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FEEDING DEVICE FOR FEEDING A WIRE IN A ROCK BOLTING EQUIPMENT
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- (71) Applicant(s)
TAMROCK OY
- (72) Inventor(s)
OSSI TIENARI; MARKKU LAUNIEMI; VESA PELTONEN
- (74) Attorney or Agent
GRIFFITH HACK , GPO Box 1285K, MELBOURNE VIC 3001
- (56) Prior Art Documents
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US 4079592
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- (57) Claim

1. A feeding device for feeding a wire in a rock bolting equipment, the feeding device including a body, a pair of feed wheels between which the wire is arranged to pass during its feeding, and a feed motor for rotating the feed wheels during the feeding of the wire, wherein at least one feed wheel of the pair of feed wheels is mounted movably with respect to the body in the transverse direction of the wire, and the device includes a loading means operable to act on said at least one feed wheel for pressing the wire placed between the pair of feed wheels with a desired force by the action of the loading means when the wheel moves transversely to the wire to be fed according to the wire thickness.

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COMPLETE SPECIFICATION
STANDARD PATENT

Applicant:

TAMROCK OY

Invention Title:

FEEDING DEVICE FOR FEEDING A WIRE IN A ROCK BOLTING EQUIPMENT

The following statement is a full description of this invention, including the best method of performing it known to me/us:

Feeding device for feeding a wire in a rock bolting equipment

5 The invention relates to a feeding device for feeding a wire in a rock bolting equipment, the feeding device comprising at least one pair of feed wheels between which the wire is arranged to pass during its feeding, and a feed motor for rotating the feed wheels during the feeding of the wire.

10 During rock bolting, longer holes require the use of wire bolting wherein a wire provided on a reel is pushed into a drilled hole and soldered thereto. The most common manner is to push the wire into the hole manually and to thereafter supply a soldering material to the hole.
15 This technique is rather unreliable, laborious and dangerous. Wire bolting devices are further known for example from US Patent 4,728,219. In these devices, the soldering material is first fed into the hole, whereafter the wire is pushed mechanically into the soldering
20 material.

25 Finnish Published Specification 831,481 discloses a feeding device where the feeding takes place by means of three feed wheels such that they are positioned triangularly with respect to each other and a bolt is fed from between them. In this arrangement, the bolt is bent by feeding two of the feed wheels towards the third feed wheel that is situated in the middle thereof on the other side of the wire, so that the bolt bends. During normal feeding, the wheels are in a fixed position with respect
30 to each other.

35 Such mechanical feeding can be implemented in a rather simple manner when the wire thickness is constant at all times. On the other hand, with a so-called bulb-anchor wire such a device cannot be used. A bulb-anchor wire comprises at regular intervals points where the wire

strands have been spread into a sparse section that is thicker than the rest of the wire, so that the soldering material can penetrate between the wire strands and it locks the wire in place effectively. Sections that have
5 been widened with a conventional mechanical feeding device would be compressed and would not therefore be useful.

An object of the present invention is to provide a feeding device that can also be used to feed this kind of bulb-anchor wires such that they substantially maintain
10 their shape.

Accordingly, the invention provides a feeding device for feeding a wire in a rock bolting equipment, the feeding device including a body, a pair of feed wheels between which the wire is arranged to pass during its
15 feeding, and a feed motor for rotating the feed wheels during the feeding of the wire, wherein at least one feed wheel of the pair of feed wheels is mounted movably with respect to the body in the transverse direction of the wire, and the device includes a loading means operable to
20 act on the at least one feed wheel for pressing the wire placed between the pair of feed wheels with a desired force by the action of the loading means when the wheel moves transversely to the wire to be fed according to the wire thickness.

25 Preferably the feeding device includes a first and a second pair of feed wheels and a loading means operable to act on at least one of the feed wheels of each pair of feed wheels.

Preferably one of the feed wheels of each pair of
30 feed wheels is mounted on a bogie frame that is movable with respect to the body and the bogie frame is connected turnably to the loading means between the feed wheels mounted on the frame.

Preferably the feeding device includes first and
35 second feed motors wherein the first feed motor is operable to rotate one of said feed wheels, and the second feed motor is operable to rotate another of said feed wheels.



Preferably said pressure medium cylinder has a piston rod and the bogie frame is connected directly to the piston rod of the pressure medium cylinder acting as the loading means.

5 Preferably at least one of the feed wheels is a measuring wheel, and the feeding device includes a sensor for detecting the rotation of the measuring wheel and therefore the feed length of the wire.

10 In order that the present invention maybe more clearly ascertained, preferred embodiments will now be described, by way of example, with reference to the accompanying drawing in which:

 Figure 1 is a schematic side view of a device according to a preferred embodiment of the invention;

15 Figure 2 shows schematically a simplified hydraulic diagram of the device of figure 1; and

 Figure 3 is a schematic side view of a device according to another embodiment of the invention.

20 Figure 1 shows schematically a wire feeding device according to a preferred embodiment of the invention. The device comprises a body 1. It also comprises two pairs of feed wheels the first of which consists of feed wheels 2a and 2b and the second of which consists of feed wheels 3a and 3b. One wheel of each pair
25 of feed wheels, in this case wheels 2a and 3a, is mounted on the body 1 rotatably but otherwise



immovably with respect to it. Further, the other feed wheel of each pair of feed wheels, i.e. wheels 2b and 3b, is mounted on a separate bogie assembly comprising a bogie frame 4. The feed wheels 2b and 3b are connected to the bogie frame 4 rotatably but otherwise immovably with respect to it. The bogie frame 4 is in turn connected movably with respect to the body 1 so that it can move substantially perpendicularly to the axes of the feed wheels towards or away from the feed wheels 2a and 3a connected to the body. For this purpose, the bogie frame 4 is attached from the middle of the feed wheels 2b and 3b mounted thereon to a loading means 6, which in this case is a pressure medium cylinder connected to the body 1, such that the frame can turn around the shaft 5. The bogie frame 4 is attached to the piston rod of the pressure medium cylinder such that the frame can turn with respect to the rod around the shaft 5 that is parallel to the axes of the feed wheels. For the purpose of feeding, a wire 7 is arranged to pass between the pairs of feed wheels, i.e. feed wheels 2a and 2b, and 3a and 3b, respectively, so that it is pressed between them. The pressure medium in the pressure medium cylinder acting as the loading means 6 is provided with such a pressure that the feed wheels 2a and 2b, and 3a and 3b, respectively, are pressed together with a force that makes the wire 7 move ahead in the desired manner also when it is pushed into a hole filled with soldering material.

When a so-called bulb-anchor wire shown in Figure 1 is used, the forward movement of the wire makes the expanded wire sections 7a push the feed wheels belonging to the same pair of wheels away from each other. In such a situation, a feed wheel, such as feed wheel 3a, that is mounted on the bogie frame 4 may move away from the other feed wheel 3a so that the expanded section is not damaged but a sufficient feed force is maintained due to the

active pressure medium. Since the other pair of feed wheels is not normally forced to change its distance at the same time, the bogie frame 4 naturally turns around its shaft 5. When the expanded section 7a has passed the pair of feed wheels, the feed wheel 3b moves back towards the other feed wheel 3a along the surface of the wire 7 by the action of the pressure of the pressure medium, and a corresponding movement also occurs with the feed wheels 2a and 2b when the expanded section 7a reaches them.

In order to provide a feed force, the pairs of feed wheels are provided with feed motors such that one of the wheels in each pair is equipped with a motor and the other wheel rotates freely. In the embodiment shown in the figure, the feed motors 8a and 8b are placed such that the feed motor 8a rotates the feed wheel 2a and the feed motor 8b rotates the feed wheel 3b. The feed wheel 2b rotates freely with respect to the bogie frame 4 and, correspondingly, the feed wheel 3a rotates freely with respect to the body 1. The feed wheel 3a is preferably formed into a measuring wheel that provides signals to a sensor 9 when it rotates, so that the feed length of the wire 7 can be measured accurately and the feeding of the wire into the hole can therefore be monitored easily.

The feed wheel 3a is provided through machining with recesses 3a' at regular intervals around it. The body 1 is correspondingly provided with a sensor 9, which produces an electric pulse whenever a recess reaches it. The sensor 9 is preferably an inductive sensor which also operates reliably under difficult circumstances. Some other kind of sensor arrangement known per se can naturally also be used to measure the rotation of the measuring wheel 3a and thus to measure the feed length of the wire.

Figure 2 shows schematically the hydraulic coupling of the feeding device of Figure 1 as regards the

operation of the device. When a wire is fed, a pressure fluid is supplied to the loading means 6 along a duct 10a, so that the piston 6a of the hydraulic cylinder acting as the loading means comes out and pushes the bogie frame 4 shown in Figure 1 and the feed wheels 2b and 3b that are connected to the frame and that are shown above in Figure 1 towards the feed wheels 2a and 3a mounted on the body 1 and shown below in the figure. The pressure in the duct 10a is adjusted such that the pressure acting on the wire between the feed wheels is suitable and it does not compress the expanded sections of the wire when for example bulb-anchor wires are used. In order to keep the loading substantially constant, the duct 10a is connected to a pressure accumulator 11 having a pressure of 50 bar, for example. When the piston 6a moves as the expanded wire sections pass between the feed wheels, the pressure fluid flows from the duct 10a to the pressure accumulator 11 and back, so that the pressure remains substantially unchanged. The pressure medium is discharged along the duct 10a when the piston 6a is moved forward and it is also possible to feed the pressure medium along this duct when the piston 6a is to be moved to its rearmost position when a new wire is placed between the feed wheels, for example, or for some other reason. Figure 2 further shows the feed motors 8a and 8b that are connected hydraulically in parallel such that a pressure fluid is fed simultaneously into each motor along a duct 12a and the pressure fluid that has flown through the motor is discharged along a duct 12b. The pressure fluid that arrives along the duct 12a ends in a control circuit 13 where it is distributed to pass along different ducts 14a and 14b to feed motors 8a and 8b, respectively. In order that both motors would rotate at the same speed, the control circuit 13 comprises pressure-controlled throttles 15a and 15b that are guided by the pressure of the

pressure fluid passing to the other motor. In this manner, the control circuit 13 distributes the flow of the pressure fluid in exactly equal amounts to each motor so that their speeds of rotation are also the same. As a
5 result, both pairs of feed wheels constantly pull the wire at the same speed and no skidding or idle rotation occurs.

Figure 3 is a schematic side view of another embodiment of a device according to the invention. The device shown in the figure corresponds otherwise to the
10 one shown in Figure 1 and like reference numerals refer to corresponding parts. The difference is that instead of a bogie assembly, each upper feed wheel 2b and 3b is provided with a separate loading means 6' and 6'', respectively. In this embodiment, the feed wheels 2b and
15 3b are placed movably in a manner known per se, such as by means of a slide structure, so that they can move with respect to the body 1 either towards their pair of drive wheels 2a and 3a, respectively, or away from them. The loading means 6' and 6'' of each upper drive wheel 2b and
20 3b are for example hydraulic cylinders connected to the pressure accumulator as shown in Figure 2, or pneumatic cylinders that are provided beforehand with a sufficient pressure. Air or gas contained in the pneumatic cylinder allows the drive wheels 2b and 3b to move back and forth
25 depending on the wire thickness without a need for additional pressure fluid ducts or other extra components.

The invention is described above in the specification and in the drawings by way of example only, and it is not restricted thereto in any way. The feed
30 motors can be placed in different ways and they can be connected hydraulically in different manners for example in series so that the same pressure fluid flows through each motor. The measurement of the wire feeding can also be implemented with different measuring devices known per
35 se, and a separate feed motor can also be used in each

feed wheel, if desired. The loading means 6 may be a pressure medium cylinder connected directly to the bogie frame as shown in the figure, or it may be attached thereto indirectly by means of different mechanical transmission means. Further, even though the figure shows a preferred structure of the invention where two of the feed wheels are fixedly mounted on the body 1 and the other two wheels 2b and 3b are attached movably and rotatably to the bogie frame, it is also possible to connect the fixedly placed feed wheels 2a and 3a to a bogie frame of their own. In practice, this arrangement is not usually necessary, but the embodiment shown in Figure 1 is very advantageous in use. It is also possible to attach the feed motors for example to three feed wheels or to all of the wheels. When only one pair of feed wheels is used, the loading means can be connected to act on one of the wheels, and correspondingly when two pairs of feed wheels are used, one or both wheels of each pair of feed wheels can be provided with separate loading means that keep the compression force substantially constant on a predetermined level and that allow the feed wheels to move towards and away from each other as the wire thickness changes without a substantial change in the compression force.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A feeding device for feeding a wire in a rock bolting equipment, the feeding device including a body, a pair of feed wheels between which the wire is arranged to pass during its feeding, and a feed motor for rotating the feed wheels during the feeding of the wire, wherein at least one feed wheel of the pair of feed wheels is mounted movably with respect to the body in the transverse direction of the wire, and the device includes a loading means operable to act on said at least one feed wheel for pressing the wire placed between the pair of feed wheels with a desired force by the action of the loading means when the wheel moves transversely to the wire to be fed according to the wire thickness.
2. A feeding device as claimed in claim 1, including a first and a second pair of feed wheels and a loading means operable to act on at least one of the feed wheels of each pair of feed wheels.
3. A feeding device as claimed in claim 2 wherein one of the feed wheels of each pair of feed wheels is mounted on a bogie frame that is movable with respect to the body and the bogie frame is connected turnably to the loading means between the feed wheels mounted on the frame.
4. A feeding device as claimed in claim 1 including first and second feed motors wherein the first feed motor is operable to rotate one of said feed wheels, and the second feed motor is operable to rotate another of said feed wheels.
5. A feeding device as claimed in either claim 2 or 3, including first and second feed motors, wherein said first feed motor is operable to rotate at least one feed wheel of said first pair of feed wheels, and, said second feed motor is operable to rotate at least one feed wheel of said second pair of feed wheels.
6. A feeding device as claimed in claim 4, wherein the feed motors are arranged in the pair of feed wheels to



rotate the feed wheels provided on opposite sides of the wire with respect to each other.

7. A feeding device as claimed in claim 5, wherein the feed motors are arranged in the pair of feed wheels to rotate the feed wheels provided on opposite sides of the wire with respect to each other.

8. A feeding device as claimed in any one of the preceding claims wherein the loading means is a pressure medium cylinder.

9. A feeding device as claimed in claim 8, wherein said pressure medium cylinder has a piston rod and the bogie frame is connected directly to the piston rod of the pressure medium cylinder acting as the loading means.

10. A feeding device as claimed in any one of the preceding claims wherein at least one of the feed wheels is a measuring wheel, and the feeding device includes a sensor for detecting the rotation of the measuring wheel and therefore the feed length of the wire.

11. A feeding device as claimed in claim 10, wherein the measuring wheel is a freely rotating feed wheel.

12. A feeding device substantially as hereinbefore described with reference to any one of the figures of the accompanying drawing.

Dated this 20th day of August 1998

TAMROCK OY

By their Patent Attorneys

GRIFFITH HACK

Fellows Institute of Patent

Attorneys of Australia



Abstract

A feeding device for feeding a wire in a rock bolting equipment.

5 The feeding device comprises two pairs of feed wheels (2a, 2b; 3a, 3b) between which the wire (7) is made to pass. One feed wheel (2b, 3b) of each pair is connected to a separate bogie frame (4) that is pressed towards the other feed wheels (2a, 3a) with a loading means (6) that is most
10 preferably a pressure medium cylinder connected directly to the bogie frame (4).

(Figure 1)

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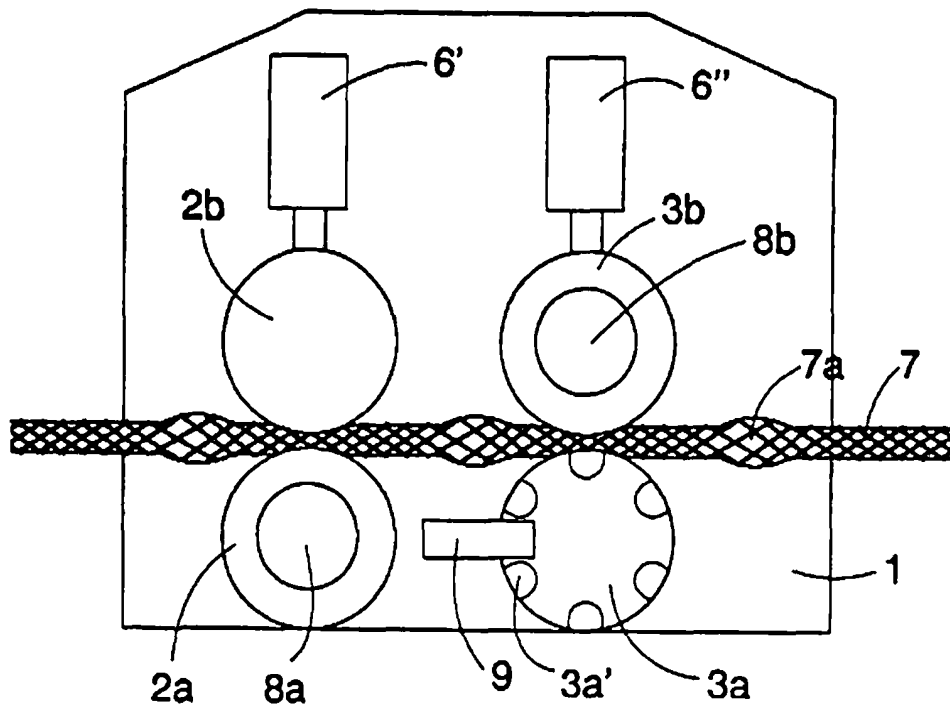


FIG. 3