

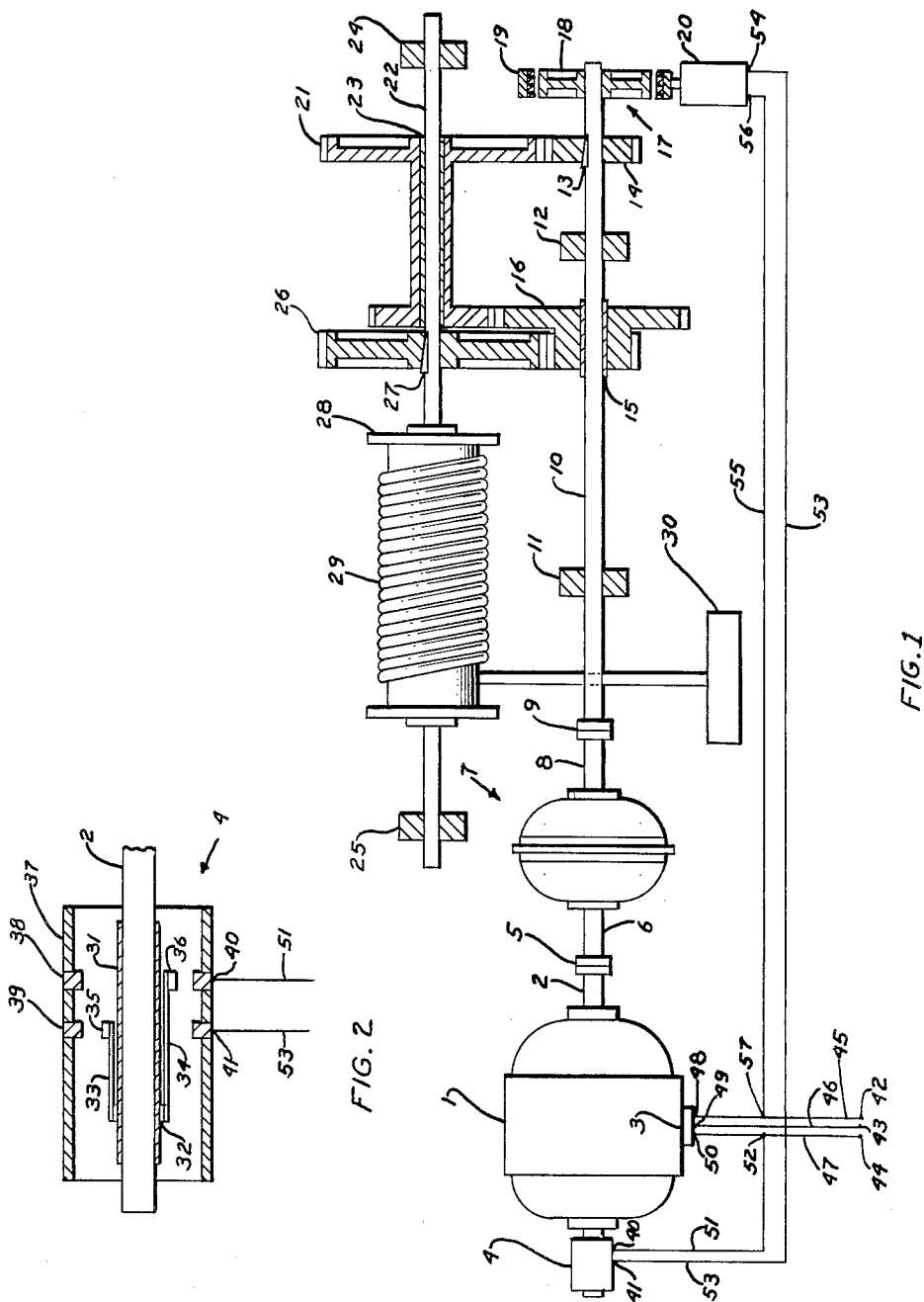
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E. A. BLEVINS

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CRANE HOIST MECHANISM

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INVENTOR.
EUGENE A. BLEVINS
BY
Andrew K. Foulds
his ATTORNEY

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CRANE HOIST MECHANISM

Eugene A. Blevins, Royal Oak, Mich., assignor to American Blower Corporation, Dearborn, Mich., a corporation of Delaware

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This invention relates to a crane hoist mechanism and more particularly to a crane hoist whereby the movement of the load is controlled through a hydraulic coupling.

Heretofore, it has been standard practice to provide a crane with a drive motor, a direct geared drive to the cable drum, and a solenoid brake connected to the drive shaft of the crane. Normally the solenoid brake and the hoist motor are wired in parallel. The brake is released when the motor is energized and spring closed when the motor is de-energized. The solenoid brake will hold the load in suspension when the motor is de-energized or if a power failure occurs. When the motor is energized, the solenoid brake is simultaneously released. On initial energization of the motor, the load has a tendency to drop slightly until sufficient torque has been developed by the motor to lift the load. The slight dropping of the load places an undue strain on the lift cables and on the crane mechanism itself. Also, this slight dropping of the load makes delicate lifting operations and inching control difficult. All of these problems become more pronounced when a hydraulic coupling is used because of the flexibility of the connection between the motor and the load.

It is, therefore, an object of this invention to provide a crane hoist including means to prevent the load from dropping slightly when the motor is energized, thus allowing excellent inching control for delicate lifting operations.

Another object of this invention is to provide a crane hoist which is capable of slow, smooth lifting operations which do not place undue strain on the lifting cables and the crane mechanism.

Another object is to provide a crane hoist including a braking means which is not released until the motor has reached a predetermined speed.

Another object of this invention is to provide a crane assembly which is simply and inexpensively manufactured and assembled and easily operated.

Other objects of this invention will become apparent from the following description, the drawings to which it relates, and the claims hereinafter set forth.

This invention comprises the new and improved construction and combination of parts and their operating relation to each other which will be more fully described hereinafter and the novelty of which will be particularly pointed out and distinctly claimed.

In the accompanying drawings, to be taken as a part of this specification, there is fully and clearly illustrated a preferred embodiment of the invention, in which drawings:

Figure 1 is a diagrammatic view of a crane hoist mechanism embodying one form of this invention,

Fig. 2 is a detail diagrammatic view of the centrifugal switch shown in Figure 1.

Referring to the drawings by numerals of reference, there is shown more or less diagrammatically a crane

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hoist having an electric hoist motor 1. The hoist motor 1 has a rotating drive shaft 2 extending laterally there-through and a junction box 3. The junction box 3 has electrical terminals 48, 49, and 50. On one end of the drive shaft 2 there is a normally open centrifugal switch 4 mounted for rotation therewith. The other end of the drive shaft 2 is connected through a coupling 5 to a drive shaft 6 of a rotary hydraulic coupling or fluid drive 7. The driven shaft 8 of the fluid drive 7 is connected through a coupling 9 to a shaft 10. Shaft 10 is rotatably supported by bearings 11 and 12. Mounted on shaft 10 and held rigidly by a key 13 is a gear 14. A tubular bearing 15 is mounted integrally on shaft 10. A reduction gear 16 is mounted on bearing 15 and is freely rotatable thereon. A solenoid brake assembly 17 is mounted adjacent the end of the shaft 10. The solenoid brake assembly 17 includes a brake drum 18 rigidly mounted on the shaft 10 and brake bands 19 cooperable therewith. The brake bands 19 are operatively connected to a solenoid coil 20. The solenoid coil 20 has electrical terminals 54 and 56 for connection in a control circuit. The gear 14 engages a reduction gear 21 that is rotatably supported on the hoist drum shaft 22 on a bearing 23. The hoist drum shaft 22 is supported in position by bearing members 24 and 25. A gear 26 is mounted on hoist drum shaft 22 and held rigidly in position thereon by a key 27. The gear 26 engages the reduction gears 16 for operation thereby. A cable drum 28 is rigidly mounted on the hoist drum shaft 22 and is provided with a cable 29 supporting a load 30. The hoist motor 1 is energized from a power source indicated by the electrical terminals 42, 43, and 44. The terminals 42, 43, 44 are connected by conductors 45, 46, 47, respectively, to the terminals 48, 49, 50 on the junction box 3 and constitute a circuit for reversible operation of the motor 1.

The solenoid coil 20 is energized by a circuit connected in parallel with the motor circuit. The solenoid circuit commences at a terminal 57 on the conductor 45 and extends through a conductor 55 to the solenoid terminal 56. The solenoid coil 20 is in turn connected to the centrifugal switch 4 by a conductor 53 connected to the solenoid terminal 54 and the switch collector ring terminal 41. The circuit is completed by a conductor 51 extending from the switch collector ring or terminal 40 to a terminal 52 on the motor conductor 47.

The switch 4 is a centrifugally operated switch and may be of any suitable design. For illustrative purposes, the switch 4 is shown in some detail in a diagrammatic view, in Fig. 2. The switch 4 has an electrically conducting sleeve 31 carried on the shaft 2 for rotation therewith. A cylindrical ring 32 is mounted on the sleeve 31 and forms a support for switch contact arms 33 and 34. The switch arms 33 and 34 carry switch contacts 35 and 36 which are centrifugally engageable with collector rings 38 and 39. The collector rings 38 and 39 are carried in cylindrical housing 37 and are provided with terminals 40 and 41 for connection as previously described.

Operation

Referring to the drawings, the operation of the crane hoist is as follows: When the hoist motor 1 is energized in a lifting direction, the drive shaft 2 of the hoist motor 1 begins to rotate in a lifting direction. The rotation of the drive shaft 2 is transmitted to the drive shaft 6 of the hydraulic coupling 7. When sufficient torque is transmitted through the fluid in the hydraulic coupling 7, the driven shaft 8 of the hydraulic coupling 7 exerts a torque in a lifting direction. The torque from shaft 8 is transmitted through coupling 9 to shaft 10. However, shaft

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10 is prevented from rotating because solenoid brake assembly 17 is engaged. Although shaft 10 is not rotating, a slippage occurs in the fluid in the rotary hydraulic coupling 7 which permits shaft 2 of the hoist water 1 to continue to build up torque and speed. When a predetermined speed of shaft 2 is reached, the contacts 35 and 36 of the normally open centrifugal switch 4 will close against the rings 38 and 39 and energize the solenoid coil 20 of the solenoid brake assembly 17 to release the same. The release of the solenoid brake permits shaft 10 to begin rotation at a predetermined lifting torque. The rotation of shaft 10 rotates the reduction gears 14, 21, 16, and 26 which turn the hoist drum shaft 22 and hoist drum 28 in a lifting direction. It should be noted that solenoid coil 20 of solenoid brake assembly 17 is connected in parallel with the motor circuit and in series with the normally open centrifugal switch 4. This circuit arrangement prevents the operation of the hoist upon energization of the motor circuit until a sufficient lifting torque has been developed by the hoist motor 1. Thus, when load 30 is suspended in mid-air and the hoist is deenergized, the solenoid coil 20 is de-energized so that the solenoid brake assembly 17 will hold the load 30 in suspension. When further lifting is desired, the hoist motor 1 is again energized in a lifting direction. As heretofore described, the centrifugal switch 4 delays energization of the solenoid coil 20 so that the solenoid brake assembly 17 will remain engaged until sufficient motor torque has developed, thus preventing load 30 from dropping slightly due to insufficient motor torque and eliminating the strain which would result on the cable 29 as a result of reversing the movement of the load.

In lowering the load, the operation is substantially the same as in lifting. In this operation the centrifugal switch 4 delays release of the solenoid brake assembly until the motor is up to speed. If the lowering of the load has a tendency to overrun or exceed the speed of the hoist motor 1, the hoist motor 1 will develop a back electromotive force which will act as an electromagnetic brake and thus control the rate of descent of the load 30.

From the foregoing description, it is seen that there is provided a crane hoist mechanism in which it is possible to use a hydraulic coupling to utilize the advantages of that type of transmission. A hydraulic coupling has the advantages of providing a flexible connection and protecting against overloading and stalling conditions, but has the disadvantage of allowing the load to slip if released before full torque is reached. In this invention, the advantages of the hydraulic coupling are retained and the disadvantage is eliminated. By making the release of the electrical brake responsive to the operating condition of the motor, i. e., torque or speed, the danger of slippage of the load and the strain on the cable produced by a reversal of load movement is eliminated.

While there has been described only one embodiment of this invention, it will be obvious to those skilled in the art that other embodiments are possible which are the equivalent of this apparatus (e. g., other types of torque or speed responsive switches, and other transmissions which are the equivalent of a hydraulic coupling) and which would be capable of performing the desired functions of this invention without departing from the scope and intent of this invention as defined in the appended claims.

Having thus described the invention, what is claimed and is desired to be secured by Letters Patent of the United States is:

1. A hoist comprising, in combination, a driving means, a hoisting means operatively connected in driven relation to said driving means, a fluid coupling operatively interposed between the driving means and the hoisting means, a releasable brake to prevent movement of said hoisting means, and means responsive to and operable upon the occurrence of a predetermined condition of said driving means for releasing said brake.

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2. A hoist comprising, in combination, a motor, a rotatable hoisting member operatively connected in driven relation to said motor, a fluid coupling operatively interposed between said motor and said hoisting member, a releasable brake to prevent rotation of said hoisting member, and means responsive to and operable upon the occurrence of a predetermined condition of said motor for releasing said brake.

3. A hoist comprising, in combination, an electric motor, a rotatable hoisting member operatively connected in driven relation to said electric motor, a rotary hydraulic coupling interposed between said electric motor and said hoisting member, an electrically operated releasable brake having a control circuit and operable to prevent rotation of said hoisting member, and a means controlling said brake control circuit, said means being responsive to and operable upon the occurrence of a predetermined condition of said electric motor for releasing said brake.

4. A hoist comprising, in combination, a driving means, a hoisting means operatively connected in driven relation to said driving means, a fluid coupling interposed between said driving means and said hoisting means, an electrically operated releasable brake operable to prevent movement of said hoisting means, a control circuit for said brake, and switch means in said control circuits responsive to and operable upon the occurrence of a predetermined condition of said driving means for releasing said brake.

5. A hoist comprising, in combination, a driving means, a hoisting means operatively connected in driven relation to said driving means, a fluid coupling operatively interposed between said driving means and said hoisting means, an electrically releasable brake operable to prevent movement of said hoisting means, a control circuit for said brake, and a centrifugal switch operatively connected to said driving means and positioned in and controlling said circuit, and said switch being responsive to and operable upon the occurrence of a predetermined rate of rotation of said driving means for releasing said brake.

6. A hoist comprising, in combination, an electric motor, a rotatable hoisting member operatively connected in driven relation to said electric motor, a rotary hydraulic coupling operatively interposed between said electric motor and said hoisting member, an electrically operated releasable brake operable to prevent rotation of said hoisting member, circuits for energizing said motor and said brake, and a centrifugal switch positioned in and controlling said brake circuit, said switch being carried by said electric motor, said switch being responsive to and operable upon the occurrence of a predetermined speed of rotation of said electric motor to release said brake.

7. A hoist comprising, in combination, a motor, a hoist drum operatively connected in driven relation to said motor, a rotary hydraulic coupling having a drive shaft and a driven shaft connected to said motor and hoist drum, respectively, brake operatively engaged with said driven shaft to prevent rotation of said hoist drum, an electromagnetic coil operable upon energization to disengage said brake and having an energizing circuit, a normally open centrifugal switch in said circuit to control energization of said coil, and said centrifugal switch being carried by said motor drive shaft for rotation therewith and being responsive to motor speed for closing said coil circuit upon occurrence of a predetermined motor speed.

8. A hoist comprising, in combination, an electric motor having an energizing circuit, a rotary hoist drum, a rotary hydraulic coupling having a drive shaft and a driven shaft connected to said motor and said hoist drum, respectively, a brake operatively engaged with said driven shaft to prevent rotation of said hoist drum, an electromagnetic coil operable upon energization to disengage said brake to release said hoist drum, a circuit for said coil connected in parallel with said motor

circuit, a normally open centrifugal switch in said coil circuit controlling energization of said coil, and said switch being carried by said motor drive shaft for rotation therewith and being closable in response to a predetermined motor speed to release said brake upon occurrence of said predetermined motor speed.

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