Sept. 20, 1971 D. PAUL 3,606,161

SELF-PROPELLED SPRINKLING APPARATUS AND SAFETY MEANS THEREFOR

Filed April 10, 1969 2 Sheets-Sheet 1

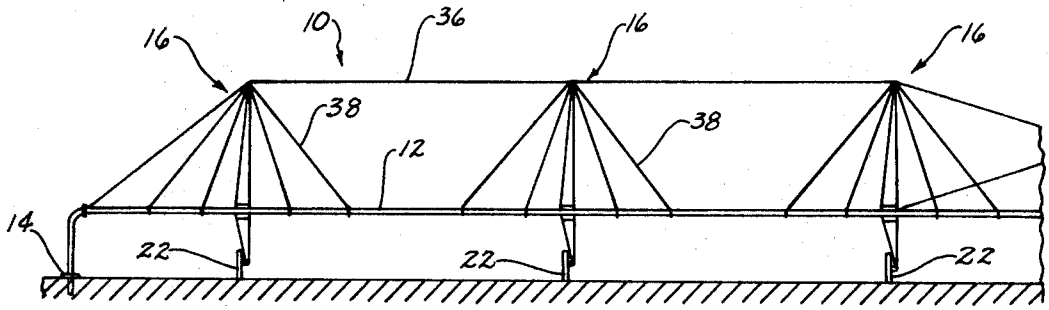

Fig. 1

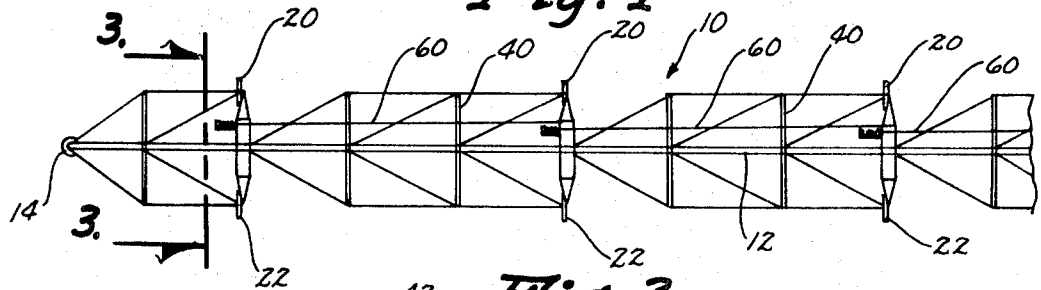

Fig. 2

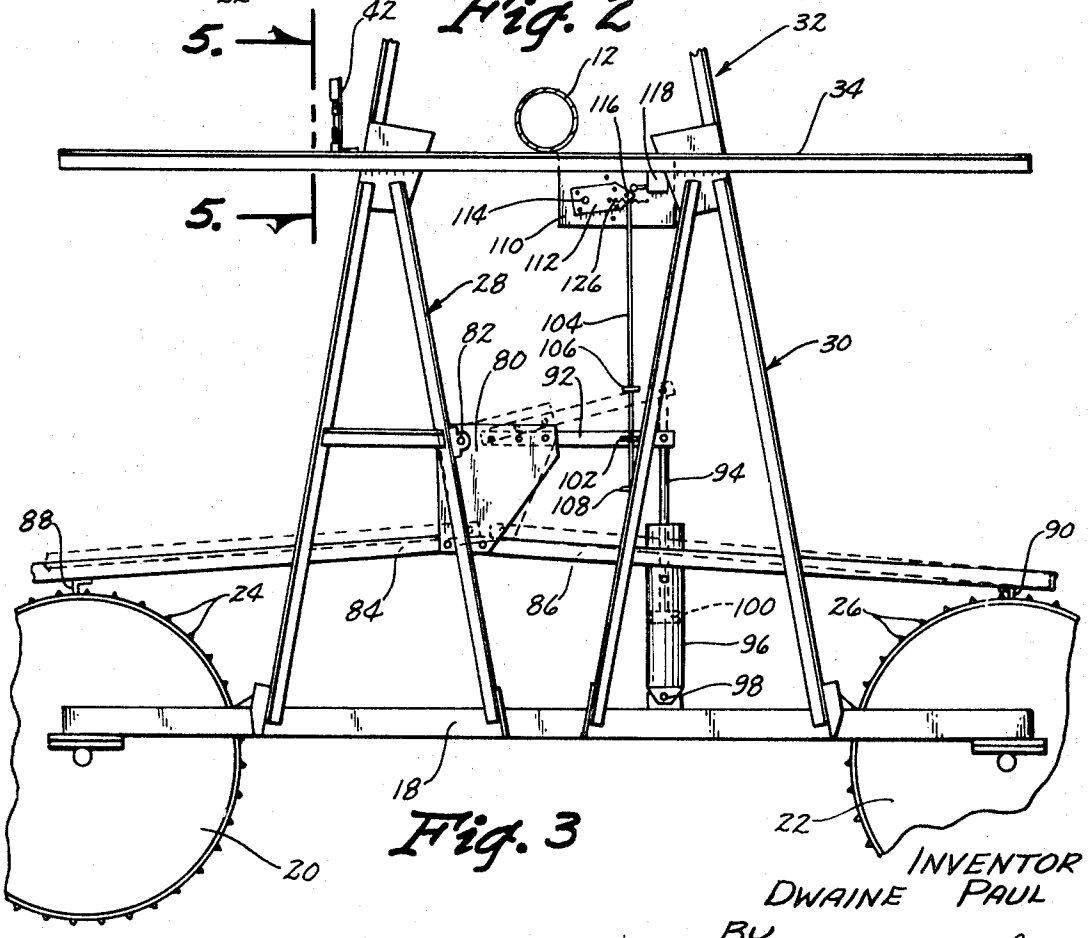

Fig. 3

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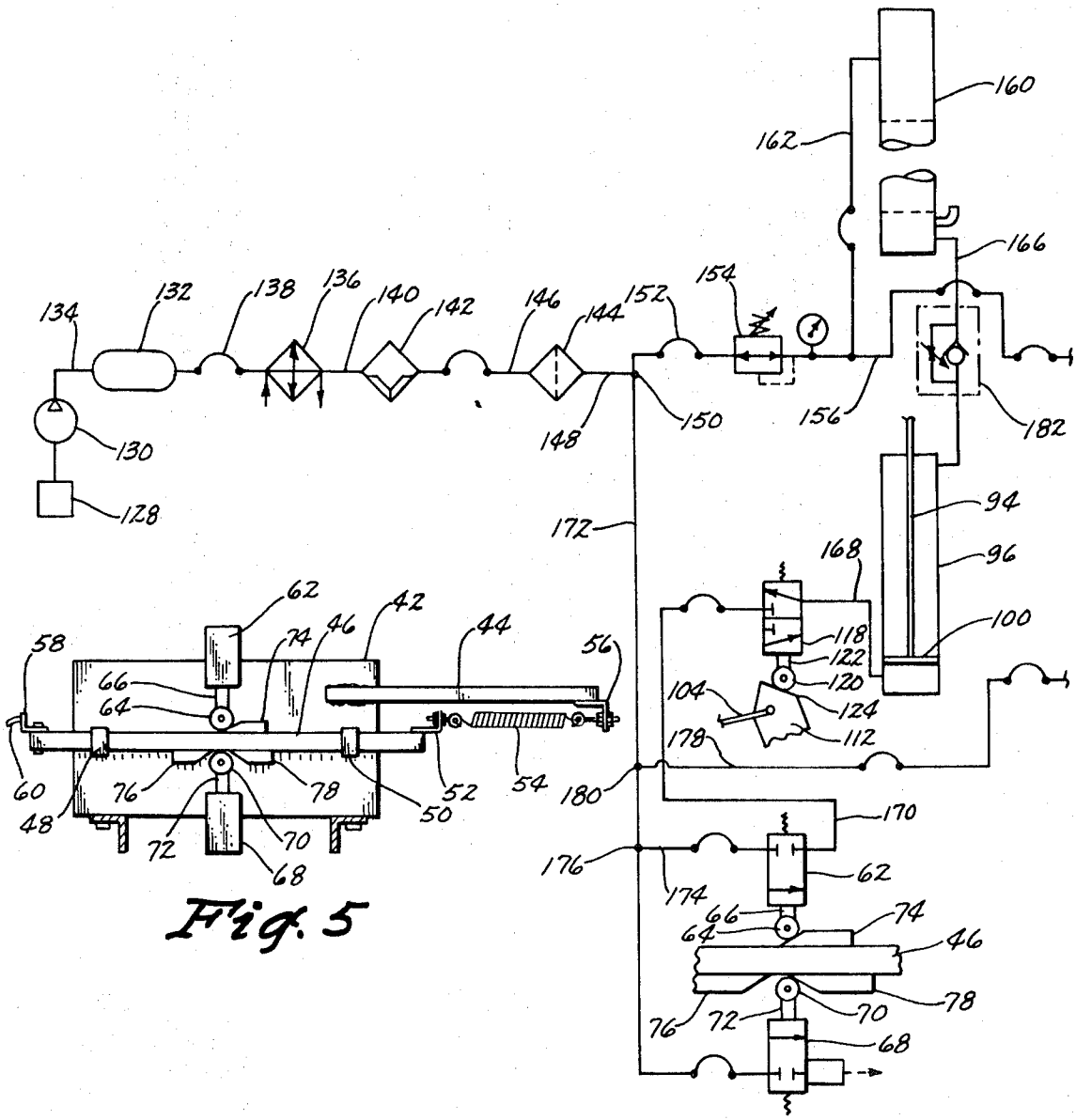

Fig. 5

Fig. 4

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SELF-PROPELLED SPRINKLING APPARATUS AND SAFETY MEANS THEREFOR

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U.S. Cl. 239—177 2 Claims

ABSTRACT OF THE DISCLOSURE

A self-propelled sprinkling apparatus for sprinkling or irrigating a relatively large area surrounding a central pivot point. A water supply pipe extends outwardly from the central pivot point and is supported by a plurality of spaced apart, wheeled towers. An air operated drive means is provided on each of the towers to propel the towers and pipe around the central pivot point. A control means is provided on each of the towers and is interconnected with each of the other towers to selectively operate the drive means associated therewith to maintain the pipe and towers in an aligned condition as the water supply pipe is pivoted around the central pivot point. A safety valve is provided in the air circuit on each of the towers to de-activate the drive means on all of the towers upon one of the towers becoming out of alignment with the other towers to prevent structural damage to the apparatus.

This invention pertains to a self-propelled sprinkling apparatus and more particularly to a safety means for de-activating the sprinkling apparatus upon one of the towers thereof becoming out of alignment with the other towers of the system.

It has been found to be economically feasible to irrigate large areas of land through the use of a long water pipe extending from a central pivot point and being supported by a plurality of driven towers which are spaced apart along the length thereof. Means have been provided on systems of this type to maintain the towers and supply pipe in an aligned condition as the pipe and towers are pivoting around the central pivot point. The alignment systems presently available are less than satisfactory due to the inability of the same to de-activate the entire system in the event that one of the towers becomes drastically out of alignment with respect to the other towers. When one of the towers does become out of major alignment with the other towers, the result is that the supply pipe, towers, cables, etc. are subjected to structural damage.

Therefore, it is a principal object of this invention to provide a self-propelled sprinkling apparatus and safety means therefor.

A further object of this invention is to provide a self-propelled sprinkling apparatus including means to de-activate the entire apparatus when one of the towers thereof becomes out of alignment with the remaining towers.

A further object of this invention is to provide a self-propelled sprinkling apparatus and safety means therefor which prevents structural damage to the associated equipment.

A still further object of this invention is to provide a self-propelled sprinkling apparatus which is efficient in operation.

A still further object of this invention is to provide a self-propelled sprinkling apparatus and safety means therefor including an elongated water supply pipe supported by a plurality of spaced apart towers which are driven by a compressed air system.

A further object of this invention is to provide a self-propelled sprinkling apparatus and safety means therefor which maintains the water supply pipe in an aligned condition during the sprinkling operation.

A still further object of this invention is to provide a self-propelled sprinkling apparatus and safety means therefor which is relatively maintenance free.

A still further object of this invention is to provide a self-propelled sprinkling apparatus and safety means therefor which is economical of manufacture, durable in use and refined in appearance.

These and other objects will be apparent to those skilled in the art.

This invention consists in the construction, arrangments, and combination of the various parts of the device, whereby the objects contemplated are attained as hereinafter more fully set forth, specifically pointed out in the claims, and illustrated in the accompanying drawings in which:

FIG. 1 is a side elevational view of a portion of the apparatus illustrating the water supply pipe being supported by a plurality of spaced apart towers;

FIG. 2 is a top view of the apparatus of FIG. 1;

FIG. 3 is an enlarged fragmentary sectional view as seen along lines **3—3**, the broken lines indicating the movement of the drive means;

FIG. 4 is a schematic view of the air circuit of this invention; and

FIG. 5 is a side elevational view of the alignment plate of this invention and the structure mounted thereon.

The sprinkling apparatus of this invention is generally designated by the reference numeral **10** in FIGS. 1 and 2 and includes a water supply pipe **12** extending outwardly from a central pivot point **14** and being in communication with a source of water under pressure. The pipe **12** is comprised of a plurality of tubular sections suitably connected together in an end to end relationship and supported by a plurality of towers **16**. Each of the towers **16** generally consist of a horizontal frame means **18** having drive wheels **20** and **22** rotatably mounted at the opposite ends thereof as illustrated in FIG. 3. Wheels **20** and **22** are provided with a plurality of driving lugs **24** and **26** mounted on the periphery thereof respectively. A frame means **28** is secured to frame means **18** adjacent wheel **20** and extends upwardly therefrom while a frame means **30** is secured to frame means **18** and extends upwardly therefrom adjacent wheel **22**. A frame **32** extends upwardly from the upper ends of frames **28** and **30** while a frame member **34** extends horizontally from the lower end thereof as seen in FIG. 3. The pipe **12** is supported on the frame member **34** as best seen in FIG. 3.

The upper ends of each of the towers **16** are interconnected by a cable means **36** extending therebetween as illustrated in FIG. 1. Each of the towers **16** also has a plurality of support cables **38** extending from the top thereof down to the pipe **12** as illustrated in FIG. 1. As illustrated in FIG. 2, a plurality of support arms **40** are secured to pipe **12** along the length thereof and extend transversely to the longitudinal axis of the pipe **12**. The arms **40** are operatively interconnected by a suitable cable means and are also connected to the pipe **12** by a suitable cable means to provide the necessary strength to the apparatus.

Each of the towers **16** is provided with an alignment plate **42** mounted on the frame member **34**. Alignment plate **42** has an arm **44** secured at one end thereof by welding or the like and extending therefrom as illustrated in FIG. 5. A cam bar **46** is movably mounted on the plate **42** by means of sleeves **48** and **50** as illustrated in FIG. 5. A bracket **52** is mounted on one end of the cam bar **46** and has one end of a spring means **54** adjustably secured thereto. The other end of the spring means **54** is adjustably connected to a bracket **56** which is mounted on the outer

end of the member **44**. A bracket **58** is mounted on the other end of cam bar **46** and has an alignment cable **60** secured thereo. Alignment cable **60** extends from bracket **58** to the tower **16** which is positioned adjacent thereto in an outward direction therefrom with respect to the central pivot point **14**. As seen in FIG. 2, each of the towers has an alignment plate mounted thereon, the cam bar of which is operatively connected to the next adjacent tower by the alignment cable **60**. As illustrated in FIG. 5, a valve **62** is mounted on the plate **42** and has a roller **64** rotatably mounted on one end of a plunger **66** which extends from the valve **62**. A valve **68** is mounted on the alignment plate **42** and has a roller **70** rotatably mounted on the outer end of the plunger **72** which extends therefrom. Cam bar **46** is provided with a cam **74** mounted on the upper end thereof and a pair of spaced apart cams **76** and **78** mounted on the lower end thereof. The movement of the cam bar **46** towards the left as viewed in FIG. 5 will cause roller **64** to engage the cam **74** which causes the plunger **66** to move into the valve **62**. Sufficient movement of the cam bar **46** in either direction as viewed in FIG. 5 will cause the plunger **72** to be moved into valve **68** due to the engagement of the roller **70** with either of the cams **76** or **78**.

A plate **80** is pivotally secured to frame means **28** at **82** and has a pair of drive arms **84** and **86** pivotally secured to the lower end thereof and extending outwardly therefrom as viewed in FIG. 3. The outer ends of drive arms **84** and **86** are provided with driving lugs **88** and **90** thereon respectively which are adapted to engage the lugs **24** and **26** respectively to cause the wheels **20** and **22** to be rotated in a predetermined direction upon the pivotal movement of the plate **80**. A bar **92** is secured to plate **80** and extends outwardly therefrom as viewed in FIG. 3. The outer end of bar **92** is pivotally connected to the upper end of a cylinder rod **94** which extends upwardly and outwardly of a cylinder **96** pivotally connected to frame **18** at **98**. The numeral **100** generally designates a piston provided at the lower end of the cylinder rod **94**. Bar **92** is provided with an ear **102** secured to one side thereof which slidably receives a rod **104** extending therethrough. Rod **104** is provided with stops **106** and **108** mounted thereon in a spaced apart condition and engageable by the ear **102** to cause the vertical movement of the rod **104** in an upward direction as cylinder rod **94** is extended from the cylinder **96** and in a downward direction when the cylinder rod **94** is retracted in the cylinder **96**. A plate **110** is mounted on the tower **16** above the bar **92** and has a a cam **112** pivotally mounted thereon. Cam **112** is pivotal about point **114** and has the upper end of the rod **104** pivotally connected thereto at **116**. A valve **118** is mounted on the plate **110** and has a roller **120** rotatably mounted on the outer end of a plunger **122** extending therefrom. As best seen in FIG. 4, roller **120** is in engagement with cam surface **124** of cam **112**. The upward movement of rod **104** causes cam **112** to be pivoted in a counter-clockwise direction as viewed in FIG. 3 which causes the plunger **122** to be moved into the interior of valve **118**. A spring means **126** extends between the plate **110** and the cam **112** to yieldably resist the counter-clockwise pivotal movement of the cam **112** as viewed in FIG. 3.

Water under pressure is supplied to the interior of pipe **12** at the central pivot point **14** and would be sprinkled on the area to be irrigated through conventional sprinkler heads provided along the length of the pipe **12**. In FIG. 4, the numeral **128** generally refers to a power source providing the necessary power to an air compressor **130**. Air compressor **130** is connected to a suitable air tank **132** by a line **134**. Tank **11** is connected to a cooling coil unit **136** by a line **138** and a line **140** connects unit **138** to a moisture trap **142**. Trap **142** is connected to a filter **144** by a line **146**. Line **148** extends from filter **144** to a T connection **150**. Line **152** connects connection **150** with a regulator **154** while line **156** connects regulator **154** with tanks **160** which are provided on each of the towers **16**. The upper end of tank **160** is connected to line **156** by a line **162**. It should be noted that a tank **160** will be provided on each of the towers **16** as will the remaining structure of FIG. 4 which is yet to be described. The lower end of tank **160** is connected to the exhaust port of the cylinder **96** or by a line **166**. Cylinder **96** is connected to valve **118** by a line **168** extending therefrom at a point below the piston **100**. Valve **118** is connected to valve **62** by a line **170** as viewed in FIG. 4. A line **172** extends from the T connection **150** to valve **68** and which is exhaustible to the atmosphere as will be described later. A line **174** connects valve **62** with the line **172** at **176** while a line **178** extends from line **172** at **180** to the control apparatus on the other towers **16**. For all practical purposes, line **152** extending from connection **150** may be best described as a low pressure line while the line **178** extending from connection **180** may best be described as a high pressure line. If desired, an optional flow control means **182** may be provided as illustrated in FIG. 4.

The operation of the apparatus is as follows. Water is supplied through the pipe **12** to the various sprinkler heads provided thereon and compressed air is furnished to the tank **132** from the compressor **130**. The air is piped to the tank **132** thence through the cooling coil **136** and thence into the moisture trap **142**. The air is then filtered through the filter **144** and supplied to the T connection **150**. The T connection **150** would be provided at the No. **1** tower, that is the tower closest to the central pivot point, to permit the compressed air to pass through a regulator **154** and thence onto the tank **160** which is pressurized to a predetermined static pressure set at the regulator **154**. The recommended static pressure in the tank **60** is 15 to 18 p.s.i. Each of the tanks **160** in the entire system are interconnected with each other by means of the low pressure line **156**. The lower portion of the tank **160** is in operative communication with the exhaust port of the cylinder **96**. At each tower, the high pressure line **172** is connected to the alignment valve **62** and to the safety valve **68** as previously described. Valve **62** is actuated by the cam **74** on the bar **46** while valve **68** is actuated by either of the cams **76** and **78** on the bar **46**. The cam bar **46** is mechanically actuated by the cable **60** and by the spring means **54** depending upon the individual tower's relative alignment within the total sprinkler system. When bar **46** causes valve **62** to open, compressed air travels through line **170** to valve **118** which is actuated by the cam **112** operatively connected to the piston rod of cylinder **96**. When valve **118** is open, the compressed air is permitted to travel to the inlet port of the cylinder **96** forcing the piston rod **94** upwardly. When the piston rod **94** has reached its maximum vertical travel, the mechanical linkage connected to the piston rod **94** closes valve **118**.

When valve **118** closes, it exhausts the compressed air in the power side of the cylinder **96** thereby allowing the pre-set static pressure in tank **160** to return the piston in cylinder **96** to the retracted position. This action, through the mechanical linkage connected to the piston rod **96** opens the valve **118** at the lower extreme of the piston travel and the cycle is repeated. The movement of the piston rod **94** causes bar **92** to pivot the plate **80** which in turn moves the drive arm to cause tht wheels **20** and **22** to be rotated in the proper direction. At such time as the respective tower regains its alignment, valve **62** is moved to the closed position by the movement of the cam bar **46**. As valve **62** closes, the stroking of the cylinder **96** is stopped. If, for any reason, the tower is unable to maintain its proper alignment, whether ahead or behind its proper relative position, and as its position becomes more critical from the standpoint of possible structural damage, the cam bar **46** moves further in a relative direction until valve **68** is opened by one of the cams **76** or **80**. When valve **68** is opened, the pressure in the system is

bled off into the atmosphere. As the pressure drops to a predetermined level it actuates a pressure sensitive switch which in turn de-activates the power source **128** which furnishes power to the air compressor. The pressure sensitive switch and the electrical circuit are of conventional design and are not illustrated herein for purposes of conciseness. As the system pressure drops and the power source is de-activated, the sprinkler system comes to a stop thereby preventing any mechanical and structural damage to any portion of the associated equipment.

Thus it can be seen that a unique self-propelled sprinkling apparatus has been provided and more particularly a safety valve means for the system which de-activates the entire system in the event that one of the towers cannot maintain its proper position relative to the towers of the system. Thus it can be seen that the apparatus accomplishes at least all of its stated objectives.

Some changes may be made in the construction and arrangement of my self-propelled sprinkled apparatus and safety means thertfor without departing from the real spirit and purpose of my invention, and it is my invention to cover by my claims, any modified forms of structure or use of mechanical equivalents which may be reasonably included within their scope.

I claim:

1. A self-propelled sprinkling apparatus, comprising,

a water supply pipe movable about a central pivot point,

means supplying water to said supply pipe, a plurality of spaced apart, wheeled towers supporting said supply pipe above the area to be sprinkled,

an air operated drive means on each of said towers to propel said towers and said supply pipe about said central pivot point, each of said drive means including a control means to cause said drive means to be operated, the control means on each of said towers being operatively interconnected whereby the drive means on each of said towers will be selectively driven to maintain said supply pipe in an aligned condition as said supply pipe is moved about said pivot point,

a source of compressed air connected to each of said drive means for powering the same,

each of said control means including a safety valve means which is exhaustable to the atmosphere to de-activate all of said drive means on said towers upon said tower becoming out of alignment a predetermined amount relative to the other towers,

an alignment cable extending from the control means on one tower to the tower next adjacent thereto,

said drive means including a hydraulic cylinder means having its piston rod operatively connected to a pivotal arm means adapted to cause the rotation of the wheel means on said tower,

said control means including a first valve means adapted to cause said hydraulic cylinder means to stroke at a predetermined rate, said first valve means being operatively connected to said alignment cable, said first valve means being closed when the tension in said alignment cable is at a predetermined amount and being opened to active said hydraulic cylinder means and to cause said wheel means to be rotated when

the tension in said alignment cable reaches another predetermined level,

said drive and control means including a tank having a static pressure therein, a first line connecting said tank with said source of compressed air, a hydraulic cylinder means having inlet and exhaust ports, a second line connecting said tank and exhaust port of said hydraulic cylinder means, a third line connecting said inlet port of said hydraulic cylinder means and one side of said first valve means, an alignment valve, a fourth line connecting one side of said alignment valve and the other side of said first valve means, a fifth line connecting said first line and the other side of said alignment valve, a sixth valve connecting said fifth line and said safety valve means,

said first valve means having a plunger means extending therefrom which is movable with respect thereto by a pivotal first cam means, said first valve means being opened when said plunger means is extended therefrom an being closed when said plunger means is retracted thereinto,

said hydraulic cylinder having a piston rod extending upwardly therefrom, the upper end of said piston rod being pivotally connected to said first cam means to open and close said first valve means.

2. The apparatus of claim **1**, wherein a cam bar is horizontally movably mounted on a support means, one end of said cam bar being connected to said alignment cable, the other end of said cam bar having a resilient means connected thereto to yieldably resist the movement of said cam bar in one direction, said safety valve means having a plunger means extending therefrom, said alignment valve and said safety valve means being positioned adjacent said cam bar so that the plungers extending therefrom are positioned adjacent a cam means on said cam bar, said cam means on said cam bar including a first cam adapted to engage the plunger of said alignment valve to open said alignment valve when the cam bar is moved in a second direction by the alignment cable and to close the alignment valve when the said resilient means moves the cam bar in said one direction, said cam mans on said cam bar also including a second cam means on said cam bar also including a second cam adapted to engage the plunger of said safety valve means and to exhaust the same to the atmosphere when said cam bar is moved in a predetermined amount in either of said directions.

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U.S. Cl. X.R.

137—344; 180—66