United States Patent

Blanchet et al.

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[54] **PIPE TENSIONING UNIT**

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[52] **U.S. Cl.** **226/108**, 226/172, 226/195, 226/177

[51] **Int. Cl.** **B65h 17/24**, B65h 25/22

[58] **Field of Search**..................226/195, 188, 108, 172, 176, 226/177; 61/72.3

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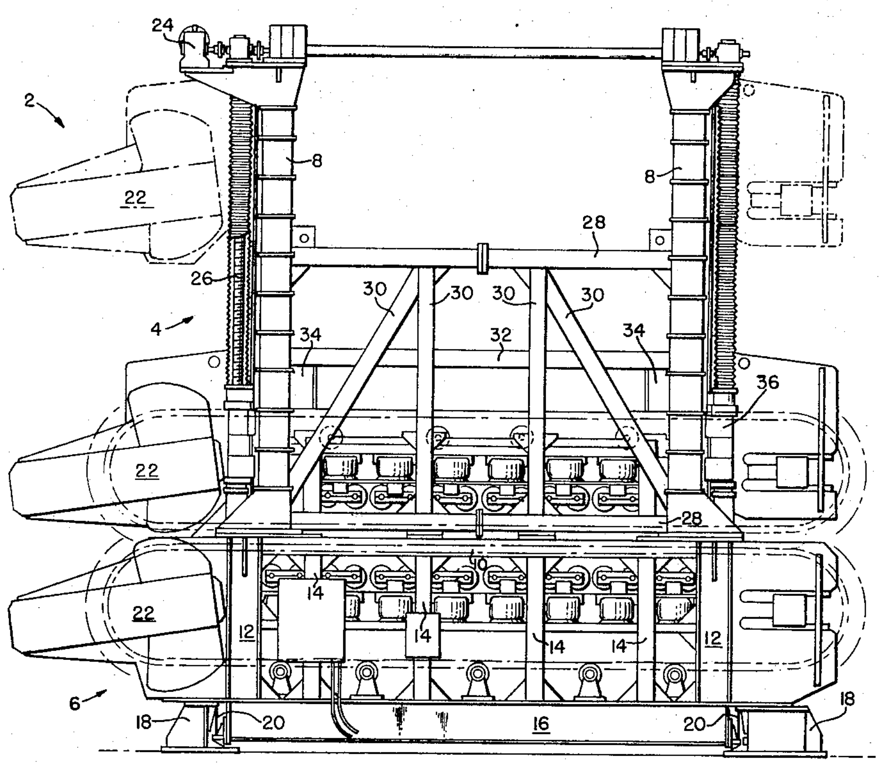
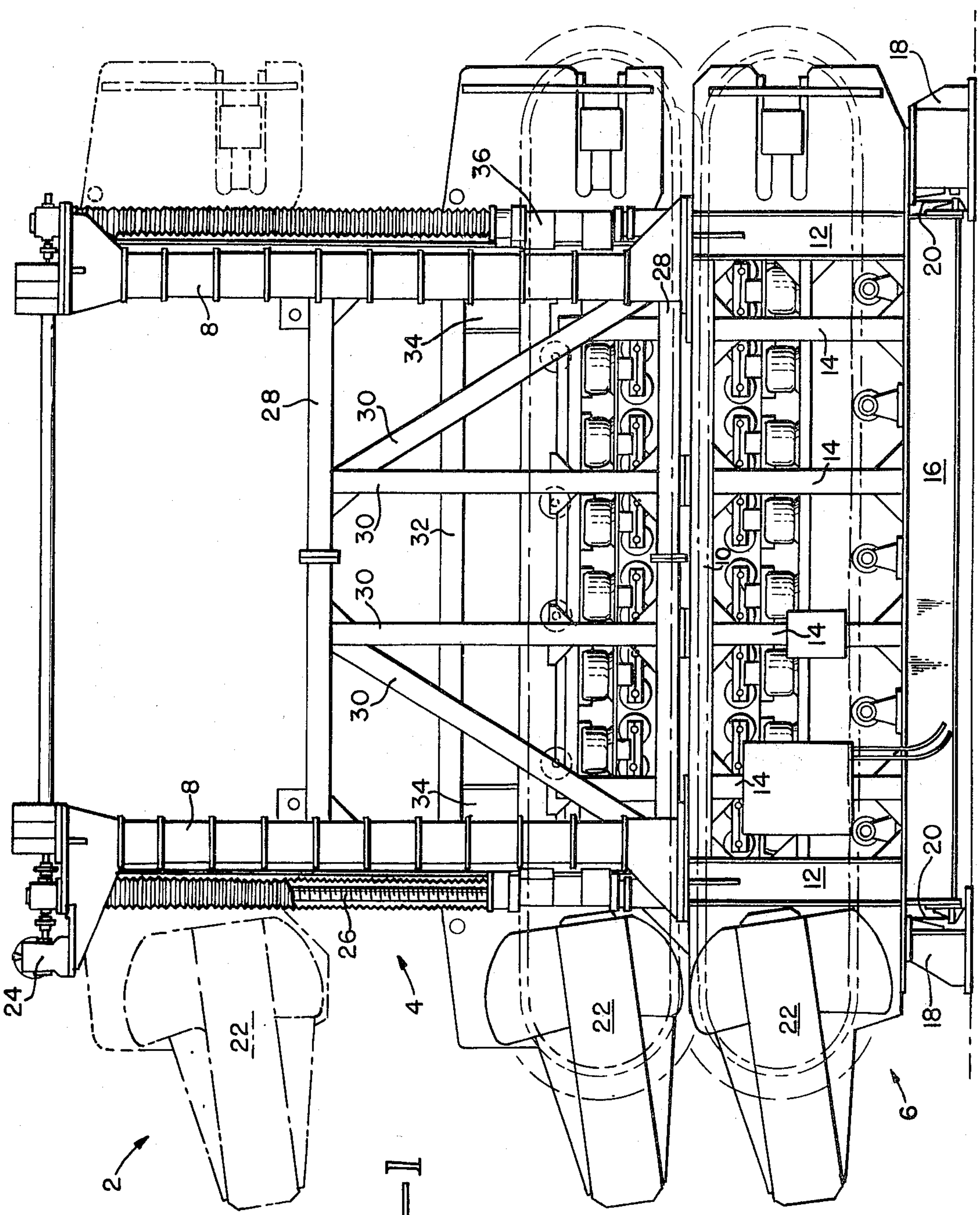
[57] **ABSTRACT**

Apparatus for laying offshore pipelines including a pipe tensioning device for maintaining a constant tension and thereby an optimum catenary upon the pipe during the laying thereof including a pair of pipe-engaging, opposed caterpillar type tractor units operable to impart continuously effective, longitudinally applied forces to the pipe line extending from the apparatus into the body of water and resting upon the bottom.

8 Claims, 10 Drawing Figures





FIG—I

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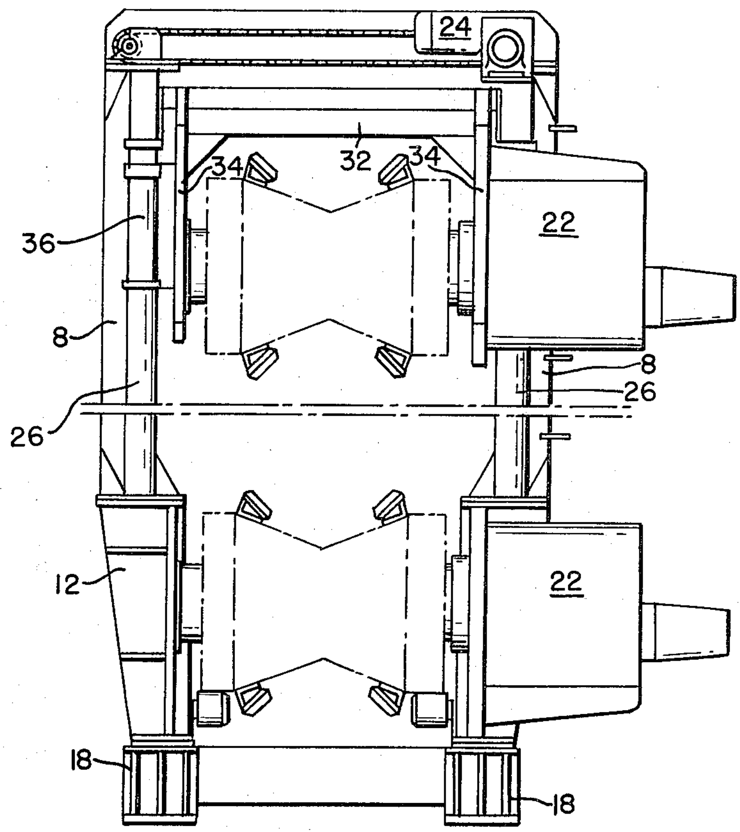
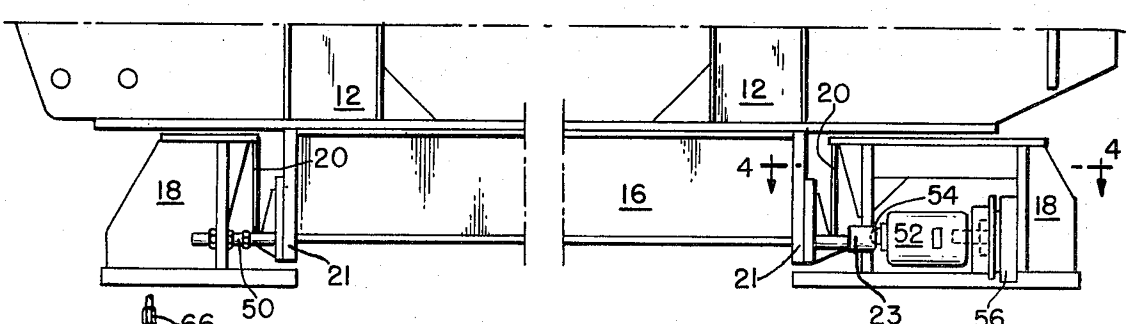
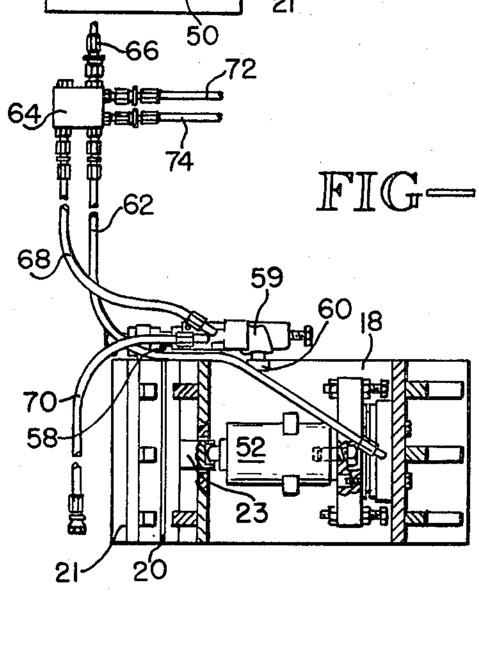


FIG—2



FIG—3



FIG—4

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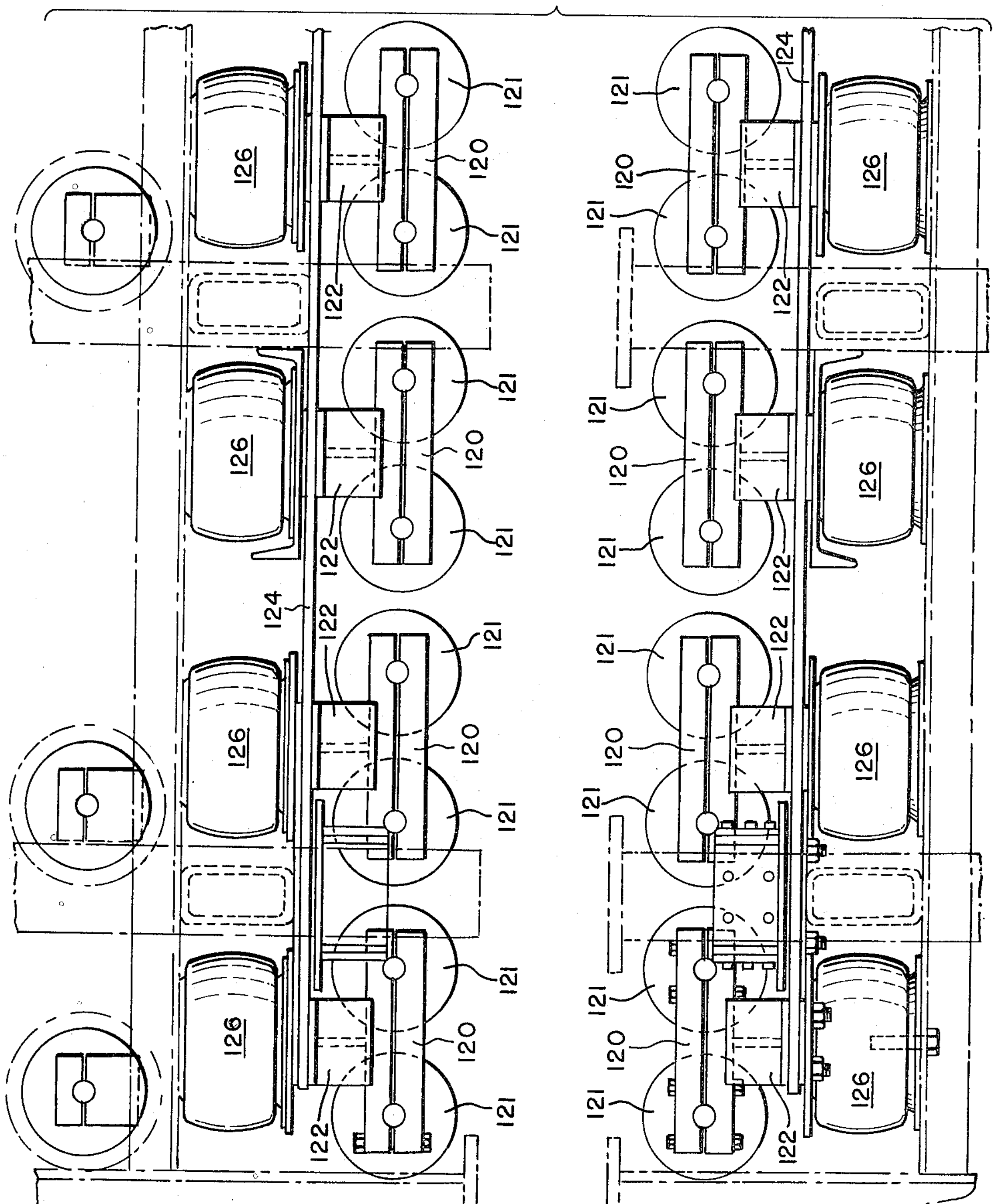

FIG—5

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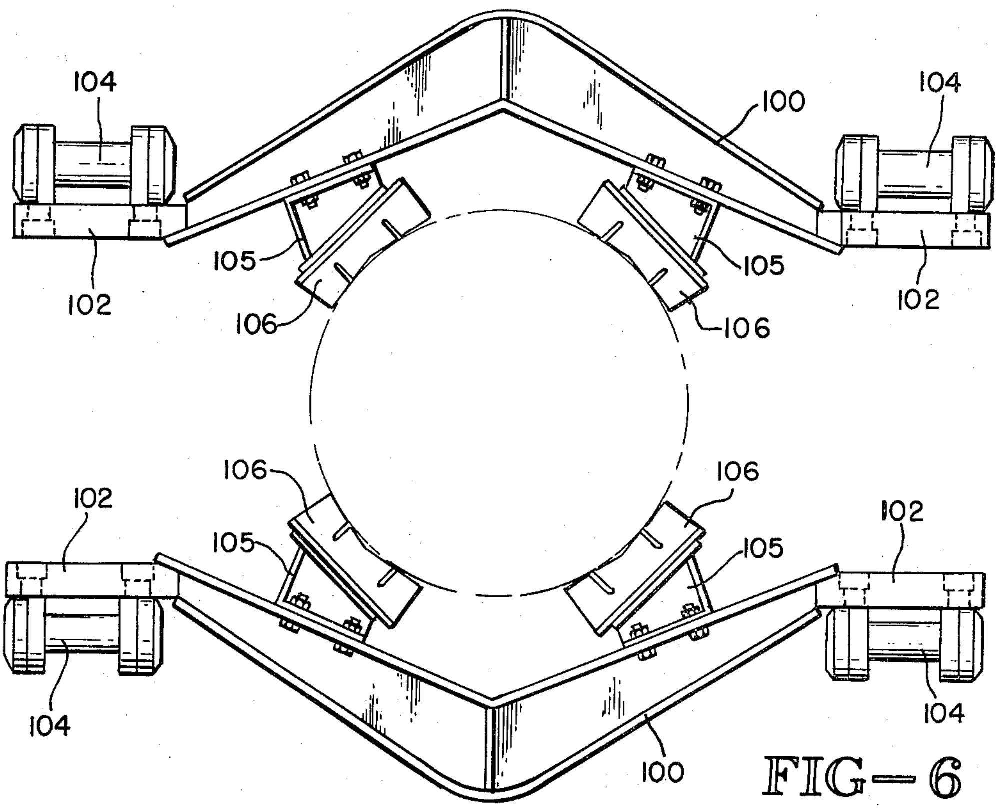
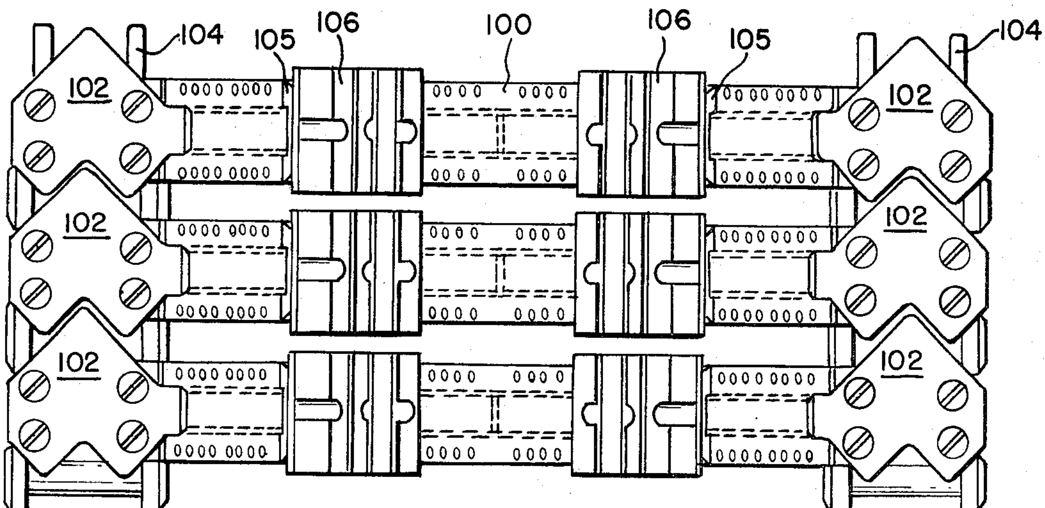
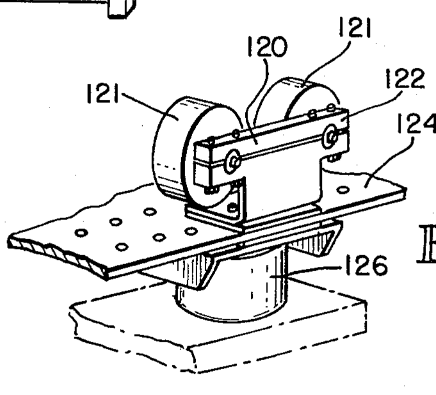


FIG—6



FIG—7



FIG—8

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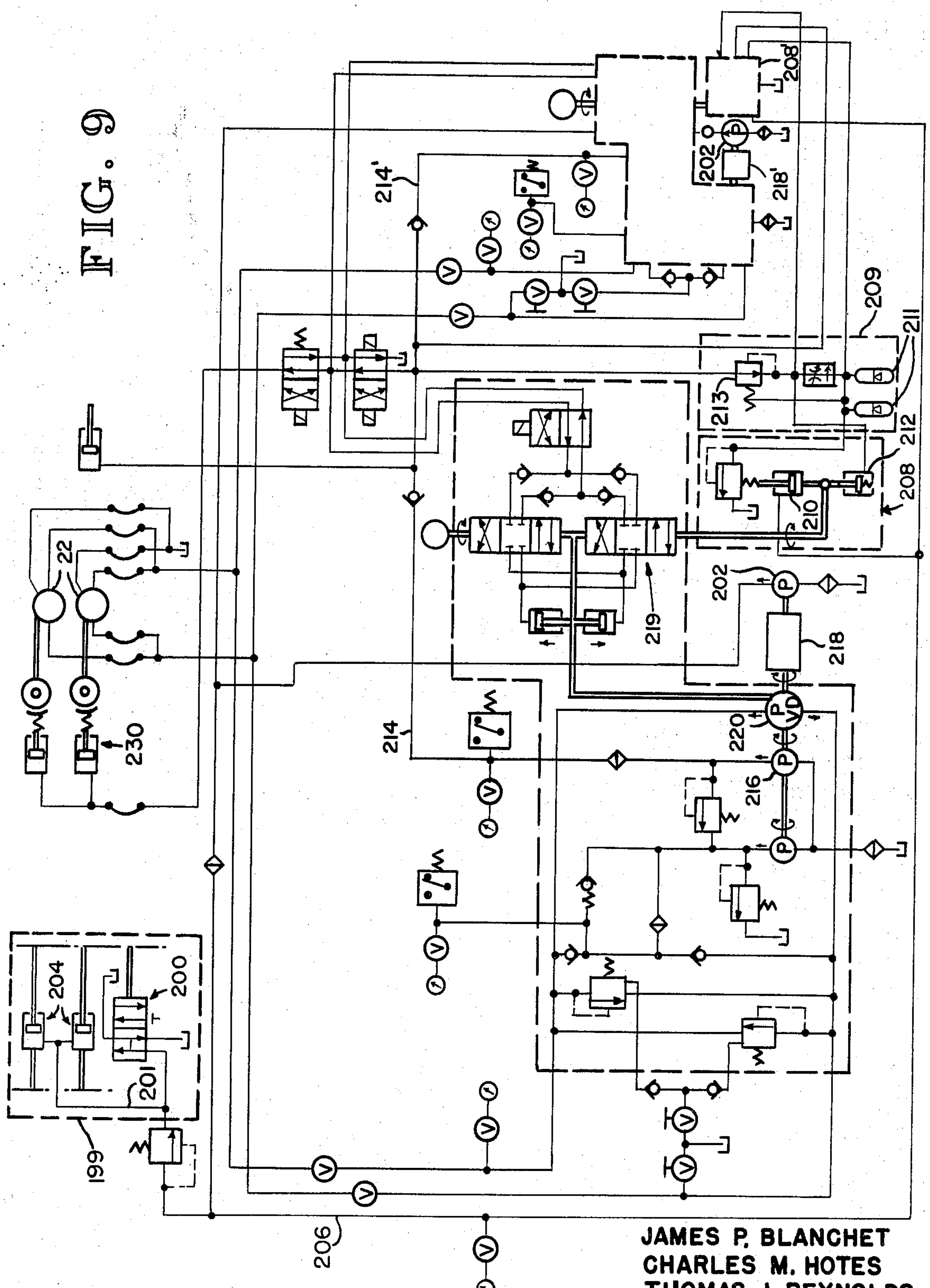

FIG. 9

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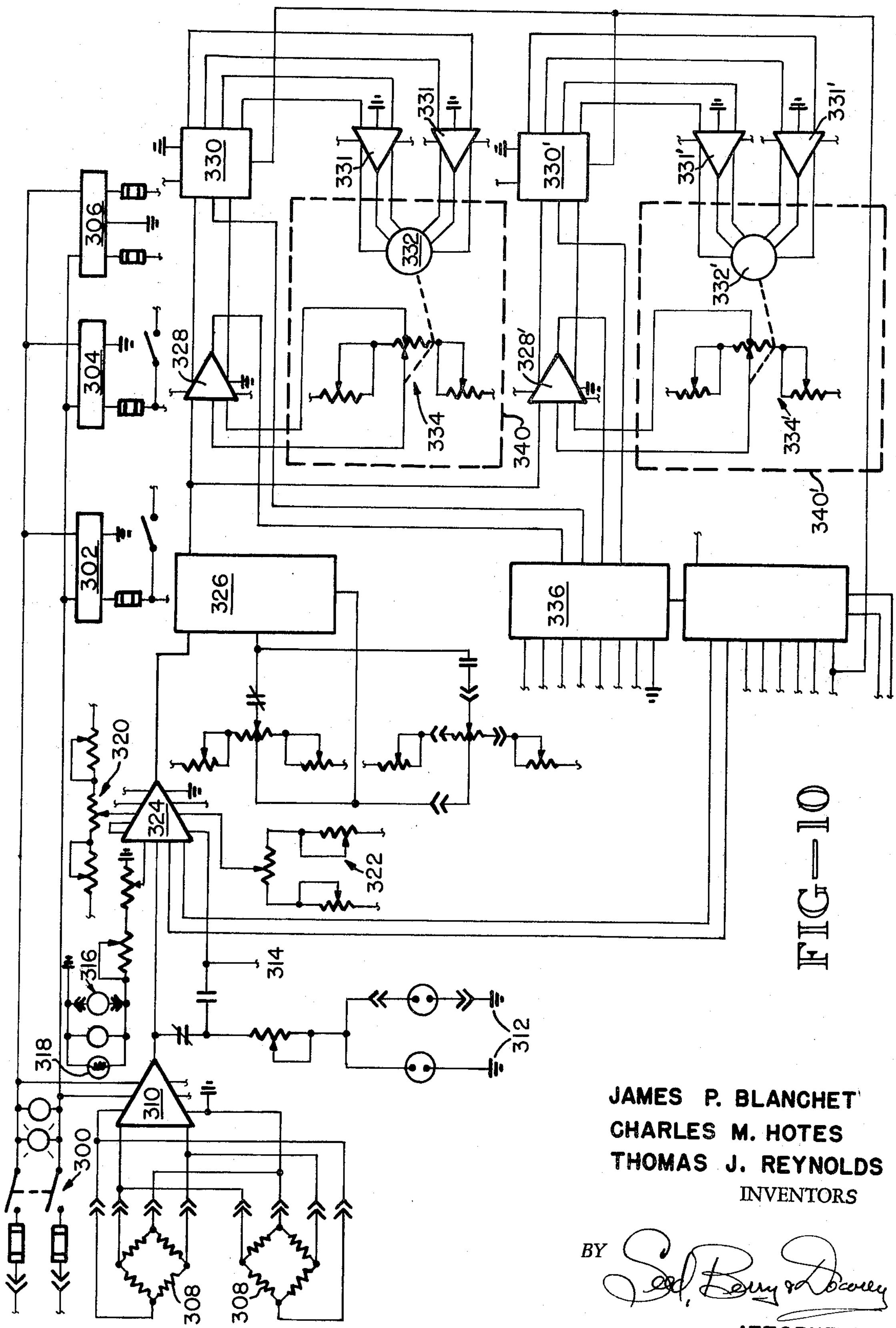

FIG—10

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PIPE TENSIONING UNIT

BACKGROUND OF THE INVENTION

The invention pertains to the laying of pipelines under water. One of the major problems in an operation of this nature is to keep the pipe under a constant tension. The tension to which the pipe is subjected must be well beneath the structural limitations of the pipe and yet sufficient to keep the catenary formed by the pipe as it leaves the surface vessel at a sufficiently large radius to prevent undue stress upon the pipe.

This control is critical in that the pipe is most efficiently laid in a continuous operation whereas the vessel from which the pipe is laid often moves forwardly in an intermittent manner. The vessel may be anchored in one position and after laying a certain amount of pipe moved forwardly to another preselected location. A short radius of the catenary formed by the pipe could cause rupture of the protective coating upon the exterior of the pipe or rupture the pipe itself. Too much tension upon the pipe could cause separation of the pipe at a joint or at some weakened section. Therefore, it is critical to maintain one optimum shape of the catenary and the laying of the pipe must be a continuous or intermittent operation coinciding with and depending upon the movement of the pipe laying vessel.

In the past there have been many suggestions for laying pipe under water including elaborate underwater tensioning structures which require that the pipe be secured to the bottom and layed in short discrete sections.

Another method heretofore proposed has been to use pipe support means extending from the rear end of the pipe laying apparatus which would keep the pipe upon the surface or close thereto during a portion of the pipe laying operation.

One of the principal objects of the present invention is to provide a mechanism which will accurately and immediately adjust the rate of pipe feed to maintain a constant tension upon the pipe accommodating undulations in the supporting surface or wind and wave movement during the pipe welding and laying procedure.

Yet another object of the present invention is to provide a pipe tensioning mechanism wherein the pipe feed incorporates caterpillar-type tracks, thereby spreading the stress inherent in such an operation along a greater length of the pipe greatly reducing the probability of undue localized stress.

Yet another object of the present invention is to provide a mechanism for laying pipe beneath the water wherein the proper tension is maintained by opposed caterpillar-type tracks mounted upon bogies or idler wheels which in turn are mounted upon a tensioning plate. The tensioning plate is fabricated in such a fashion that it flexes, allowing the track to flex, thereby accommodating manufacturing errors or undulations in the pipe without building up internal stress within the pipe or the pipe laying mechanism.

Still a further object of the present invention is to provide a mechanism for laying pipe beneath the water surface wherein the means for maintaining a constant tension upon the pipe comprises a pair of opposed caterpillar type tracks having resilient pads or shoes mounted upon the track to contact the pipe without undue stress being placed upon the pipe, said pads being adjustable to accommodate a large variety or pipe sizes.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of the inventive linear pipe tensioning unit;

FIG. 2 is a front elevational view of the inventive linear pipe tensioning unit;

FIG. 3 is an enlarged side elevational view partially broken away showing the means for suspending the drive mechanism within the main frame mechanism;

FIG. 4 is an enlarged sectional view along lines 4—4 of FIG. 3 showing the tensioning machine sensing mechanism and the means for maintaining the mechanism in a neutral position during operation.

FIG. 5 is an enlarged sectional view through the caterpillar track mechanism showing the means for supporting the track guiding bogies;

FIG. 6 is an enlarged sectional view showing the details of the track mounting means within the pipe driving unit;

FIG. 7 is a plan view of the mechanism depicted in FIG. 6;

FIG. 8 is an isometric showing the track bogie and support means;

FIG. 9 is a schematic hydraulic diagram showing the hydraulic control mechanism for the above noted machine;

FIG. 10 is a wiring diagram of the electrical control circuit for the above noted machine.

DETAILED DESCRIPTION OF THE DRAWINGS

As can be seen in FIG. 1, the pipe tensioning mechanism comprises a generally upright vertically disposed mechanism 2, having an upper drive unit 4, and a lower drive unit 6. Upper drive unit 4 is vertically adjustable with respect to the lower drive unit by means hereinafter described within the limits defined by corner posts 8. Corner posts 8 are supported by the framework of lower drive unit 6 which has an upper horizontal beam 10 vertically maintained in a fixed position by corner posts 12 and intermediate vertical uprights 14. The corner posts 12 and vertical uprights 14 are in turn supported by a lower horizontally disposed fixed frame member 16. The entire structural unit, including the horizontal beams, and the upper and lower drive units is supported by the lowermost horizontally disposed frame member 16.

Mounted to the deck or supporting surface of the pipe laying vessel, are upstanding structural members 18 which have secured thereto a strap member 20 which is in turn secured to the lower portion of horizontal frame member 16. Strap members 20, one located upon each end of the horizontal frame members 16, provides the sole support for the entire pipe laying mechanism. The suspension of the entire mechanism by the plurality of straps 20 allows the mechanism to move easily in the direction longitudinally of frame member 16 which is coincident with the direction of the pipe during the laying process.

Allowing the mechanism to move relative to the supporting surface in the direction of pipe movement during the pipe laying process and providing a means to detect the movement of the tensioning unit affords a ready means to detect any change in the tension upon the pipe during the laying process. Means, hereinafter described, is provided for immediately returning the tensioning unit to a neutral position after the tension in the pipe has been corrected, assuring a constant datum plane for measuring future alterations in the pipe tension.

Each of the drive, upper 4 and lower 6, includes a hydraulic motor of 22 the variable speed type controlled by means hereinafter described. Each of the motors is operatively connected to a caterpillar track unit, hereinafter described, which in combination serves as the means of propulsion and velocity control of the pipe as it passes through the pipe tensioning apparatus. The pipe being layed passes between the tracks located in opposed relation and to accommodate pipes of varying diameters the upper drive unit 4 of the pipe tensioning mechanism is vertically adjustable as noted above. The vertical adjustment of the upper unit is accomplished by means of a motor 24 mounted upon the top of one of the uprights 8 and which, by means of standard drive connections such as chain and drive shaft, simultaneously turns worms 26 at each corner of the mechanism at an identical rate of speed, assuring that the upper drive unit is raised or lowered at a uniform rate and the relationship between the units remains constant.

To assure structural integrity, the uprights 8 are maintained in position by horizontal cross beams 28 as well as upright and diagonal support members. The necessity for inherent strength within the frame work can well be understood when it is realized that the unit 6 which is the preferred embodiment is capable of supplying up to 100,000 pounds of force upon the pipe. It is to be understood that the force factor is determined by the pipe and the depth at which it is laid.

The upper drive unit, within the upright framework, includes the drive motor 22 as well as the track mechanism and the supporting and guiding structure mounted upon a box-like structure having top frame members 32 and rigid upright braces 34. The connection between the box-like structure supporting the upper drive unit and the vertical adjusting means 26 mounted to the main framework is by means of an elongated, threaded collar or nut 36 which is rigidly attached to each corner of the box-like structure and mated with the screw threads of the member 36. Rotation of the member 26 within the mating collar 36 will cause the entire box-like structure and its contents, including the track and its supporting elements, to raise and lower.

The pipe when laid, for purposes of efficiency in the operation, is placed under tension to a maximum safe point. It is critical that the tension on the pipe be kept under constant control to prevent excess stresses which would cause a rupture as noted above. Attempts in the past have been made to measure the tension by means of sensing devices located upon a pipe laying machine which was mounted upon rollers and then adjust the tension in accord with the measurement. The friction of the rollers against the deck affected the sensitivity, therefore rendering the mechanism far less accurate than acceptable. In order to maintain the pipe at a constant tension it is necessary to instantly feel or sense the change in tension on the pipe as it is being laid. The suspension of the present pipe tensioning mechanism by the four straps as noted above allows any linear movement caused by an increase in tension upon the pipe to be immediately detected.

Referring now in particular to FIG. 3 it can be seen that the suspension by means of the straps 20 from the supports 18 allows the slightest movement to be detected. It is to be noted that there is no connection between the tensioning unit and the supports 16 other than the straps 20. Adjacent the straps 20, the beam 16 has an end plate 21. The leftwardmost support as seen in FIG. 3 would be the one located to the rear of the pipe tension machine, in other words, the direction opposite from the pipe laying direction and includes an adjustable stop means 50 mounted between the plate 21 and the support 18 allowing control of the movement of the mechanism. On the end from which the pipe is being fed or front end during the laying process, the slightest movement of the tensioning machine, which would indicate an increased tension on the pipe, is immediately detected and corrected. Because of the thickness of the straps, for safety purposes, only minor deflection can be allowed. The preferred embodiment is adjusted to allow a maximum of one-sixteenth of an inch deflection. The deflection itself is felt by a load cell 52 having a load button 54, placed in series with a compression cell 56. Referring now to FIG. 4, which is the tension sensing mechanism in conjunction with the plumbing and connections necessary to make it operative in the present embodiment, it can be seen that the load cell is activated by a ram rigidly mounted upon beam 16. Mounted behind the tension sensing means and under the tensioning device itself is a standard hydraulic valve similar in form to a power steering control valve which has one end of its piston attached to the tensioning mechanism at 58 and the other end secured to the support 18 at 60. Hydraulic line 62 extends from the load cell 52 to a manifold 64 which is likewise connected via a hydraulic line 66 to an identical load cell on the other side of the pipe tensioning mechanism. Leading outwardly from the manifold is line 68 which transmits fluid back to the valve 59 which returns the pipe tensioning mechanism to a neutral position whereat it can respond to a future increase in the tension on the pipe. Line 70 leads from the hydraulic valve 59 to the supply tank not shown. Likewise, as will be noted, there are two other lines 72 and 74 leading from the manifold, the first being an intake line from the supply and the second being a line to the control system hereinafter described.

Referring now to FIGS. 5–8 the means for imparting the drive to the pipe itself will be more particularly described. As noted above, the track drive includes a pair of opposed caterpillar track-like structures which are mounted in such a manner that they will absorb the undulations or imperfections of of the pipe without placing undue stress upon either the pipe or the pipe laying mechanism itself. The track, as best seen in FIGS. 6 and 7, comprises a plurality of substantially V-shaped bridging numbers 100 having outwardly extending flanges 102 at the extremities of each to which are secured the chain link members 104 for engagement with sprockets in the drive members mounted upon the motors hereinabove described. The bridging members 100 have a plurality of evenly spaced holes along their entire length to accommodate inclined brackets 105 having rubber pads 106 mounted thereon. As can be seen in FIG. 7, each bridging member has a pair of pads mounted thereon, one on each leg of the V. The pads 106 may be easily moved inwardly or outwardly along the bridging member 100 to accommodate pipes of various sizes by simply relocating the brackets 105. The preferred embodiment is designed to accommodate pipes from 8 inches in diameter to 48 inches in diameter but it is to be understood that pipe differing in diameter can be accommodated by minor structural changes. In the instance of the smallest pipe capable of being handled, i.e. 8 inches in diameter, the alternate pads and supports on successive bridging members must be removed to prevent the pads from interfering with each other.

The chain 104, which is driven by sprockets mounted to the hydraulic motors 22, is kept at a uniform position throughout its length by means of bogies or idler trucks 120, each of which have a pair of wheels 121 and which, as can be seen in FIG. 5, provide support for both the upper and lower track. The wheels 121 of the bogies 120 are mounted upon a bracket 122 which is in turn bolted to a tension plate 124.

As best seen in FIG. 8, the tension plate 124 has a plurality of holes therein to prevent points of extreme stress being built up around the bolt securement to the bogie. The holes not only retard structural deterioration but also increase flexibility.

The tension plate is in turn supported by a plurality of air bags 126. The air bags preferably have a linear reaction thereby assuring that a zero spring rate on outward extensions over 6 inches. The combination of the air bags, the tension plate and the flexible pads upon the bridging member allows a substantial amount of linear force to be placed upon the pipe during the laying process without endangering the non-corrosive casing surrounding the pipe or the pipe itself. The air bags used in the preferred embodiment are commercially available and could equally well be replaced by a hydraulic cylinder or other means capable of applying a variable load.

In operation, the desired tension upon the pipe and the rate of movement of the vessel are determinative of the immediate speed at which the pipe is passed through the tensioning device. Once a general speed of operation is determined, a change in speed of the tensioning mechanism will vary the tension upon the pipe and thus becomes a controlling factor.

To keep control of the tension, a definitive friction is necessary between the pads 106 and the pipe being layed. The amount of friction is determined by the pressure in the air bags which is variable, in combination with the weight of the pipe and the bogies. Normally the pressure within the air bags used in the illustrative embodiment will be 50 pounds per square inch with an increased poundage to 85 pounds per square inch at the front and rear ends. The bogies at the ends of the mechanism are at a slight angle to the horizontal to accommodate any minor variance in the height of the pipe being fed into or out of the pipe tensioning machine and thus requires the increased pressure to have a vertical component of approximately 50 pounds per square inch.

When the pipe is being laid, the maximum load on the track will be at the front of the machine, and the maximum tension of the pipe will be at the after portion of the machine. In general, the resiliency of the pads 106 and the coincident ability to give in the direction parallel to the pipe movement evens the load over the entire mechanism. It is to be noted that a rubber pad in the illustrative mechanism deflects approximately three-fourths of an inch when the machine is used at a pull of approximately 100,000 pounds.

Because of the conditions under which the mechanism is operated, i.e. upon a barge at sea where the critical factor is laying the pipe and not working on the mechanism, it includes a fail-safe control system having parallel systems of an electronic and hydraulic nature. The normal mode of operation utilizes the electronic control system with a spring-loaded servo switch such that if there is an electronic or electric failure, the mechanism is automatically switched to the hydraulic control system. As noted above, the pipe is fed by opposed caterpillar tracks driven by hydraulic motors, the speed of which is controlled by variable speed pumps turned by diesel engines or some other suitable self-contained power source. In the preferred embodiment the mechanism is motivated by a pair of identical engines driving a pair of identical pumps. The mechanism is operable with only one engine but at a reduced speed. For example, with both engines in use, the pipe can be fed at 80 feet per minute and with one engine 40 feet per minute or approximately half speed. The use of the pipe tensioning mechanism hereinabove described allows the pipe to be laid in water in the vicinity of 350 feet deep but it is to be understood that the rate of pipe movement and depth of possible lay is dependent upon structural capabilities and does not effect the principles of operation.

The sensing of the pipe tension is done electronically by a strain gauge for use with the electronic control system and hydraulically by a diaphragm cylinder for use with the hydraulic control system, both of which measure the deflection of the machine which, as noted above, is suspended by steel bands.

The control system will be more specifically described hereinafter but it briefly includes a means responsive to the movement of the machine to either speed up or slow down the movement of the track to maintain the pipe at a proper tension assuring the optimal catenary. Movement of the machine and the detection thereof likewise necessitates returning the mechanism to a neutral position by the power steering mechanism so that any change in the pipe tension can again be detected.

As can be seen in FIGS. 9 and 10, the control system is, to a large extent, repetitive because the twin diesel engines which are used for driving the identical pumps which in turn drive the tracks are controlled by the same system to keep them in phase and separately operable without the need for shutdown during changeover. The hydraulic control system herein below described is primarily a backup system for an electronics control system in the preferred embodiment likewise hereinafter described.

As can be seen in the upper left hand portion of FIG. 9, the tension sensing mechanism or tension signal generator **199** senses a leftward movement (in the figure) of the machine which moves the valve **200** toward a closed position building up the pressure in line **201**. The pressure in line **201** is maintained by pumps **202** and **202**¹ and the pressure buildup resulting from the closing of valve **200** causes the pair of identical cylinders **204** to force the machine back toward its neutral position. Simultaneously, with the increase of pressure in line **201**, there is an increase in pressure in line **206**. Line **206** is functionally connected to assemblage in the square areas **208**, and **208'** which serve as a damped compensator. Any change in the control pressure in line **206** acts upon the piston **210**, causing it to react against the reference pressure in cylinder **212**. The pistons of the two cylinders are spring self-centered. For purposes of illustration, the varying surfaces of the two cylinders are such that 340 pounds of control pressure on one side of the piston will balance 160 pounds of reference pressure acting on the other side of the piston, the particular values involved will vary depending upon the size, capacity and application. The reference pressure is supplied via lines **214**, **214'** by servo pump **216**, driven by diesel engine **218** which is the prime mover. The arrangement of pistons having varying effective surfaces in combination with the self-centering springs in the compensator **208** makes the system pressure responsive and cuts down on the gain rate of amplification making it a proportional relationship. Without the spring, any change in the pressure in line **206** acting upon cylinder **210** would cause a full stroke reaction whereas the compensator in the preferred embodiment requires a variance of 25,000 pounds from the preselected tension before there is a full stroke reaction. The area enclosed in box **209** which is a reference and correction circuit includes accumulators **211** and flow control valve **213**. The flow control valve **213** serves as an adjustable tension set and interconnected such that the pressure in the drain port varies the setting of the valve. The accumulators **211** serve to slow down the signal or feed back from pump **220** prior to the signal reaching relief valve **215** thus making the system inherently more stable. It is to be understood that the size of the accumulators and/or the spring can be varied for a different system requiring a different rate of response. Movement of the cylinders **210** and **212**, which are hydraulically linked by means of a rotary servo valve **219** to the swash plate of the variable pump **220** cause the speed of the tracks to increase or decrease in direct relation to the movement of the plate to compensate for error felt by the sensing mechanism. Thus it can be seen that the slightest movement of the pipe tension sensing mechanism will result in an immediate change in the feeding speed of the pipe to assure a constant tension by the machine so controlled. The control system has included therein a dampening factor to preclude overcompensation and the control pressure can be varied to accommodate various tensions in the pipe being layed.

The brake **230** is capable of stopping the track and is shown in a spring-loaded condition requiring fluid pressure to maintain the released position. In the event of failure, if the machine is being hydraulically controlled, the brake will instantly be engaged preventing damage to the equipment or material. The primary mode of operation is with electronic controls and when operating in this mode, the brake is held in an open condition electrically.

As can be seen in FIG. 9, the power source **218**, **218'** drives the variable pump **220** which drives the hydraulic motor **222** as well as the servo pump **216** and the replenishing pump **217** assuring a constant volume of hydraulic fluid in the system.

Although the hydraulic system as depicted is in the hydraulic automatic tension mode, it is to be understood that it is the back up system and in the event of a break in the hydraulic line or other failure the system would set the brake. Failure of electronic control system will transfer control to the hydraulic control system.

Referring now to FIG. 10 in the upper portion of the picture, the main power supply is shown having switch **300** and connected thereto stepdown transformers **302** through **306** to provide the lower voltages necessary for the various control elements. Clustered in the upper lefthand corner of the figure are the various elements which provide the inputs to the tension control as will be hereinafter described. A pair of load cells **308**, one mounted on each side of the main frame as hereinabove described, generate a small voltage when actuated by movement of the main frame. The small voltage generated by the load cells is then fed to an amplifier **310** which increases the signal to a useable quantity. The signal from the amplifier **310** as well as input signals from the tension indicators **312**, the tension set input **314**, the pipe speed indicators **316** including attached generator **318**, and the infinitely adjustable dead band which has an upper level adjustment **320** and a lower level adjustment **322** enabling variable tolerances to be set at either end of the acceptable limit are all fed into amplifier **324**. The signal from amplifier **324** is then fed to monitor **326**, the output signal of which is simultaneously fed to amplifiers **328** and **328'** which trigger a generator on the card and regulates the pulse rate fed to logic cards **330** and **330'**. The signal from logic cards **330**, **330'** is again amplified and fed to stepper motors **322** and **322'** which are digital and responsive directly to amplifier **328** or **328'** respectively. The condition of the stepper motors is monitored by feedback pots **334**, **334'** which provide another input into the amplifier **328, 328'**. Signals from the amplifiers **328** and **328'** and logic cards **330** and **330'** are fed to fail-safe monitor **336** which in response to the signals will allow the mechanism to continue operation, switch to the hydraulic mode of operation or stop the entire unit and indicate the problem. For purposes of the summary hereinafter the element located within the squares **340** and **340'** will be referred to as "power servo actuators".

In summary then, in the speed mode, the operator directly controls speed and direction. The command is in the form of a voltage signal from the pot which passes through monitor **326** to amplifier **328**. The signal is amplified and applied through logic card **330** to amplifier **331** or **331'** which drives the servo actuator in the required direction. The movement of the servo actuator moves the wiper of the feedback pot **334** or **334'** and the voltage of the wiper is applied back through amplifier **328, 328'**. If the feedback voltage is equal to the command voltage the command signal is cancelled and the system remains stable.

In the tension mode, the tension set voltage from the tension set pot is fed to amplifier **324** from which the signal is applied to the servo actuator. The input signal from the load cells is applied through amplifiers **310** to another input on amplifier card **324**. When the tension set voltage and the load cell input voltages are equal a null balance within the amplifier occurs. When the load on the load cells is varied due to barge motion or other means, error voltage is generated and sent to amplifier **324** which unbalances the amplifier and the servo actuator is triggered to adjust the rate of speed of the pipe until a null balance occurs in the amplifier.

The input from the tach generator is used to build in an error to the system. Normally, when the command sets the tension and the speed a servo actuator would respond and once the command signal was reached there would be no error signal and the mechanism would stop. It is desirable to have the machine run in a continuous fashion so the tach generator builds in a continuous error which varies with the speed of operation whereby the system is more rapidly responsive at a higher rate of operation and further because of the continuous error continuously operating.

In summary, the prime mover will drive the variable pumps controlling the hydraulic motor and thusly the speed of the pipe feed. In the event of the failure of one of the two prime movers the control system is such that the other can carry the operation at a reduced speed by itself. The speed is automatically controlled within the vicinity of the preset tension valve by the control system which is noted above, includes both electrical and hydraulic systems. The event of the failure of the electronic system, the hydraulic system automatically takes over. In the event of failure of both systems the brake is automatically set.

We claim:

1. An apparatus for maintaining a constant tension upon a pipe during the underwater laying thereof comprising;
   - a pair of opposed vertically stacked caterpillar type tracks, each of which is individually driven at a variable speed to maintain the pre-selected tension upon the pipe,
   - a rigid framework serving as a mount for the tracks and the associated motor,
   - means for adjusting the relative vertical location of the upper and lower tracks within the framework whereby pipes of varying diameter may be accommodated,
   - means suspending the entire framework from a relatively fixed support means allowing ease of movement of the framework and supported track along the direction of the pipe feed,
   - means responsive to movement of the frame to adjust the rate of feed allowing the framework to return to a neutral position whereby a constant tension is maintained upon the pipe.

2. An apparatus as in claim **1** wherein the movement of the frame is detected by apparatus placed between the frame the fixed supporting means and is operationally connected to a control means which simultaneously adjusts the speed of the track again placing the tension within the prescribed limits and returns the frame to a neutral position whereby frame movement indicating tension beyond the prescribed limit may again be detected.

3. Apparatus as in claim **1** wherein the suspension means comprises an upright at each corner of the frame and a vertical band secured at the top to the upright and at the bottom to the frame, said bands being parallel to each other and transverse to the direction of pipe movement whereby a change in tension in the pipe will be immediately reflected in a movement of the frame.

4. Apparatus as in claim **1** wherein the tracks comprise a pair of parallel chains and a plurality of parallel cleats extending between the chains, said cleats being substantially V-shaped and secured at the outward ends to the chains, and a pair of pads adjustably secured to the cleats whereby a pipe being fed by the apparatus will be contacted at four points about its circumference by corresponding cleats on opposing tracks.

5. Apparatus as in claim **1** wherein the tracks are supported by bogies which are mounted upon flexible steel plates.

6. Apparatus as in claim **5** wherein the steel plates are perforated to prevent a build-up of local stress and are supported by a plurality of air bags whereby the track will flex to accommodate variance in pipe dimension.

7. Drive means for a pipe laying mechanism comprising;
   - a pair of driven opposed caterpillar-type tracks,
   - a plurality of angular plates mounted upon the tracks forming a wide V therebetween,
   - a plurality of angular rubber pads mounted to the plates such that the angles of the plate and the pad are additive whereby the contact between the pad and the pipe are diverse reducing the possibility of pipe collapse.

8. A drive means as in claim **7** wherein the track is supported by a plurality of idler trucks mounted upon a plurality of air bags and has mounted between the trucks and the air bags a suspension plate means for softening the vertical movement of the idler trucks.

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