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APPARATUS FOR FORMING PRE-STRESSING WINDINGS ON CONCRETE OR LIKE PIPES

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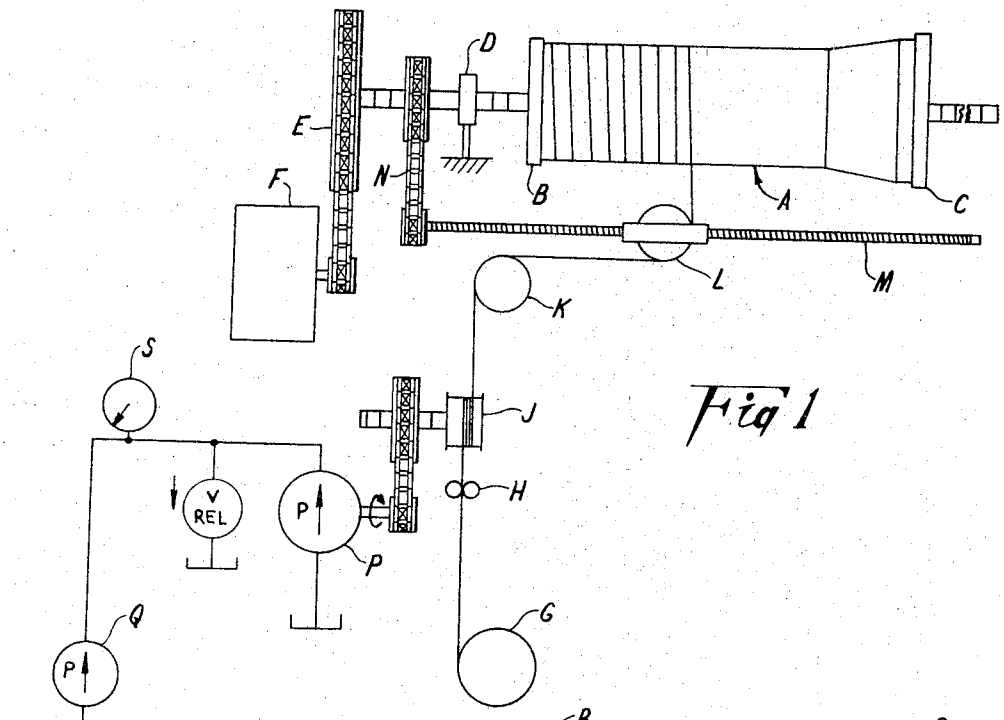


Fig 1

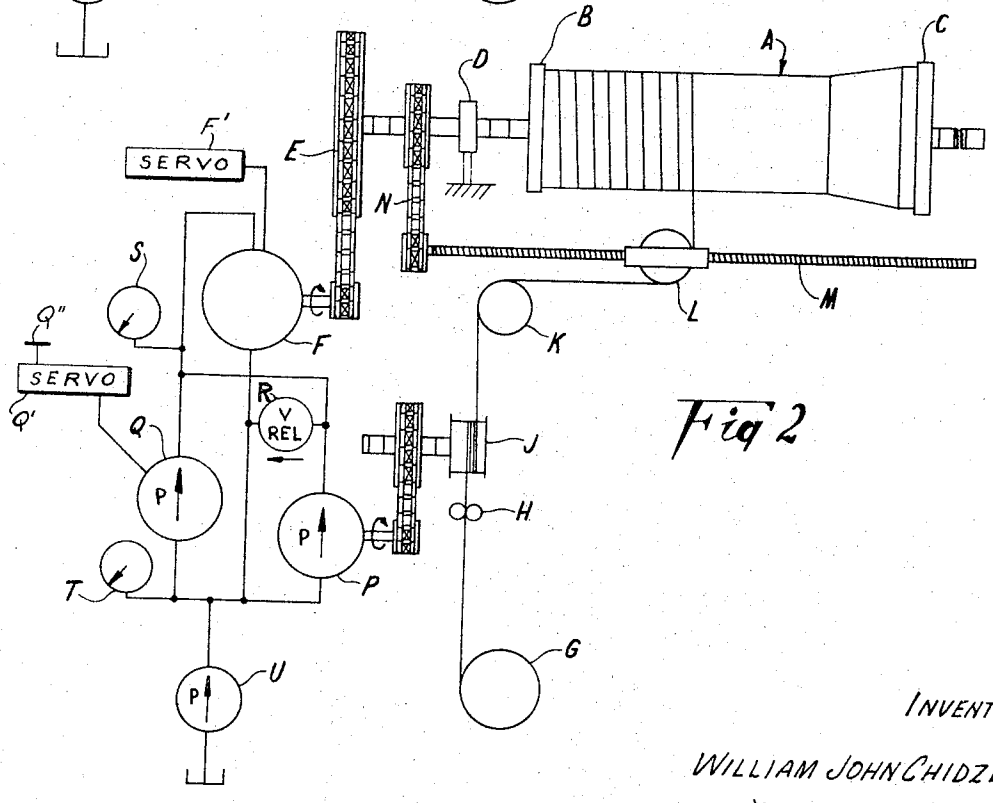


Fig 2

INVENTOR

WILLIAM JOHN CHIDZEY

By Young & Thompson

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APPARATUS FOR FORMING PRE-STRESSING WINDINGS ON CONCRETE OR LIKE PIPES

William John Chidzey, Sandringham, Victoria, Australia, assignors to Humes Limited, Victoria, Australia, a corporation of Australia

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The present invention relates to apparatus for forming pre-stressing windings on concrete or like pipes.

The advantages of providing a concrete pipe with a helical winding to pre-stress it are well known and various types of machines have been provided to feed wire to a concrete pipe, under tension, to form the winding as the pipe is rotated on its longitudinal axis.

Machines utilizing hydraulic pressure are particularly suitable for use in forming pre-stressing windings on concrete pipes but known machines of this type suffer from the disadvantage that, if the rotation of the pipe is stopped for any reason, the tension on the wire being fed to the pipe ceases. This means that either the winding provided on the pipe does not have the proper tension or the tension of the winding is uneven. Thus the completed pipe is not satisfactory.

The present invention has for its primary object to overcome the foregoing disadvantage.

According to the invention apparatus for forming a pre-stressing winding on a concrete or like pipe comprises a hydraulic system, means for developing hydraulic pressure in the system, rotatable means for rotating a pipe on its longitudinal axis in one direction, means operatively connected to the rotatable means to prevent the pipe being rotated in the reverse direction, wire feeding means for feeding wire to the pipe as the pipe is being rotated, and means operatively connected to the wire feeding means and to the system and adapted to utilize the pressure developed in the system so as to apply tension to the wire irrespective of whether or not the wire is in motion.

In order that the invention may be readily understood reference is made to the accompanying drawings in which:

FIGURE 1 illustrates, in diagrammatic form, apparatus in accordance with one form of the invention; and

FIGURE 2 illustrates, in diagrammatic form, apparatus in accordance with a further form of the invention.

In the drawings a pipe A is rotated on its longitudinal axis by rotatable means such as chucks B and C on which the pipe is mounted. The chuck B may be keyed to a shaft driven in one direction by an independent variable speed drive E and F. To prevent rotation in the reverse direction means such as a ratchet D may be provided.

Wire is fed from a spool G and the wire feeding means for feeding the wire to the pipe A may include pinch rolls H, a capstan J, and pulleys K and L. The wire is preferably passed several times around the capstan J to prevent slipping between the wire and the capstan. The pulley L may be traversed in a path parallel to the pipe by gearing M and N.

The means for developing hydraulic pressure and for applying the pressure so developed to a hydraulic system may comprise a pump Q driven by an electric motor to pump oil or other fluid into the system. The hydraulic pressure in the hydraulic system may be utilized by a motor/pump P, arranged to function as a motor, which is operatively connected to the capstan J by gearing. The pressure in the hydraulic system may be determined by a pressure relief valve R. A pressure gauge S may also be provided. Servo control means may be combined with the pump Q so that it will develop a pressure in the hydraulic system just below the pressure determined by the pressure relief valve R.

In the operation of the apparatus shown in FIGURE 1 wire is fed to the pipe A via the capstan J. The hydraulic pressure developed in the hydraulic system causes the motor/pump P to function as a motor to apply a tension which is proportional to the hydraulic pressure in the system to the wire via the capstan J. Reverse rotation of the pipe A by reason of the tension exerted on the wire will be prevented by the ratchet D.

As the pipe A is rotated the motor/pump P will be operated to pump oil into the hydraulic system. The oil so pumped will be discharged through the pressure relief valve R.

It will be apparent from the foregoing that, even if the rotation of the pipe A is stopped, tension will be applied to the wire via the capstan J and the motor/pump P as long as the pump Q is operated by the electric motor.

The apparatus shown in FIGURE 2 is similar to that shown in FIGURE 1 with respect to the application of tension to the wire but it also includes power feed back for economy of operation. It also provides for automatic control of the tension applied to the wire irrespective of the diameter of the pipe. Parts equivalent to those of FIGURE 1 have the same reference characters.

In FIGURE 2 the pipe A is rotated by a hydraulic motor F which is connected to the hydraulic system. The motor F is of the variable displacement type and may be provided with servo control means F′ for automatically increasing the motor displacement when the pressure of the hydraulic system exceeds a predetermined value in the operating range.

In the apparatus of FIGURE 2 the pump Q is of the variable displacement type and may be fitted with servo control means Q′ adapted to limit the displacement flow to a value such as will provide the required pressure in the hydraulic system. Means Q″ may also be provided in operative association with the pump Q to over-ride the servo control means so that the displacement flow of the pump can be increased to any required value irrespective of the pressure of the hydraulic system.

The servo control means of the present invention are conventional, for example as shown in either of U.S. Patents Nos. 2,722,894 of November 8, 1955 or 2,910,943 of November 3, 1959.

In order to boost the pressure in the hydraulic system to avoid cavitation in the suction line an auxiliary pump U, driven by an electric motor, may be provided. The pump U may incorporate an integral relief valve set to operate at a low pressure.

A pressure gauge T may be provided in addition to the pressure gauge S.

To operate the apparatus of FIGURE 2 the pressure relief valve R is set, for safety only, to release oil at a pressure slightly in excess of the pressure required to operate motor/pump P as a motor to develop the desired tension on the wire fed to the pipe A via the capstan J. The servo means associated with motor F is set to operate at the pressure to be developed in the hydraulic system as will provide the required tension on the wire. The servo means associated with the pump Q is set to limit the delivery of oil by the pump at a pressure slightly below the pressure at which the servo means on motor F is set. At these settings with the pump Q and its motor in operation the pressure in the hydraulic system will be such that the desired tension will be applied to the wire but the motor F will develop insufficient torque to rotate the pipe A against the tension exerted on the wire.

The servo over-riding means on pump Q is operated to cause increased flow of oil through the pump. The pressure in the hydraulic system will then rise and the servo

control means associated with the motor F will automatically increase the displacement and hence the output torque of the motor F and the pipe A will then be rotated by the motor F. The speed of rotation may be controlled by suitable adjustment of the servo over-riding means.

As the pipe is rotated the motor/pump P is operated to deliver oil into the hydraulic system and the pressure so developed in the system is utilized in driving the motor F. Thus there is a feedback of power which will permit greater economy in operation and enable a smaller driving motor to be used.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. Apparatus for forming a prestressing winding on a concrete pipe comprising a hydraulic system, a variable displacement pump for pumping fluid into said system to develop hydraulic pressure in said system, rotatable means for rotating a pipe on its longitudinal axis in one direction, means operatively connected to said rotatable means to prevent the pipe being rotated in the reverse direction, a variable displacement motor operatively connected to said system for rotating said rotatable means, wire-feeding means for feeding wire to the pipe as the pipe is being rotated, and a motor/pump operatively connected to said wire-feeding means and to said system and adapted to utilize the pressure developed in said system so as to apply tension to the wire irrespective of whether or not the wire is in motion and to develop pressure in said system when it functions as a pump as the wire is being fed to the pipe, said variable displacement pump including servo-control means adapted to be set so that the pressure developed in said system by said pump is

sufficient to cause said motor/pump to apply tension to said wire and is insufficient to operate said variable displacement motor to rotate said rotatable means, and said variable displacement motor including servo-control means adapted to be set to operate at a pressure in said system as will cause said motor/pump to apply tension to said wire, in combination with means for overriding the servo-control means on said pump to increase the displacement of said pump thereby to increase the pressure in said system sufficiently to actuate the servo-control means on said motor to increase the displacement of said motor and cause said motor to rotate said rotatable means.

2. Apparatus according to claim 1, in combination with an auxiliary pump for pumping fluid into said system to boost the pressure in said system thereby to avoid cavitation in said system.

3. Apparatus according to claim 1, and a pressure relief valve for determining the maximum pressure to be developed in said system.

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FRANK J. COHEN, *Primary Examiner.*