm will reach its low point, during pivotal movement of said connector about said rope, when said fingers are disposed substantially horizontally.

11. A lead connector as defined in claim 2, wherein the spacing between said fingers is such that in one rotative position of said connector, the connector may be moved toward said rope into, or away from said rope out of, a position in which said fingers overlie opposite sides of said rope.

12. A lead connector as defined in claim 2, wherein said fingers have oppositely facing arcuately shaped portions adapted to engage said rope and a stop mounted on said fingers for preventing movement of said rope relative to said fingers from said rope engaging portions thereof in a direction toward said connector.

13. A hanger for a ski tow having a main rope supported at a plurality of points along the course that the skiers are to be moved by the tow, said hanger comprising a supporting bracket open at one side, a pair of roller elements mounted for rotation in a common plane about spaced parallel axes and substantially in rolling engagement with each other, the peripheral portions of the rollers being formed of resilient material and having annular mating rope receiving grooves adapted to receive said main rope, said rolling engagement of said rollers being exposed at said open one side of said bracket.

14. A hanger as defined in claim 13, and including a guide supported on said bracket at said one side thereof and below the level of said rolling engagement of said roller elements, said guide extending generally at right angles to the plane of said axes and having one end portion deformed toward said common plane of said rolling elements.

15. A hanger as defined in claim 13, and including a second pair of rollers mounted for rotation about spaced parallel axes disposed parallel to and on opposite sides of the plane of said first named parallel axes and perpendicular to said first named axes, said second pair of rollers being disposed at the elevation of said rolling engagement of said first named rollers and with their peripheries tangent to said common plane.

16. A hanger as defined in claim 13, and including a second pair of rollers mounted on said bracket and disposed to support a rope received in said mating grooves and prevent lateral movement of said rope in one direction.

17. A hanger as defined in claim 13, and including a second pair of rollers mounted on said bracket and disposed to support a rope received in said mating grooves and prevent lateral movement of said rope in one direction, each of said second pair of rollers having its outer surface formed to define an annular rope receiving groove.

18. A hanger as defined in claim 13, and including a second pair of rollers mounted on said bracket and disposed to support a rope received in said mating grooves and prevent lateral movement of said rope in one direction, each of said second pair of rollers having a cylindrical rope engaging outer surface having a substantial axial extent to provide lateral support for the rope throughout the limits of its movement axially of said second pair of rollers.

19. A hanger for a ski tow having a main rope supported at a plurality of points along the course that the skiers are to be moved by the tow, said hanger comprising an inverted U-shaped bracket, a fixed shaft supported at its opposite ends on said bracket, a wheel rotatably mounted on said shaft, a fixed cantilever shaft supported on said bracket in spaced parallel relation to said first named shaft, a second wheel rotatably mounted on said cantilever shaft and disposed in the plane of said first named wheel, said wheels having resilient annular peripheral portions having mating annular grooves formed therein adapted to receive said rope.

20. A hanger for a ski tow having a main rope supported at a plurality of points along the course that the skiers are to be moved by the tow, said hanger comprising an inverted U-shaped bracket, a fixed shaft supported at its opposite ends on said bracket, a wheel rotatably mounted on said shaft, a fixed cantilever shaft supported on said bracket in spaced parallel relation to said first named shaft, a second wheel rotatably mounted on said cantilever shaft and disposed in the plane of said first named wheel, said wheels having resilient annular peripheral portions having mating annular grooves formed therein adapted to receive said rope and a guide arm fixed on the outer end of said cantilever shaft and extending generally perpendicular to the plane of said shafts with an end portion curved toward the plane of said wheels to extend under a rope supported in said hanger and disposed in said mating grooves.

21. A ski tow comprising a continuous main rope, means for supporting said rope at a plurality of points spaced along its course, means for driving said rope, a plurality of leads detachably connected to said main rope for movement therewith past said points, said leads having portions adapted to be engaged by a skier to be moved up the tow, said means for supporting said rope including a plurality of hangar elements each having a pair of roller elements mounted for rotation about spaced parallel axes and substantially in rolling engagement with each other, the peripheral portions of the rollers being formed of resilient material and having mating rope receiving grooves, and said leads including fingers extending generally at right angles to said rope and adapted to extend parallel to the axes of said rollers and movable between said rollers while engaging said rope.

22. A ski tow comprising a continuous main rope, means for supporting said rope at a plurality of points spaced along its course, means for driving said rope, a plurality of leads detachably connected to said main rope for movement therewith past said points, said leads having portions adapted to be engaged by a skier to be moved up the tow, said means for supporting said rope including a plurality of hangar elements each having a pair of roller elements mounted for rotation about spaced parallel axes and substantially in rolling engagement with each other, the peripheral portions of the rollers being formed of resilient material and having mating rope receiving grooves, said leads including fingers extending generally at right angles to said rope and adapted to extend parallel to the axes of said rollers and movable between said rollers while engaging said rope, and means on each of said hangar elements engageable with said leads to dispose the latter with said fingers extending substantially parallel with the axes of rotation of said rollers.

23. A ski tow comprising a continuous main rope, means for supporting said rope at a plurality of points spaced along its course, means for driving said rope, a plurality of leads detachably connected to said main rope for movement therewith past said points, said leads having portions adapted to be engaged by a skier to be moved up the tow, said means for supporting said rope including a plurality of pulley wheels spaced along the rope and said leads including fingers extending at right angles to and engaging said rope and adapted to extend substantially parallel to the axis of each of said rollers and movable with said rope past said rollers while engaging said rope.

24. A ski tow comprising a continuous main rope, means for supporting said rope at a plurality of points spaced along its course, means for driving said rope, a plurality of leads detachably connected to said main rope for movement therewith past said points, said leads having portions adapted to be engaged by a skier to be moved up the tow, each of said leads including a connector element having spaced fingers adapted to engage said rope at opposite sides thereof at spaced points therealong and an arm connected to said element for pivotal movement

about an axis so spaced from said rope and said fingers that a load applied to the free end of said arm produces a couple at the engagement between said fingers and said rope effecting a gripping of the latter by the former.

25. A ski tow comprising a continuous main rope, means for supporting said rope at a plurality of points spaced along its course, means for driving said rope, a plurality of leads detachably connected to said main rope for movement therewith past said points, said leads having portions adapted to be engaged by a skier to be moved up the tow, each of said leads including a connector element having a finger extending substantially at right angles to said rope and overlying and engaging the upper side of said rope, a second finger parallel to said finger spaced along said rope from said finger in the direction opposite the direction of movement of said rope and underlying and engaging the underside of said rope, and an arm connected to said element for pivotal movement about an axis spaced from said first named finger in the opposite direction.

26. A ski tow comprising a continuous main rope, means for supporting said rope at a plurality of points spaced along its course, means for driving said rope, a plurality of leads detachably connected to said main rope for movement therewith past said points, said leads having portions adapted to be engaged by a skier to be moved up the tow, each of said leads including a connector element having a finger extending substantially at right angles to said rope and overlying and engaging the upper side of said rope, a second finger parallel to said finger spaced along said rope from said finger in the direction opposite the direction of movement of said rope and underlying and engaging the underside of said rope, and an arm connected to said element for pivotal movement about an axis spaced from said first named finger in the opposite direction and spaced below the axis of said rope so that a load applied to the free end of said arm parallel to said rope will produce a couple at the engagement between said fingers and said rope to effect a gripping of the latter by the former.

27. A ski tow comprising a continuous main rope, means for supporting said rope at a plurality of points spaced along its course, means for driving said rope, a plurality of leads detachably connected to said main rope for movement therewith past said points, said leads having portions adapted to be engaged by a skier to be moved up the tow, each of said leads including a connector element having spaced fingers movable to be disposed at opposite sides of the rope and operable upon rotation of the connector element in one direction to grip the rope to prevent movement of the connector longitudinally of the rope, and an arm having one end pivotally connected to the connector element and effective when a load is applied to said element through said arm to urge said connector element to turn in said one direction to effect a gripping of said rope by said fingers.

28. A ski tow comprising a continuous main rope, means for supporting said rope at a plurality of points spaced along its course, means for driving said rope, a plurality of leads detachably connected to said main rope for movement therewith past said points, said leads having portions adapted to be engaged by a skier to be moved up the tow, each of said leads including a connector element having spaced fingers adapted to engage said rope at opposite sides thereof and rotatable between a first position in which said connector element is movable laterally relative to said rope for attaching the lead to and removing it from the rope, and a second position in which said fingers engage said rope tending to kink the latter and preventing slipping of the connector element longitudinally of the rope, and an arm pivotally connected to said connector element for urging it toward said second position.

29. A ski tow comprising a continuous main rope, means for supporting said rope at a plurality of points spaced along its course, means for driving said rope, a plurality of leads detachably connected to said main rope for movement therewith past said points, said leads having portions adapted to be engaged by a skier to be moved up the tow, each of said leads including a connector element having spaced fingers adapted to engage said rope at opposite sides thereof and rotatable between a first position in which said connector element is movable laterally relative to said rope for attaching the lead to and removing it from the rope, and a second position in which said fingers engage said rope tending to kink the latter and preventing slipping of the connector element longitudinally of the rope, and an arm pivotally connected to said connector element for urging it toward said second position, and including means for automatically rotating said connector elements to said first position and moving them laterally away from said rope to detach said leads from said rope.

30. A ski tow comprising a continuous main rope, means for supporting said rope at a plurality of points spaced along its course, means for driving said rope, a plurality of leads detachably connected to said main rope for movement therewith past said points, said leads having portions adapted to be engaged by a skier to be moved up the tow, each of said leads including a connector element having spaced fingers adapted to engage said rope at opposite sides thereof and rotatable between a first position in which said connector element is movable laterally relative to said rope for attaching the lead to and removing it from the rope, and a second position in which said fingers engage said rope tending to kink the latter and preventing slipping of the connector element longitudinally of the rope, and an arm pivotally connected to said connector element for urging it toward said second position, and including means for automatically rotating said connector elements to said first position and moving them laterally away from said rope to detach said leads from said rope, said last named means comprising means defining a guide passage and a guide follower carried by said connector element movable along said passage, said passage including a portion co-operable with said guide follower upon movement of the latter therealong to pivot said connector element to said first position, and a second portion co-operable with said guide follower upon movement of the latter therealong to move the connector element laterally away from said rope.

31. A ski tow comprising a continuous main rope, means for supporting said rope at a plurality of points spaced along its course, means for driving said rope, a plurality of leads detachably connected to said main rope for movement therewith past said points, said leads having portions adapted to be engaged by a skier to be moved up the tow, each of said leads including a connector element having spaced fingers adapted to engage said rope at opposite sides thereof and rotatable between a first position in which said connector element is movable laterally relative to said rope for attaching the lead to and removing it from the rope, and a second position in which said fingers engage said rope tending to kink the latter and preventing slipping of the connector element longitudinally of the rope, and an arm pivotally connected to said connector element for urging it toward said second position, and including means disposed along the return course of the rope adjacent said means for driving the rope for automatically removing said leads from said rope and comprising a ball mounted on a rod secured to said connector element and disposed above said fingers and spaced along said connector element in the direction of movement of said rope from said fingers, and a tube of an internal diameter to freely receive said ball and having a slot at its bottom through which said rod may pass freely, said tube having a first portion extending along said rope in position to receive said ball in the open end thereof as said connector element is

carried along said rope and curving upwardly away from the rope for co-operating with said ball to rotate said connector element to said first position, and said tube having a second portion curving laterally away from said rope for co-operating with said ball to move said connector element laterally away from the rope to detach it therefrom.

32. A ski tow comprising a continuous main rope, means for engaging and supporting said rope at a plurality of points spaced along its course, means for driving said rope, a plurality of leads detachably connected to said main rope for movement therewith past said points, each of said leads including a portion adapted upon movement of the lead past one of said points to move between said means and a portion of the rope engaged thereby, each of said leads also being movable relative to said rope between a first position in which it firmly grips said rope for movement therewith and a second position in which it is disengaged from said rope, said leads having portions adapted to be engaged by a skier to be moved up the tow.

33. A ski tow comprising a continuous main rope, means for supporting said rope at a plurality of points spaced along its course, means for driving said rope, a plurality of leads detachably connected to said main rope for movement therewith past said points, each of said leads being movable relative to said rope between a first position in which it firmly grips said rope for movement therewith and a second position in which it is disengaged from said rope, said leads having portions adapted to be engaged by a skier to be moved up the tow, each of said leads normally remaining in said first position, and means adjacent said second named means for automatically moving said leads to said second position and removing said leads from said rope so that said leads are automatically returned to the vicinity of said second named means and there removed from said rope.

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