(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 715 017 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
05.06.1996 Bulletin 1996/23

(51) Int. Cl.[6]: **D07B 3/10**

(21) Application number: **95610055.6**

(22) Date of filing: **16.11.1995**

(84) Designated Contracting States:
IT

(30) Priority: **16.11.1994 DK 1309/94**

(71) Applicant: **ROBLON A/S**
DK-9300 Saeby (DK)

(72) Inventor: **Kurtzmann, Knud**
DK-9300 Saeby (DK)

(74) Representative: **Wittrup, Flemming et al**
Hofman-Bang & Boutard, Lehmann & Ree A/S,
Ryesgade 3,
Postboks 367
8100 Aarhus (DK)

(54) An apparatus for winding of wire with variable hydrostatic transmission

(57) The invention concerns an apparatus for twisting and winding a wire (1) onto a spool (6) and comprising at least one externally driven swing arm shaft to which outwardly directed arms (3, 10) are secured for guiding and twisting the wire (1). The apparatus moreover comprises a suspended cradle (20) which comprises a wire spool (6) onto which the wire (1) is wound by means of a traversing mechanism (5). The wire spool (6) is driven via a hydrostatic transmission arranged in the cradle (20) and comprising a hydraulic motor (17) and a pump (14) which are driven by the swing arm shaft. The hydrostatic transmission of the apparatus is adapted to perform variable displacement of the hydrostatic medium. This ensures that the displacement of the hydrostatic medium can be regulated, thereby avoiding unnecessary generation of heat and providing controlled tension of the wire.

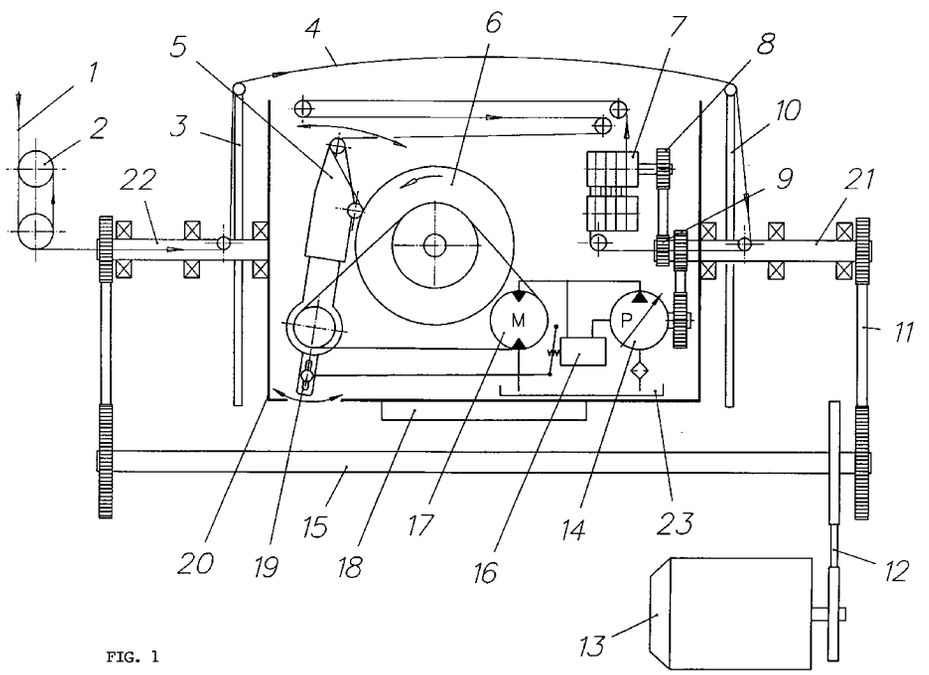

FIG. 1

EP 0 715 017 A1

Description

The present invention concerns an apparatus for twisting and winding of wire onto a spool and comprising at least one externally driven swing arm shaft to which radially protruding control means are secured for guiding and twisting the wire, as well as a suspended cradle which comprises a wire spool onto which the wire is wound by means of a traversing mechanism, and which is driven via a hydrostatic transmission arranged in the cradle and comprising a hydraulic motor and a pump which are driven by the swing arm shaft.

Devices of this type are known. These devices always employ pumps and motors having a fixed displacement, i.e. their performance can be varied only by changing the number of revolutions. The structure of the hydrostatic transmission is very compact, as it is arranged in the cradle.

The drawback of these devices is firstly that the pump must be so geared with respect to the swing arm shaft as to provide a flow which is sufficient in all operating situations, as will be explained below. When winding is started, where the spool diameter is small, quick wire spool acceleration and rotation are required, i.e. the pump is to provide a large flow. As the spool diameter increases, the flow requirements diminish, however, for which reason the oil is passed through one or more pressure regulating valves, and the flow energy is converted into heat. This heat release, which is a great nuisance to the operator, is difficult and expensive to discharge from the device, because it is soundproof, and moreover results in a poor efficiency of the device. In addition, a high temperature might damage the wire and impair the coil quality. Finally, the increase in temperature results in undesirable temperature expansions of the parts of the device.

Another serious drawback of these known devices is that it is difficult for the hydraulic motor to maintain a sufficient wire tension when winding is started and stopped. The reason is that the wire is pulled into the apparatus as soon as the control means begin to rotate, and at this time the hydraulic motor and the pump have not built up a sufficient pressure and flow in the hydraulic system, for which reason the wire spool does not rotate sufficiently quickly, and the wire is thus not wound when it is pulled into the cradle. This frequently causes the wire to slide out of its guides and to break, and consequently the entire device has to be re-wired.

The object of the invention is to provide an apparatus of the type mentioned in the opening paragraph which prevents the above-mentioned heat drawbacks, and which ensures sufficient tensioning of the wound wire during start and stop as well as in continuous operation.

Another object of the invention is to provide an apparatus which is at least just as compact as the known structures.

The apparatus of the present invention is characterized in that the hydrostatic transmission is adapted to perform variable displacement of the hydrostatic medium.

The use of a hydrostatic transmission with variable displacement ensures that the apparatus may be controlled such that it always just supplies the necessary amount of oil to the hydraulic motor for it to maintain the pressure and the wire tension which correspond to the setting of the pressure regulating valve. Thus, no excess oil is converted into heat. Further, the variable hydrostatic transmission ensures that the hydraulic motor receives a sufficient amount of oil at both the start and the stop phases. This provides correct wire tension from the moment when the hydrostatic transmission is activated through the swing arm shaft, which means that the wire is wound while being pulled into the cradle.

Although on the face of it one would think that the hydrostatic transmission with variable displacement would take up more space inside the cradle, it has been found that it is still possible to obtain a sufficiently compact structure when using pump and motor with variable displacement, even though, seen in relation to pumps and motors with fixed displacement, it is necessary additionally to use a regulating device and a reversing mechanism.

The reason why a impact structure can still be achieved is that it has been found that the use of a hydrostatic transmission with variable displacement reduces the hydraulic medium requirement. Thus, the size of the tank containing hydraulic medium is reduced by 2/3. As this tank is built into the cradle structure, a hydrostatic transmission with variable displacement still enables a compact structure to be achieved, which can be built into the cradle in spite of a further regulating device and reversing mechanism.

In operation, the variable hydrostatic transmission supplies precisely the amount of oil which is sufficient for the wire to be wound with a suitable tension. The hydrostatic system is controlled by a valve.

Expedient embodiments of the invention are defined in claims 1-7.

It is noted that the term "wire" in this connection covers all types of wire-shaped objects, such as e.g. yarn, rope, plastics fibres, tapes, lines, cables, steel wires, etc.

In a particularly expedient embodiment the hydraulic pump is adapted to perform variable displacement of the hydrostatic medium during the winding operation, while the hydraulic motor has a fixed displacement. Thus, with a simple hydraulic motor, the displacement of the hydrostatic medium may be adjusted.

In another advantageous embodiment the hydraulic motor is adapted to perform variable displacement of the hydrostatic medium during the winding operation, while the hydraulic pump may have either a fixed or a variable displacement. Combination of both regulating possibilities provides a hydraulic transmission with variable power and variable moment.

According to claim 4, the hydrostatic transmission is controlled by a valve which detects the wound wire spool diameter by means of a diameter detecting device. The

displacement in the hydrostatic transmission may hereby be regulated in response to the wire spool diameter, and controlled and sufficient tension of the wire is achieved.

In a particularly expedient embodiment the radially protruding control means are provided as two outwardly directed arms for twisting the wire. The wire hereby obtains two twists per rotation of the swing arms. This type of device is known under the designation two for one twister.

In another expedient embodiment the radially protruding control means are provided as four outwardly directed arms for twisting the wire. The wire hereby obtains four twists per rotatation of the swing arms. This type of apparatus is known under the designation four for one twister.

According to claim 7 the radially protruding control means may comprise circular elements, whereby, depending on the number, in the same manner as described above, different numbers of twists of the wire per rotation can be obtained.

The invention will be explained more fully below with reference to the drawing, which shows an embodiment, and in which

Fig. 1 shows the structure of the two for one twister apparatus type for twisting and winding wire.

The apparatus shown in fig. 1 for twisting and winding wire onto a spool comprises two externally driven swing arm shafts 21, 22 having secured thereto two radially protruding control means which are constructed as outwardly directed swing arms 3, 10 for guiding and twisting the wire 1. A cradle 20 is suspended from the swing arm shafts 21, 22, comprising a wire spool 6 onto which the wire 1 is wound by means of a traversing mechanism 5, and which is driven via a hydrostatic transmission, which is arranged in the cradle and comprises a hydraulic motor 17 and a pump 14 which are driven by the swing arm shaft 21. The cradle 20 comprises a balance weight 18 which prevents the cradle 20 from revolving.

The wire 1, which is to be twisted and wound, is first run around brake rollers 2 and into a bored swing arm shaft 22. Then the wire is run around a first swing arm 3, around a second swing arm 10, in through the second bored swing arm shaft 21 and further on into the cradle 20. Rotation of the swing arms 3 and 10 causes the wire 1 to follow a "balloon" path around the cradle 20. To prevent the balloon 4 from getting too big, it is controlled by the brake rollers 2.

The swing arms 3 and 10 are synchronized by means of toothed belt drives 11 and a transmission shaft 15 and are driven by an electric motor 13 via the drive 12.

The yarn now twisted is pulled forward in the cradle by means of pull rollers 7, which are synchronized with the swing arms 3 and 19 via the drives 8 and 9. The ratio of the speed of the pull rollers 7 to the speed of the swing arms determines the applied number of twists per length unit of the wire. The pull speed of the wire is constant and depends on the speed of the pull rollers 7.

Inside the cradle the wire is wound onto a spool 6 via a traversing device 5. The wire spool 6 rotates at a decreasing speed as the spool diameter increases, and it is driven together with the traversing device 5 by a hydraulic motor 17. The hydraulic motor 17 is fed by a hydraulic pump 14, which is controlled by a regulating valve 16 and is driven by the swing arm 10 through a belt drive. The hydraulic pump draws oil from a tank 23 which is built into the cradle 20.

The regulating valve 16 is controlled by a diameter detecting device 19 which detects the wound wire core diameter. It is noted that the diameter detecting device is not necessary according to the invention, as the regulating valve 16 may be controlled in another manner, e.g. via a device which measures the tension of the wire. Likewise, the diameter detecting device 19 may be constructed in many other ways.

During start, the hydraulic pump provides a maximum flow until the pre-set pressure has been reached.

During continuous operation, the hydraulic pump supplies precisely the amount of oil which is necessary to maintain the desired pressure, which is regulated by means of the regulating valve 16.

During slow-down, the hydraulic pump 14 is caused to feed the hydraulic motor 17 with the amount of oil necessary to maintain the pre-set pressure. The hydraulic pump 17 has to supply an additional amount of oil to compensate for leakage in the hydraulic motor 17 at low revolutions.

It is noted that the invention is also applicable to four for one twisters, where winding takes place in the cradle by means of a hydraulic device. Thus, four swing arms may be provided, running in opposite directions in pairs. Also other forms of radially protruding control means than swing arms may be used. Thus, it will e.g. be possible to use substantially circular or elliptical control means which are secured to the swing arm shaft. Finally, the invention may be used for other types of devices for winding of wire, etc.

Instead of a pump with variable displacement, a motor with variable displacement or a both a pump and a motor with variable displacement may be used within the scope of the invention.

The hydrostatic medium preferably comprises oil, but also other liquids may be used.

Claims

1. An apparatus for twisting and winding of wire (1) onto a spool (6), comprising at least one externally driven swing arm shaft (21) to which radially protruding control means (3, 10) are secured for guiding and twisting the wire (1), as well as a suspended cradle (20) which comprises a wire spool (6) onto which the wire (1) is wound by means of a traversing mechanism (5), and which is driven by a hydrostatic transmission arranged in the cradle (20) and comprising a hydraulic motor (17), a pump (17) and a hydraulic medium tank (23) which are driven by the swing arm shaft, **characterized** in that the hydrostatic trans-

mission is adapted to perform variable displacement of the hydrostatic medium.

2. An apparatus according to claim 1, **characterized** in that the hydraulic pump (14) is adapted to perform variable displacement of the hydrostatic medium during the winding operation.

3. An apparatus according to claim 1, **characterized** in that the hydraulic motor (17) is adapted to perform variable displacement of the hydrostatic medium during the winding operation.

4. An apparatus according to claims 1-3, **characterized** in that the hydrostatic transmission is controlled via a valve (16) by a diameter detecting device (19) which detects the wound wire spool diameter.

5. An apparatus according to one or more of the preceding claims, **characterized** in that the radially protruding control means comprise two substantially radially outwardly directed arms (2, 10).

6. An apparatus according to one or more of claims 1-4, **characterized** in that the radially protruding control means comprise four substantially radially outwardly directed arms.

7. An apparatus according to one or more of claims 1-4, **characterized** in that the radially protruding control means comprise substantially circular elements.

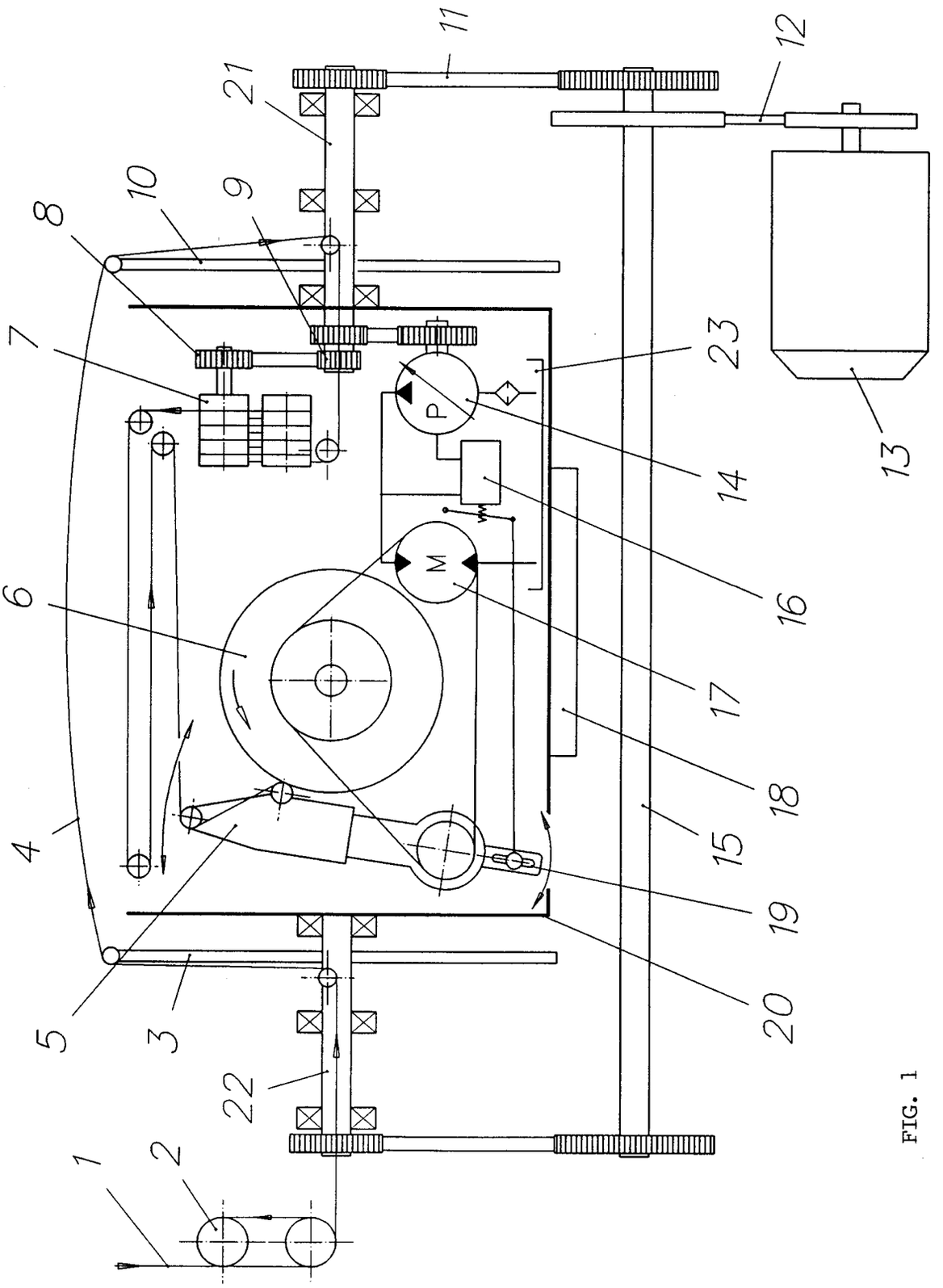

FIG. 1

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 61 0055

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EP-A-0 063 054 (NATIONAL-STANDARD COMPANY) * page 3, line 34 - page 4, line 14 * ---	1	D07B3/10
A	US-A-4 588 142 (F.H.MALZACHER) * column 1, line 50 - column 2, line 17 * * column 4, line 40 - column 5, line 25 * -----	2	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

D07B
B65H
H01B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	28 March 1996	Goodall, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)