Dec. 24, 1963 J. C. SILLIMAN 3,115,316

HYDRAULIC WIRE ROD TENSIONING MEANS

Filed Aug. 7, 1961 2 Sheets-Sheet 1

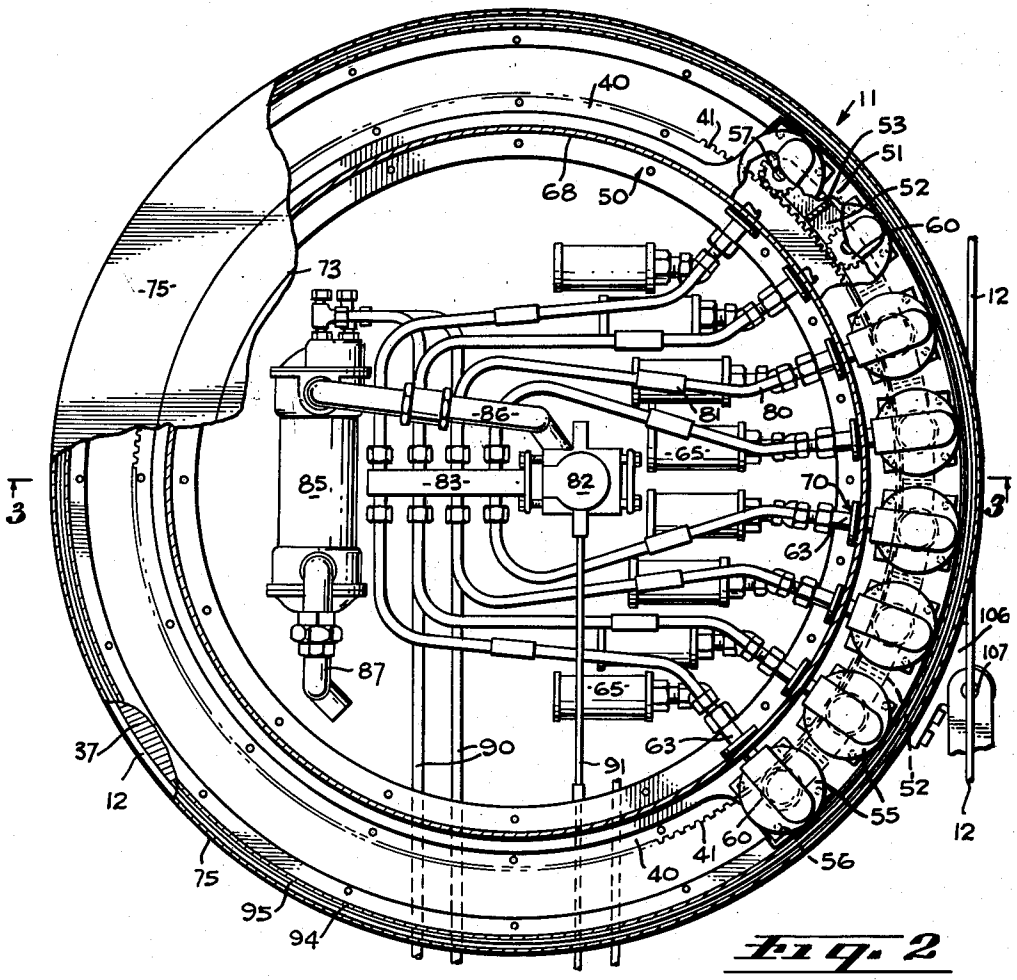


Fig. 2

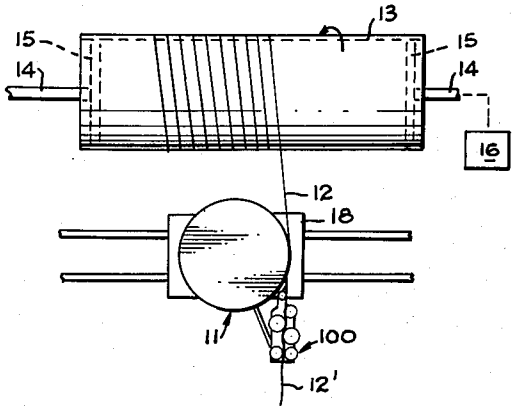


Fig. 1

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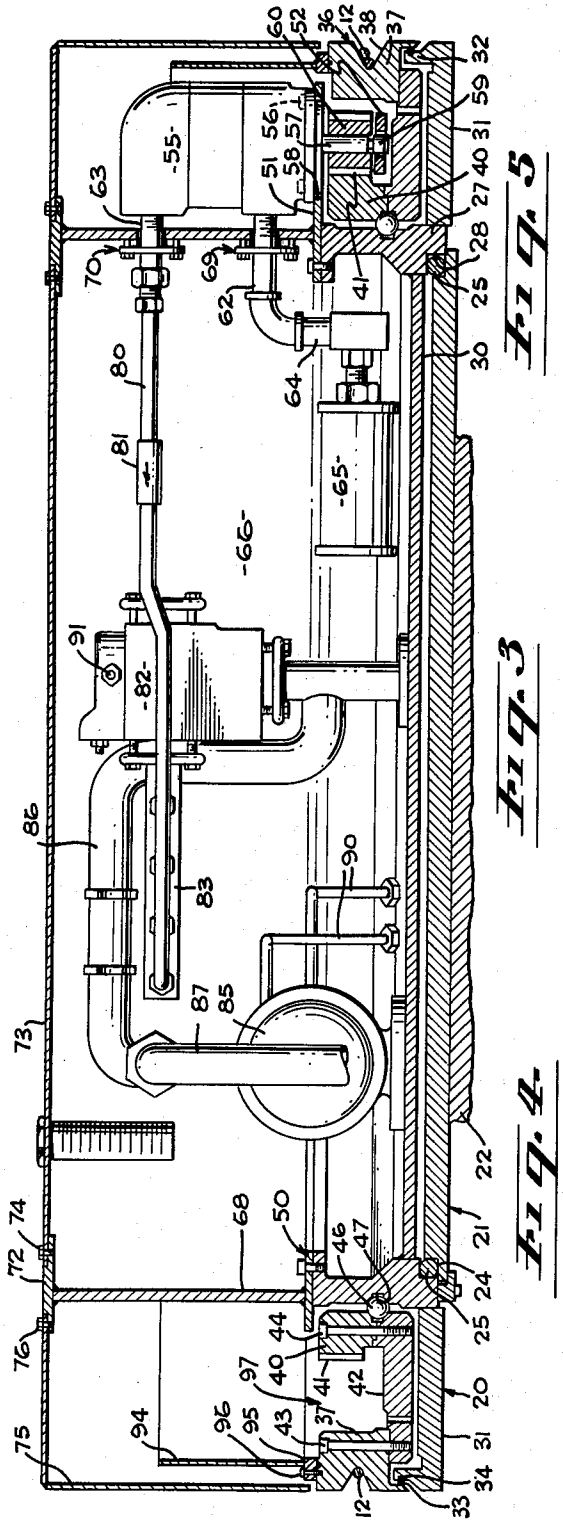


Fig. 3

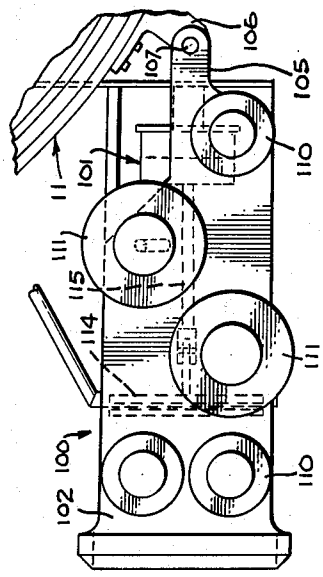


Fig. 5

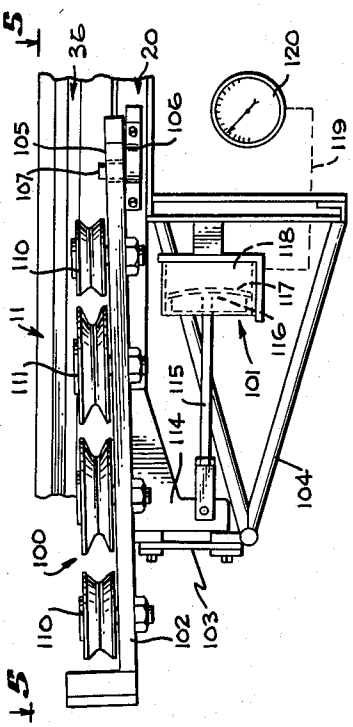


Fig. 4

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HYDRAULIC WIRE ROD TENSIONING MEANS

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This invention has to do generally with apparatus for restraining or tensioning wire as it is wound about an object.

The invention has to do more particularly with the tensioning of relatively heavy reinforcement wire or wire rod as it is wrapped helically about metal cylinders used in constructing concrete pipe or about a concrete pipe body or other object. Heretofore the tensioning of the wire has been accomplished by passing it through a series of opposed rollers or sheaves which also served as a straightening means. However, this has proved unsatisfactory because of the difficulty of regulating the tension within the limits desired and because it often results in failure or breaking of the wire at welded joints therein.

An object of the invention is to provide a new and improved means for imparting tension to a wire or wire rod as the same is fed to an object about which it is being wound under tension.

Another object is to provide apparatus for restraining or tensioning a wire or wire rod which enables the continuous accurate determining and indicating of the amount of tension imparted. In this connection, it is an object to provide a novel mounting construction to facilitate the continuous measurement of the tension.

A further object is to provide apparatus of inherently simple construction which can be regulated or adjusted to cause it to restrain a wire with a required degree of force. In this connection, it is an object to provide a wire tensioning means embodying fluid pump means for providing the necessary braking action to restrain the wire, and means controlling the braking effect of the pump means.

Another object is to provide a hydraulic braking or restraining unit having a novel, self-contained reservoir-type hydraulic system.

These and other objects will be apparent from the drawings and the following description. Referring to the drawings:

FIG. 1 is a diagrammatic plan view showing the wire tensioning means of the invention associated with an object being wrapped;

FIG. 2 is a plan view with the cover broken away of the tensioning means of the invention;

FIG. 3 is a sectional view on line 3—3 of FIG. 2;

FIG. 4 is a fragmentary plan view of the fair-lead means; and

FIG. 5 is a fragmentary sectional view on line 5—5 of FIG. 4.

More particularly describing the invention, numeral 11 generally indicates a wire or wire rod tensioning means about which the wire or wire rod 12 passes prior to being wound upon an object 13 under tension. The object may be anything, as for example a steel cylinder, and this is shown supported upon shafts 14 having head 15 received in the ends of the cylinder. One shaft is adapted to be driven by a suitable motor 16. Thus in operation the object to be wound is rotated and pulls the wire rod around the tensioning means (the wire being wrapped once or twice around the same, as will later appear) from a source located beyond the broken end 12' of the wire.

The tensioning means itself is mounted on a carriage 18 which can be driven in any suitable manner in coordination with the speed of rotation of the object being wound so as to traverse the object and feed the wire thereto at the proper spacing.

Referring now to the tensioning means 11, this comprises a generally circular housing structure 20 which is mounted upon a circular base plate 21. The base plate is fixed to a suitable support such as a portion 22 of the carriage 18 and may conveniently be bolted thereto although the bolts are not shown. The periphery of the base plate is stepped at 24 to form part of a ball race to accommodate ball bearings 25. The housing structure 20, includes an annular wall 27 which has a stepped edge portion 28 opposite that of the plate to form the other side of the ball race for the bearings 25.

A bottom wall 30 is provided interiorly of and welded to the annular wall 27 to form a fluid-tight construction. Extending outwardly from the lower portion of wall 27 is an annular shelf 31. This terminates at its periphery in an upwardly-extending flange 32 which is provided with a seal ring 33 in a groove 34 thereof.

A sheave or pulley 36 is mounted for rotation relative to the main housing structure 20 just above the shelf 31. This member includes a ring 37 having a peripheral V-groove 38 adapted to receive one or two turns of the wire or wire rod 12 to which the tension is to be imparted, a ring gear 40 having gear teeth 41 and a lower ring 42, the parts being secured together by capscrews 43 and 44. Members 40 and 42 cooperate to form part of a ball race for ball bearings 46 received in a groove 47 of the annular wall 27. The sheave is thus mounted for rotation with respect to the housing.

The housing structure includes a pump mounting ring 50 mounted on the upper edge of the annular wall 27. The ring 50 is provided with an arcuate pump mounting section which includes an upper deck or plate 51, a lower deck or bearing support 52, and upright webs 53 therebetween. A plurality of fluid pumps 55 are mounted on the deck 51, being secured by bolts 56. Pump shafts 57 pass through apertures 58 of the deck 51 and are journaled in bearings 59 in support 52. Each pump shaft has a pinion 60 which meshes with the teeth 41 of the ring gear 40 so that sheave 36, when rotated, drives the pumps.

Each pump has an inlet 62 and an outlet 63. The inlets are connected by conduit 64 to a filter 65 which is open to the space 66 within the housing structure 20 which serves as a reservoir for oil or hydraulic fluid. An annular wall or inner casing 68 extends upwardly from the ring 50 being welded thereto. Suitable packing glands 69 and 70 are provided about the inlets and outlets of the pumps, respectively, where these pass through the inner casing wall. In order to fully enclose the space 66, the casing is provided with an annular top wall section 72 which is welded or otherwise secured at the top of wall 68 and this serves to support a circular cover 73. The latter is detachably secured by screws 74. An outer apron-like cover 75, is mounted by screws 76.

For the purpose of controlling the amount of resistance offered by the pumps to the rotation of the sheave 36, the outlet of each pump is connected by a conduit 80, which may include a check valve 81, to a throttle or adjustable control valve 82, the individual conduits leading into the intake manifold 83 of the valve. The liquid passing through the valve from the pumps is conducted to a heat exchanger 85 by conduit 86 and after passing through this unit, the hydraulic fluid emerges through outlet tube 87 to flow into the reservoir space 66.

Any suitable cooling fluid, such as water, can be pumped through the heat exchanger by means of tubing 90 and appropriate connections with an outside source which are made through the wall member 27. Valve 82 may be of a conventional type adapted to be controlled from a remote point and by way of example this may be fluid-controlled by means which includes a fluid control tube 91.

The sheave 36 is provided with a splash ring wall 94 having a base 95 which is secured to the sheave body 37 by screws 96. This construction provides for retaining oil in the space 97 for lubrication of the ring gear 41 and the pump pinions 60.

As previously indicated, the base plate 21 is rigidly mounted upon the carriage 18. A wire fair-lead means 100 is mounted between the housing structure and the carriage and, in conjunction with a load cell unit 101, serves to limit rotation of the housing structure 20 relative to the base plate 21 and provide means for measuring and indicating the amount of torque exerted by the housing, thus providing an indication of the tension being applied to the wire rod, one or two turns of which extend around the sheave of the device. The fair-lead means also serves to guide the wire rod to the sheave and to some extent acts as a straightening means for the wire rod.

The fair-lead means includes a plate 102 which is supported upon a flexible plate 103 attached to a bracket 104 which is mounted on carriage 18. The inner end of the plate is provided with an apertured end portion 105, and this is connected to the housing structure by means of a bracket 106 mounted on the portion 31 of the housing structure, the bracket having an upright pin 107 which is received in the end of the plate. The plate carries several small sheaves or rollers 110 and 111 through which the wire rod is fed and one or more of these may be adjustably mounted.

The plate 102 includes a depending arm 114 to which is connected a piston rod 115 of a piston member or other suitable device 116 of the load cell unit. The latter may include a diaphragm 117 and a fluid chamber 118 therebehind together with a fluid line 119 leading to a pressure gauge 120 which has been calibrated in any suitable manner.

It will be apparent that, in use, the wire rod is pulled around the sheave 36, rotating the same. Since the rotation of the sheave is braked or restrained by the pumps 55, there will be a tendency for the entire housing structure to rotate and that the force of this torque developed in the housing structure will depend upon the resistance to rotation offered by the pumps 55 to the rotation of the sheave 36. Thus it is possible to have a constant gauging and indicating of the tension applied to the wire rod by providing the means described, or its equivalent, to restrain rotation of the housing structure and measure the force involved. Suitable allowance may be made for the forces developed by the wire rod traversing the fair-lead means which tend to pull this unit along in the direction of travel of the wire rod.

I claim:

1. In apparatus for tensioning a moving wire rod, a support, a base plate mounted on said support, a housing structure rotatably supported on said base plate, said housing structure being constructed and arranged to provide a reservoir chamber, means connected between said housing structure and said support for yieldably restraining said housing structure against rotation and for giving a sensible indication of the torque exerted by the housing structure, a sheave rotatably mounted on said housing structure, a pump mounted in said housing structure, a driving connection between said pump and said sheave, intake conduit means leading from said reservoir chamber to said pump, outlet conduit means leading from said pump to said reservoir chamber, and means for adjustably restricting flow of fluid through said outlet conduit means.

2. In apparatus for tensioning a moving wire rod or the like including a support, a structure rotatably mounted on the support, a main sheave rotatable relative to the support and structure about which the wire rod passes, and means carried by the structure for resisting rotation of the sheave whereby torque is transmitted from the sheave to the structure, means for restraining said structure against rotation and giving a sensible indication of the torque exerted by said structure, comprising a fair-lead member extending generally tangential of said structure and sheave and connected at its inner end to said structure, a plurality of guide sheaves on said member through which the wire rod passes to the main sheave, and a load cell unit means operably connected between said member and said support for resisting movement of the member and giving a sensible indication of the amount of force required to resist movement of the member.

3. The means set forth in claim 2 in which said fair-lead member is supported for limited movement on said support and in which said load cell unit is hydraulic.

4. In apparatus for tensioning a wire rod which is drawn by an exterior means, a support, a base plate fixed to the support, a housing structure mounted for rotation on said base plate, a sheave mounted on said housing structure for rotation relative thereto about the same axis as said housing is rotatable relative to said base plate, a ring gear carried by said sheave, a plurality of pumps carried by said housing, each pump having a shaft with a pinion fixed thereto and meshing with said ring gear, said housing providing a reservoir chamber for hydraulic fluid, said pumps each having an intake conduit communicating with said reservoir chamber, outlet conduit means for said pumps leading to said reservoir chamber, adjustable means in said outlet conduit means for restricting flow of fluid through said outlet conduit means, and means connected between said support and said housing structure for restraining said housing against rotation.

5. The apparatus set forth in claim 4 in which said base plate and said housing structure are circular and in which said reservoir chamber is circular and said sheave extends around the reservoir chamber.

6. The apparatus set forth in claim 4 in which said reservoir chamber is circular, said sheave encircles said chamber and said pumps are carried by the housing structure above the sheave and externally of the chamber.

7. In apparatus for tensioning a moving wire rod drawn by an exterior means, a support, a circular base plate, a circular housing structure rotatably mounted on the plate,, said housing structure providing a central circular chamber for hydraulic fluid, a sheave rotatably mounted on said housing structure and encircling said chamber, said sheave being annular and providing an open-topped annular space and ring gear teeth defining a wall portion of the space, an arcuate deck carried by the housing structure over said sheave, a plurality of fluid pumps carried by said deck and having shafts projecting into said annular space with a pinion fixed to each shaft and meshing with said ring gear teeth of the sheave, intake conduit means leading from said chamber to said pumps, outlet conduit means leading from said pumps to said chamber, valve means in said outlet conduit means for restricting flow of fluid from the pumps to said chamber, and means connected between said housing structure and said support for restraining movement of said structure relative to the support.

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